# Operating Instructions

# for

# Thermal Mass Flow Meter for Gas

# Model: KEP-2

# KEP-2

# 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 instruction manuals on our website www.kobold.com are always for currently manufactured version of our products. Due to technical changes, the instruction manuals available online may not always correspond to the product version you have purchased. If you need an instruction manual that corresponds to the purchased product version, you can request it from us free of charge by email (info.de@kobold.com) in PDF format, specifying the relevant invoice number and serial number. If you wish, the operating instructions can also be sent to you by post in paper form against an applicable postage fee.

Operating instructions, data sheet, approvals and further information via the QR code on the device or via www.kobold.com

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 EC machinery directive.

## 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:
- Thermal Mass Flow Meter for Gas          model: KEP-2

# 4. Regulation Use

Any use of the device, which exceeds the manufacturer's specification, may invalidate its warranty. Therefore, any resulting damage is not the responsibility of the manufacturer. The user assumes all risk for such usage.

The KEP-2 consumption sensor is used for continuous flow measurements.
The KEP-2 consumption sensor is designed and constructed exclusively for the intended purpose described here and may only be used accordingly.
The user must check whether the instrument is suitable for the selected application. It must be ensured that the medium is compatible with the wetted parts. The technical data listed in the data sheet are binding.
Improper handling or operation outside the technical specifications is not permitted.
Claims of any kind based on improper use are excluded.

# 5. Safety Instructions

**Please read carefully before starting the device!**

Warning: Do not exceed the pressure range of 16 bar!
Observe the measuring range of the sensor!
Always observe the direction of flow when positioning the sensor!
The screwed fixture must be pressure tight.

It is absolutely necessary to avoid condensation on the sensor element or water drops in the measuring air as they may cause faulty measuring results.

The manufacturer cannot be held liable for any damage which occurs as a result of non-observance or non-compliance with these instructions. Should the device be tampered with in any manner other than a procedure which is described and specified in the manual, the warranty is cancelled and the manufacturer is exempt from liability.

The device is destined exclusively for the described application.

We offer no guarantee for the suitability for any other purpose and are not liable for errors which may have slipped into this operation manual. We are also not liable for consequential damage resulting from the delivery, capability or use of this device.

We offer you to take back the instruments of the instrument's family KEP-2 which you would like to dispose of.

The installation has to be carried out by authorized professionals.

Qualified employees from the measurement and control technology branch should only carry out adjustments and calibrations

**Caution! Danger of burns when touching surfaces!**

During operation, the components, measuring section and connection nut, can reach a temperature close to the process temperature.
To avoid burns, protection against contact must be ensured at elevated process temperatures, as there is a risk of medium to light injury.

The consumption sensor KEP-2 works according to the calorimetric measuring procedure.

**Flammable gases**

If this consumption sensor is used for measurement of flammable gases (e. g. natural gas and so on) we expressly would like to point out that the sensor has no DVGW admission, however, it can be used for measurements in natural gas. A DVGW admission is not mandatory.

The consumption sensor corresponds with the current state of technology and basically it can be used in any flammable and non-flammable gases.
The area outside the pipeline (ambient area of the sensor) must not be an explosive area.

# 6.  Operation

The KEP-2 is a compact consumption counter for compressed air and gases.

**Special features**:
- Optimum accuracy due to compact design
- Integrated Display showing Flow, consumption, velocity and temperature
- Input inner tube diameter via display keys
- Units free selectable. m³/h, m³/min, l/min, l/s, kg/h, kg/min, kg/s, cfm
- Modbus RTU (RS485) Interface
- Analogoutput 4...20mA
- Pulse output galv. isolated.

**Service Software**
- Analogue output 4...20 mA scaleable
- Selection of gas type (Air, Nitrogen, Argon, Nitrous oxide, CO2, Oxygen, Natural gas)
- Read out Service data
- Sensor diagnoses

## 7. Scaling Analogue Output   Compressed Air

Reference DIN1945/ ISO 1217: 20°C, 1000 mbar (Reference during calibration)

| Description | Version | Analogue output | |
|---|---|---|---|
| KEP-2 with integrated 1/4" meas. section | Low Speed | 4…20 mA = | 0…25 l/min |
| | Standard | | 0…50 l/min |
| | Max | | 0…105 l/min |
| | High Speed | | 0…130 l/min |
| KEP-2 with integrated 1/2" meas. section | Low Speed | 4…20 mA = | 0...20 m³/h |
| | Standard | | 0...45 m³/h |
| | Max | | 0...90 m³/h |
| | High Speed | | 0...110 m³/h |
| KEP-2 with integrated 3/4" meas. section | Low Speed | 4…20 mA = | 0...45 m³/h |
| | Standard | | 0...85 m³/h |
| | Max | | 0...175 m³/h |
| | High Speed | | 0...215 m³/h |
| KEP-2 with integrated 1" meas. section | Low Speed | 4…20 mA = | 0...75 m³/h |
| | Standard | | 0...145 m³/h |
| | Max | | 0...290 m³/h |
| | High Speed | | 0...355 m³/h |
| KEP-2 with integrated 1 1/4" meas. section | Low Speed | 4…20 mA = | 0...140 m³/h |
| | Standard | | 0...265 m³/h |
| | Max | | 0...530 m³/h |
| | High Speed | | 0...640 m³/h |
| KEP-2 with integrated 1 1/2" meas. section | Low Speed | 4…20 mA = | 0...195 m³/h |
| | Standard | | 0...365 m³/h |
| | Max | | 0...730 m³/h |
| | High Speed | | 0...885 m³/h |
| KEP-2 with integrated 2" meas. section | Low Speed | 4…20 mA = | 0...320 m³/h |
| | Standard | | 0...600 m³/h |
| | Max | | 0…1195m³/h |
| | High Speed | | 0...1450 m³/h |
| KEP-2 with integrated 2 1/2" meas. section | Low Speed | 4…20 mA = | 0...550 m³/h |
| | Standard | | 0...1025 m³/h |
| | Max | | 0…2050m³/h |
| | High Speed | | 0...2480 m³/h |
| KEP-2 with integrated 3" meas. section | Low Speed | 4…20 mA = | 0...765 m³/h |
| | Standard | | 0...1420 m³/h |
| | Max | | 0…2840m³/h |
| | High Speed | | 0...3440 m³/h |

# 8. Installation

## 8.1 Pipe/tube requirements

- Correctly sized gaskets
- Correct aligned flanges and gaskets
- Diameter mismatch at the pipe junctions should be avoided but must be less than 1 mm. For further information see ISO 14511
- Ensure clean pipes after installation

## 8.2 Inlet/outlet runs

The principle of thermal Mass flow measurement is very sensitive against disturbances. Therefore, it is necessary to ensure the recommended inlet and outlet runs.

Table of additionally required inlet sections

| Flow obstruction in front of the measuring section | Minimum length inlet section (L1) | Minimum length outlet section (L2) |
|---|---|---|
| Slight curve (bend < 90°) | **12 x D** | **5 x D** |
| Reduction (Pipe narrows to the meas. section) | **15 x D** | **5 x D** |
| Expansion (Pipe expands towards meas. section) | **15 x D** | **5 x D** |
| 90° bend or T-piece | **15 x D** | **5 x D** |
| 2 bends á 90° on one level | **20 x D** | **5 x D** |
| 2 bends á 90° 3-dimensional change of direction | **35 x D** | **5 x D** |
| Shut-off valve | **45 x D** | **5 x D** |
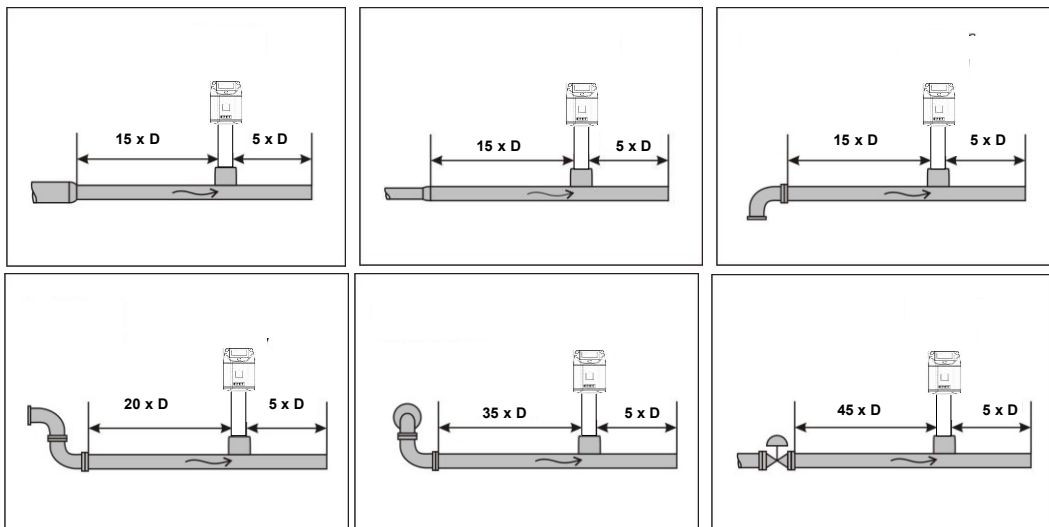
The respective minimum values required are indicated here. If it is not possible to observe the stipulated equalizing sections, considerable deviations in the measuring results must be expected.

**Attention:**
The dimensions of the KEP-2 consumption counter measuring sections do not fulfil the required minimum lengths of the input and outlet runs.
Please ensure recommended in - and outlet distances, dimensions for measuring sections see page 12 and 13.

## 8.3 Installation of KEP-2

The sensor KEP-2 is pre-supplied with the measuring section.

- **An installation at customer site is only allowed in the unpressurized state of the system**
- **It has to be checked whether the KEP-2 is correctly installed in the measuring section, the flow direction arrows must point in the same direction.**
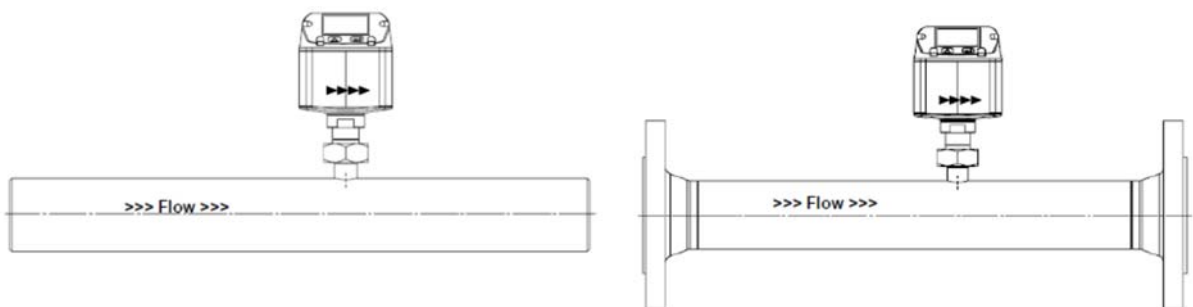


- **The connecting nut is tightened to a torque of 25 -30 Nm.**
- **Tightness of the connection must be checked and ensured**

## 8.4 Display Head Position
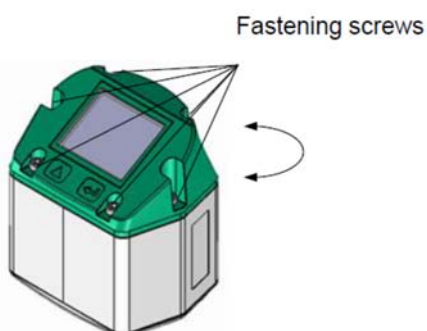


Fastening screws

The Position of the Display head is twistable by 180 e.g. in case of reverse flow direction.
For this purpose, the 6 fastening screws are to be released and the display head rotated 180°.

**Caution:**
It must be ensured that the connection plugs are still plugged and the gasket is installed correctly.

# 9. Flow measuring ranges

## 9.1 Flow for different gases

| | | 1/4" | 3/8" | 1/2" | 3/4" | 1" | 1 ¼" | 1 ½" | 2" | 2 ½" | 3" |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Analog output 20mA | Analog output 20mA | Analog output 20mA | Analog output 20mA | Analog output 20mA | Analog output 20mA | Analog output 20mA | Analog output 20mA | Analog output 20mA | Analog output 20mA |
| | | l/min | [m³/h] **l/min | [m³/h] | [m³/h] | [m³/h] | [m³/h] | [m³/h] | [m³/h] | [m³/h] | [m³/h] |
| **Reference DIN1945/ ISO 1217: 20°C, 1000 mbar** (Reference during calibration) | | | | | | | | | | | |
| **Air** | Low Speed | 25 | 225** | 20 | 45 | 75 | 140 | 195 | 320 | 550 | 765 |
| | Standard | 50 | 25 | 45 | 85 | 145 | 265 | 365 | 600 | 1025 | 1420 |
| | Max | 105 | 50 | 90 | 175 | 290 | 530 | 730 | 1195 | 2050 | 2840 |
| | High Speed | 130 | 60 | 110 | 215 | 355 | 640 | 885 | 1450 | 2480 | 3440 |
| **Adjustment to DIN 1343: 0°C, 1013,25 mbar** | | | | | | | | | | | |
| **Air** | Low Speed | 25 | 200** | 20 | 40 | 70 | 130 | 180 | 295 | 505 | 705 |
| | Standard | 50 | 380** | 40 | 80 | 135 | 240 | 335 | 550 | 945 | 1305 |
| | Max | 100 | 45 | 80 | 160 | 270 | 485 | 670 | 1100 | 1885 | 2610 |
| | High Speed | 120 | 55 | 100 | 195 | 325 | 590 | 815 | 1330 | 2280 | 3165 |
| Argon (Ar) | Low Speed | 45 | 20 | 35 | 75 | 120 | 220 | 305 | 505 | 865 | 1200 |
| | Standard | 85 | 35 | 70 | 135 | 230 | 415 | 570 | 935 | 1605 | 2225 |
| | Max | 170 | 75 | 140 | 275 | 460 | 830 | 1140 | 1870 | 3205 | 4440 |
| | High Speed | 205 | 95 | 170 | 335 | 555 | 1005 | 1385 | 2265 | 3880 | 5380 |
| Carbon dioxide (CO2) | Low Speed | 25 | 225** | 20 | 45 | 75 | 140 | 195 | 320 | 545 | 760 |
| | Standard | 50 | 25 | 45 | 85 | 145 | 260 | 360 | 590 | 1015 | 1405 |
| | Max | 105 | 50 | 90 | 175 | 290 | 525 | 720 | 1185 | 2030 | 2810 |
| | High Speed | 130 | 60 | 105 | 210 | 350 | 635 | 875 | 1430 | 2455 | 3405 |
| Nitrogen (N2) | Low Speed | 25 | 205** | 20 | 40 | 70 | 130 | 180 | 295 | 505 | 705 |
| | Standard | 50 | 20 | 40 | 80 | 135 | 240 | 335 | 550 | 945 | 1305 |
| | Max | 100 | 45 | 80 | 160 | 270 | 485 | 670 | 1100 | 1885 | 2610 |
| | High Speed | 120 | 55 | 100 | 195 | 325 | 590 | 815 | 1330 | 2280 | 3165 |
| Oxygen (O2) | Low Speed | 25 | 215** | 20 | 45 | 75 | 135 | 185 | 305 | 525 | 730 |
| | Standard | 50 | 20 | 40 | 80 | 140 | 250 | 345 | 570 | 980 | 1355 |
| | Max | 100 | 45 | 85 | 165 | 280 | 505 | 695 | 1140 | 1955 | 2710 |
| | High Speed | 125 | 55 | 105 | 205 | 340 | 610 | 845 | 1380 | 2365 | 3280 |
| Nitrous oxide (N2O) | Low Speed | 25 | 220** | 20 | 45 | 75 | 140 | 190 | 315 | 540 | 750 |
| | Standard | 50 | 20 | 40 | 85 | 140 | 260 | 355 | 585 | 1005 | 1395 |
| | Max | 105 | 45 | 85 | 170 | 285 | 520 | 715 | 1170 | 2010 | 2785 |
| | High Speed | 125 | 60 | 105 | 210 | 345 | 630 | 865 | 1420 | 2435 | 3375 |
| Natural gas (NG) | Low Speed | 15 | 130** | 15 | 25 | 45 | 85 | 115 | 190 | 325 | 450 |
| | Standard | 30 | 245** | 25 | 50 | 85 | 155 | 215 | 355 | 605 | 840 |
| | Max | 60 | 25 | 50 | 105 | 170 | 310 | 430 | 705 | 1210 | 1680 |
| | High Speed | 75 | 35 | 65 | 125 | 210 | 380 | 520 | 855 | 1465 | 2035 |

Other gases on request

**Please note:**

The consumption sensor corresponds with the current state of technology and basically it can be used in any flammable and non-flammable gases.

If this consumption sensor is used for measurement of flammable gases (e.g. natural gas and so on) we expressly would like to point out that the sensor has no DVGW admission, however, it can be used for measurements in natural gas. A DVGW admission is not mandatory.

The area outside the pipeline (ambient area of the sensor) must <u>not</u> be an explosive area.

# 10. Electrical wiring

## 10.1 Modbus, 4...20 mA, Pulse
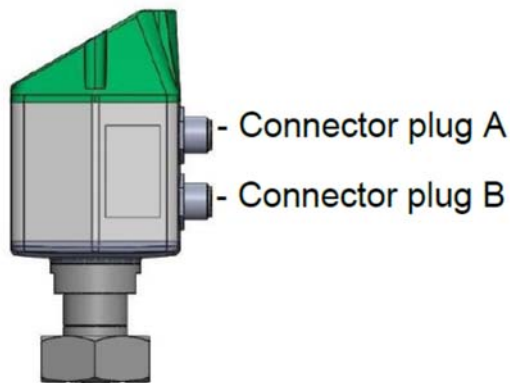


Attention: Not required connections NC must not be connected to a voltage and/or to protection earth. Cut and insulate cables.

|  | Pin 1 | Pin 2 | Pin 3 | Pin 4 | Pin 5 |
|---|---|---|---|---|---|
| **Connector plug A** | +VB | RS 485 (A)<br>RS 485 (+) | -VB | RS 485 (B)<br>RS 485 (-) | I+ 4...20 mA |
| **Connector plug B**<br>Pulse output (standard) | NC | GND | DIR | Pulse<br>galv. isolated | Pulse<br>galv. isolated |
| **Connector plug B**<br>Option MBus | NC | GND | DIR | MBus | MBus |
| Colours pulse cables<br>0553 0106 (5 m)<br>0553.0107 (10 m) | brown | white | blue | black | grey |

### Legend:

| -VB | Negative supply voltage 0 V |
|---|---|
| +VB | Positive supply voltage 18...36 VDC smoothed |
| I + | Current signal 4...20 mA – selected measured |
| RS 485 (A)<br>RS 485 (B) | Modbus RTU A / Modbus RTU (+)<br>Modbus RTU B / Modbus RTU (-) |

| Pulse | Pulse for consumption |
|---|---|
| NC | Must not be connected to a voltage and/or to protection earth. Please cut and isolate cables. |
| MBus | MBus (reverse polarity protected) |

If no connection cable/ pulse cable is ordered the sensor will be supplied with a M12 connector plug. The user can connect the supply and signal cables as indicated in the connection diagram.
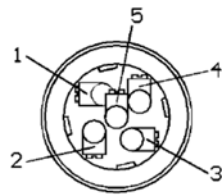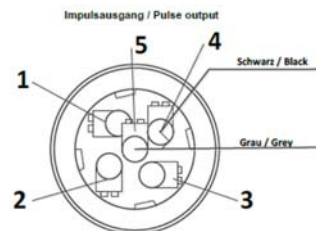
M12 Connector plug

View from back side
(terminal side)

**Connector plug A (M12 - A-coding)**
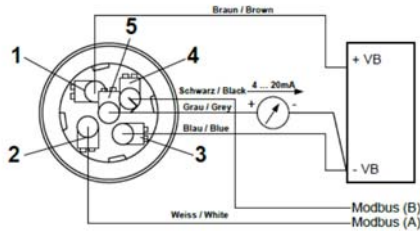


**Connector plug B (M12 - A-coding)**



 **Remark: If the sensor is placed at the end of the Modbus system a termination is required. The sensors have an internal switchable termination, therefore the 6 fastening screws from the lid are to be released and set the internal DIP Switch to "On". It must be ensured that the connection plugs are still plugged and the gasket is installed correctly.**
**Alternatively, a 120R resistor can be installed in the plug between pin 2 and pin 4.**

# 11. Operation

**Remark:** Only for version with display



"Up" ( △ )     "OK" ( ↵ )
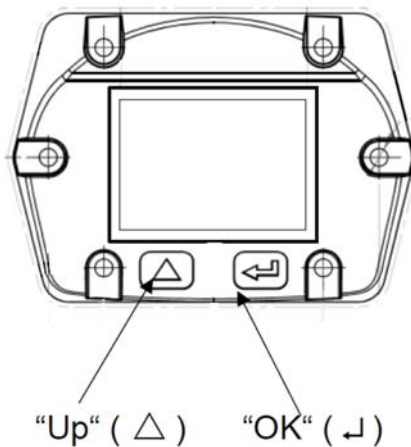
The operation of the KEP-2 is done by the two capacitive key buttons Up (△) und Enter (↵).

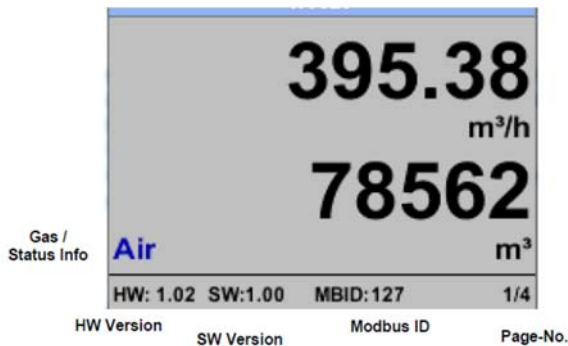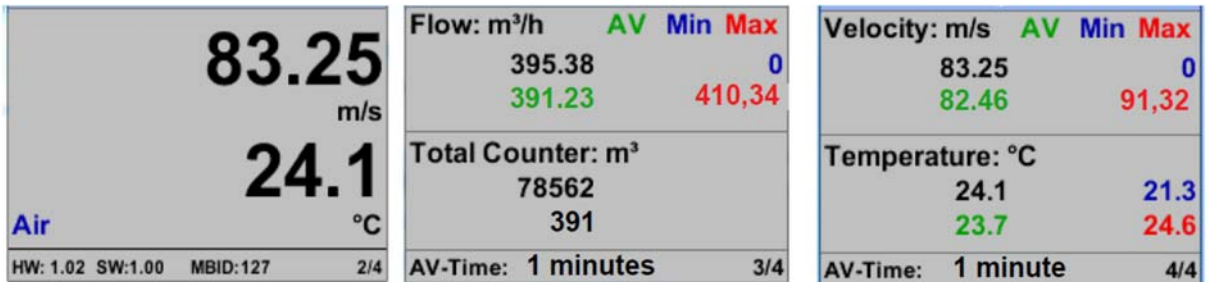## 11.1 Initialization
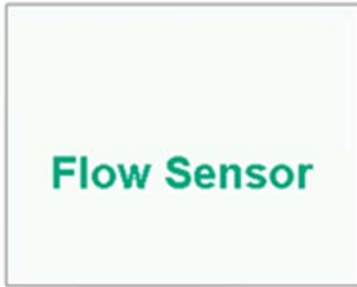


After switching on the KEP-2, the initialized screen is displayed followed by the main menu.

## 11.2 Main menu



Switching to pages 2-4 or back by pressing key „△"



AV-Time (Period for average value calculation) could be changed under *Sensor Setup.-Advanced– AV- Time*

## 11.3 Settings

The settings menu could accessed by pressing the key „OK". But the access to the *settings menu* is password protected.
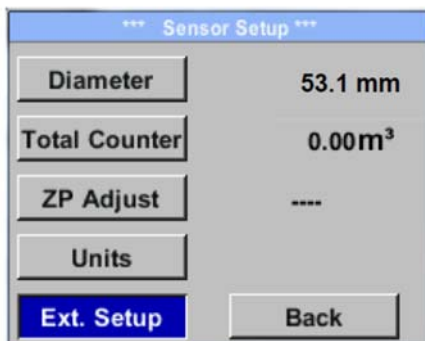
Factory settings for password at the time of delivery: 0000 (4 times zero).

If required the password could be changed at *Setup–User setup-Password.*
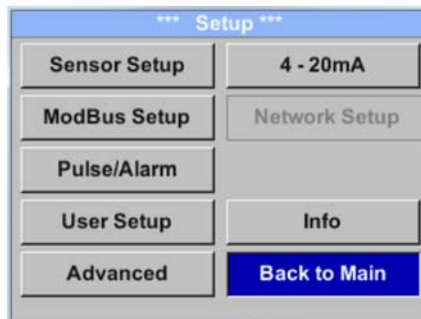
Selection of a menu item or to change a value is done with the key „△ ", a final move to the chosen menu item or takeover of the value change needs the confirmation by pressing the key „*OK*"

### 11.3.1 Sensor Setup

*Setup → Sensor Setup*

For changes, first select the menu item with key „△ " and then confirm it with "*OK*".
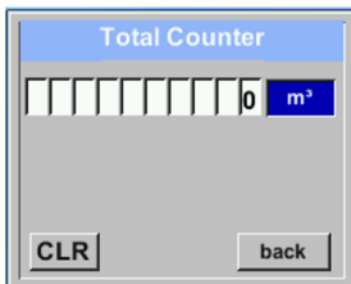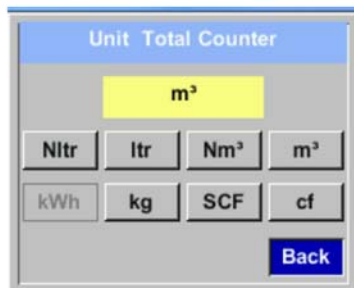
### 11.3.1.1 Input / change tube diameter
*Settings→ Sensor Setup→ Diameter*
For KEP-2 not adjustable (suspended) as voted on included measuring section with corresponding pipe diameter.


### 11.3.1.2 Input / change consumption counter

*Setup → Sensor Setup→ Total Counter → Unit button*

In order to change, e.g. the unit, first select by pressing key „△ " the button *"Unit"* and then key *"OK".*

Select with the key „△ " the correct unit and then confirm selection by pressing 2x *„OK".*

Entering / changing the consumption counter via button „△ ", select the respective position and activate the position with the *"OK"* button.
By pressing „△ " the position value is incremented by 1. Complete with *"OK"* and activate next number position.
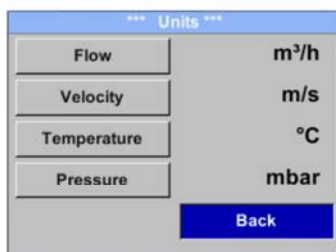
Confirm entry by pressing *„OK".*

**Important!**
**When the counter reach 100000000 m³ the counter will be reset to zero.**

### 11.3.1.3 Definition of the units for flow, velocity, temperature and pressure

*Setup → Sensor Setup→ Units*

To make changes to the unit for the respective measurement value, first select by pressing „△ " the field of the „measurement value" and activate „it with „*OK*" .

Selection of the new unit with „△ "

In case the quantity of units selectable are not presentable on one page, pleas move to next page by pressing „*<<*".

Confirm selection by pressing 2x „*OK*".

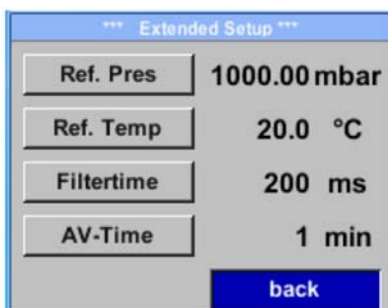Procedure for all 4 measurement variables is analogous.
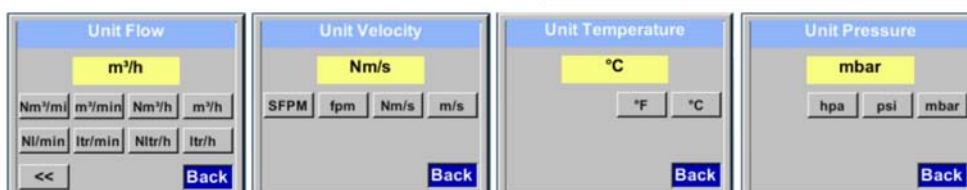
### 11.3.1.4   Definition of the reference conditions

Here can be defined the desired measured media reference conditions for pressure and temperature  and times for the filter and averaging.

- Factory presetting for reference temperature and reference pressure are  20 °C, 1000 hPa
- All volume flow values (m³/h) and consumption values indicated in the display are  related to 20 °C and 1000 hPa (according to ISO 1217 intake condition)
- Alternatively, 0 °C and 1013 hPa (=standard cubic meter) can also be entered as a reference.
- Do not enter the operation pressure or the operation temperature under reference conditions!

*Setup → Sensor Setup→ Advanced*

| *** Extended Setup *** | |
|---|---|
| Ref. Pres | 1000.00 mbar |
| Ref. Temp | 20.0 °C |
| Filtertime | 200 ms |
| AV-Time | 1 min |
| | back |

To make changes, first select a menu with button „△ " and confirm selection by pressing „*OK* " .

*Setup → Sensor Setup → Advanced → Ref.Pref*

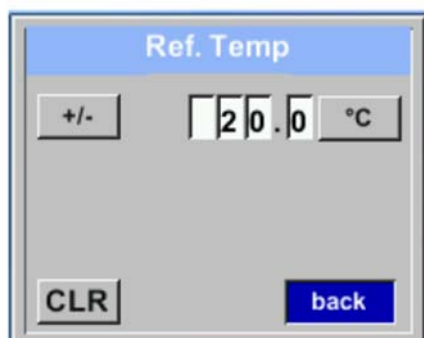| Ref. Pres | |
|---|---|
| 1 0 0 0 . 0 0 | hpa |
| CLR | OK | Cancel |
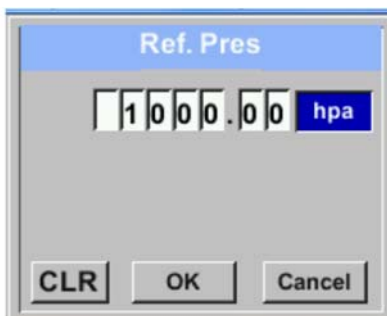
In order to change, e.g. the unit, first select by pressing key „△ " the field *"Units"* and then key "*OK*".

Select with the key „△ " the correct unit and then confirm selection by pressing 2x  „*OK*".

Input / change of the value by selecting the respective position with button „△ "and entering by pressing button „*OK*" .
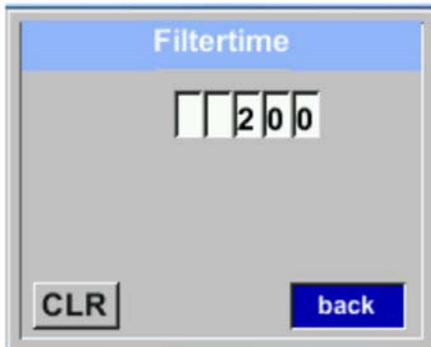
By pressing „△ " the position value is incremented by 1. Complete with *"OK"* and activate next number position.

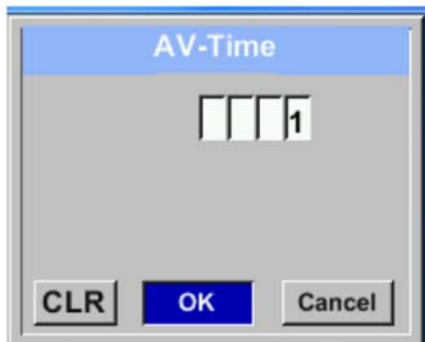Procedure for changing the reference temperature is the same.

*Setup → Sensor Setup→ Advanced →Ref.Temp*

| Ref. Temp | |
|---|---|
| +/- | 2 0 . 0   °C |
| CLR | back |

*Setup → Sensor Setup→ Advanced → Filtertime*

**Filtertime**

200

CLR    back

Under item *"Filtertime" "* an attenuation can be defined.
Input values of 0 -10000 in [ms] are possible

*Setup → Sensor Setup→ Advanced → AV-Time*

**AV-Time**

1

CLR    OK    Cancel

The time period for averaging can be entered here.

Input values of 1-1440 [minutes] are possible.

For average values see display window 3 + 4

## 11.3.1.5   Setting of Zeropoint and Low-flow cut off

*Setup → Sensor Setup→ ZP Adjust*
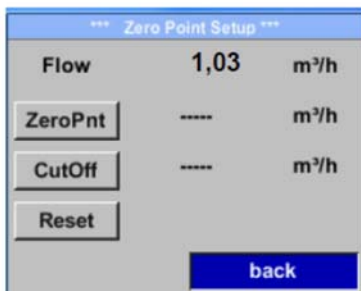
| *** Zero Point Setup *** | | |
|---|---|---|
| Flow | 1,03 | m³/h |
| ZeroPnt | ----- | m³/h |
| CutOff | ----- | m³/h |
| Reset | | |
| | back | |

To make changes, first select a menu with button „△" and confirm selection by pressing „*OK*".

*Setup → Sensor Setup → ZP Adjust → ZeroPnt*

**Zero Point**

| | 0.00 | m³/h |

**CLR**      **Back**
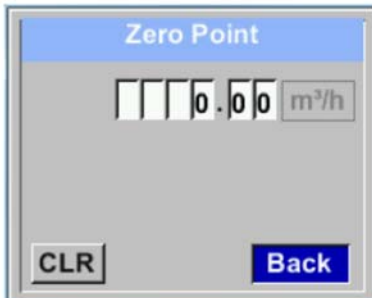
When, without flow, the installed sensor shows already a flow value of > 0 m³/h herewith the zero point of the characteristic could be reset.
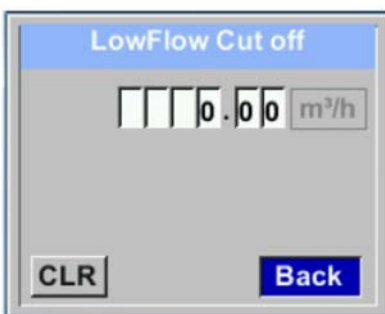
For an input / change of the value select with the button „△" the respective number position and activate it with „*OK*".

By pressing „△" the position value is incremented by 1. Confirm the input with „*OK*" and activate next number position.

Leave menu with button „*Back*"

*Setup → Sensor Setup → ZP Adjust →CutOff*

**LowFlow Cut off**

| | 0.00 | m³/h |

**CLR**      **Back**

With the low-flow cut off activated, the flow below the defined "LowFlow Cut off" value will be displayed as 0 m³/h and not added to the consumption counter.

For an input / change of the value select with the button „△" the respective number position and activate it with „*OK*".

By pressing „△" the position value is incremented by 1. Confirm the input with „*OK*" and activate next number position.

Leave menu with button „*Back*"

*Setup → Sensor Setup → ZP Adjust t → Reset*

**\*\*\* Zero Point Setup \*\*\***

| Flow | 1,03 | m³/h |
| ZeroPnt | ----- | m³/h |
| CutOff | ----- | m³/h |
| Reset | | |
| | back | |

By selection of „*Reset*" all settings for „*ZeroPnt*" and. „*CutOff*" are reset.

Menu item to be select with button „△" and confirm the reset with „*OK*".

Leave menu with button „*Back*"

### 11.3.2    Modbus Settings

### 11.3.2.1    Modbus RTU Setup

The Flow sensors KEP-2 comes with a Modbus RTU Interface. Before commissioning the sensor, the communication parameters

- Modbus ID, Baudrate, Parity und Stop bit

must be set in order to ensure the communication with the Modbus master.

*Settings → Modbus Setup*

For changes, e.g. the sensor ID, first select by pressing key „△" the field *"ID"* and then key *"OK"*.

Select the desired position by pressing the *">"* and select with *"OK"* button.

Change values by pressing the „△" values takeover by pressing *"OK"*.

Inputs for baudrate, stopbit and parity is done analogue.

By means of the button "Byte Order" it is possible to change the data format (Word Order). Possible formats are "ABCD" (Big Endian) and "CDAB" (Middle Endian)

Saving the changes by pressing *"Save"*, therefore select it with key „△" and then confirm it with *"OK"*.
To set back to default values please press button *"Set to Default"*

**Default values out of factory:**

| | |
|---|---|
| Modbus ID: | 1 |
| Baud rate: | 19200 |
| Stopbit: | 1 |
| Parity: | even |
| Byte Order: | ABCD |

**Remark: If the sensor is placed at the end of the Modbus system a termination is required. The sensors have an internal switchable termination, therefore the 6 fastening screws from the lid are to be released and set the internal DIP switch to "ON".**
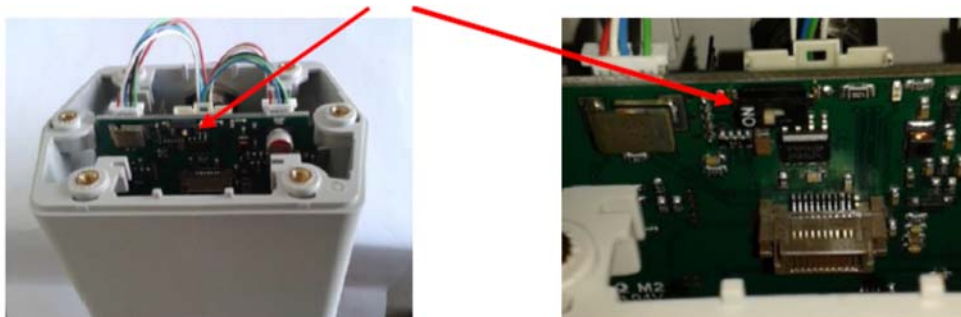


Alternatively, a 120R resistor can be installed in the plug between pin 2 and pin 4. It must be ensured that the connection plugs are still plugged and the gasket is installed correctly, see also chapter 4.5.

### 11.3.2.2 Modbus Settings (2001…2005)

| Modbus Register | Register Adress | No.of Byte | Data Type | Description | Default Setting | Read Write | Unit /Comment |
|---|---|---|---|---|---|---|---|
| 2001 | 2000 | 2 | UInt16 | Modbus ID | 1 | R/W | Modbus ID 1…247 |
| 2002 | 2001 | 2 | UInt16 | Baudrate | 4 | R/W | 0 = 1200<br>1 = 2400<br>2 = 4800<br>3 = 9600<br>4 = 19200<br>5 = 38400 |
| 2003 | 2002 | 2 | UInt16 | Parity | 1 | R/W | 0 = none<br>1 = even<br>2 = odd |
| 2004 | 2003 | 2 | UInt16 | Number of Stopbits | | R/W | 0 = 1 Stop Bit<br>1 = 2 Stop Bit |
| 2005 | 2004 | 2 | UInt16 | Word Order | 0xABCD | R/W | 0xABCD = Big Endian<br>0xCDAB = Middle Endian |

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### 11.3.2.3 Values Register (1001 …1500)

| Modbus Register | Register Adresse | No.of Byte | Data Type | Description | Def ault | Read Write | Unit /Comment |
|---|---|---|---|---|---|---|---|
| 1101 | 1100 | 4 | Float | Flow in m³/h | | R | |
| 1109 | 1108 | 4 | Float | Flow in Nm³/h | | R | |
| 1117 | 1116 | 4 | Float | Flow in m³/min | | R | |
| 1125 | 1124 | 4 | Float | Flow in Nm³/min | | R | |
| 1133 | 1132 | 4 | Float | Flow in ltr/h | | R | |
| 1141 | 1140 | 4 | Float | Flow in Nltr/h | | R | |
| 1149 | 1148 | 4 | Float | Flow in ltr/min | | R | |
| 1157 | 1156 | 4 | Float | Flow in Nltr/min | | R | |
| 1165 | 1164 | 4 | Float | Flow in ltr/s | | R | |
| 1173 | 1172 | 4 | Float | Flow in Nltr/s | | R | |
| 1181 | 1180 | 4 | Float | Flow in cfm | | R | |
| 1189 | 1188 | 4 | Float | Flow in Ncfm | | R | |
| 1197 | 1196 | 4 | Float | Flow in kg/h | | R | |
| 1205 | 1204 | 4 | Float | Flow in kg/min | | R | |
| 1213 | 1212 | 4 | Float | Flow in kg/s | | R | |
| 1221 | 1220 | 4 | Float | Flow in kW | | R | |

| Modbus Register | Register Adresse | No.of Byte | Data Type | Description | Default | Read Write | Unit /Comment |
|---|---|---|---|---|---|---|---|
| 1269 | 1268 | 4 | UInt32 | Consumption m³ before comma | x | R | |
| 1275 | 1274 | 4 | UInt32 | Consumption Nm³ before comma | x | R | |
| 1281 | 1280 | 4 | UInt32 | Consumption ltr before comma | x | R | |
| 1287 | 1286 | 4 | UInt32 | Consumption Nltr before comma | x | R | |
| 1293 | 1292 | 4 | UInt32 | Consumption cf before comma | x | R | |
| 1299 | 1298 | 4 | UInt32 | Consumption Ncf before comma | x | R | |
| 1305 | 1304 | 4 | UInt32 | Consumption kg before comma | x | R | |
| 1311 | 1310 | 4 | UInt32 | Consumption kWh before comma | x | R | |
| 1347 | 1346 | 4 | Float | Velocity m/s | | | |
| 1355 | 1354 | 4 | Float | Velocity Nm/s | | | |
| 1363 | 1362 | 4 | Float | Velocity Ft/min | | | |
| 1371 | 1370 | 4 | Float | Velocity NFt/min | | | |
| 1419 | 1418 | 4 | Float | GasTemp °C | | | |
| 1427 | 1426 | 4 | Float | GasTemp °F | | | |

**Remark:**
For more additional Modbus values please refer to separate Operating Instructions Modbus Installation and Operating Instructions for the sensors KEP-1 and KEP-2.

### 11.3.3 Pulse /Alarm

*Setup → Sensor Setup → Puls/ Alarm*

The galvanically isolated output can be defined as pulse- or alarm output.
Selection of field „*Relay Mode"* with key „△" and change modus by pressing key „*OK"*.

For alarm output following units could be chosen: kg/min, cfm, ltr/s, m³/h, m/s, °F, °C and kg/s.
„*Value"* defines the Alarm value, „*Hyst."* defines the desired hysteresis and with „*Hi-Lim"* or. „*Lo-Lim"* the alarm settings when the alarm is activated
Hi-Lim: Value over limit
Lo-Lim: Value under limit

For the pulse output following units could be chosen: kg, cf, ltr and m³. The pulse value definition to be done in menu „*Value"* . Lowest value is depending on max. flow of sensor and the max frequency of pulse output of 50Hz.

With „*Polarity"* the switching state could be defined.   Pos. = 0→ 1  neg. 1→ 0
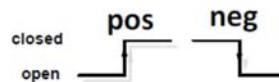
### 10.3.3.1 Pulse output

The maximum frequency for pulse output is 50 pulses per second (50 Hz). The Pulse output is delayed by 1 second.

| Pulse value | [m³ /h] | [m³ /min] | [l/min] |
|---|---|---|---|
| 0.1 ltr / Pulse | 18 | 0,3 | 300 |
| 1 ltr / Pulse | 180 | 3 | 3000 |
| 0.1m³ / Pulse | 18000 | 300 | 300000 |
| 1 m³ / Pulse | 180000 | 3000 | 3000000 |

Table 1 Maximum flow for pulse output

Entering pulse values that are not allow a presentation to the full scale value, are not allowed. Entries are discarded and error message displayed.

## 11.3.4    User Setup.

### 11.3.4.1  Password
*Settings → User Setup. → Password*
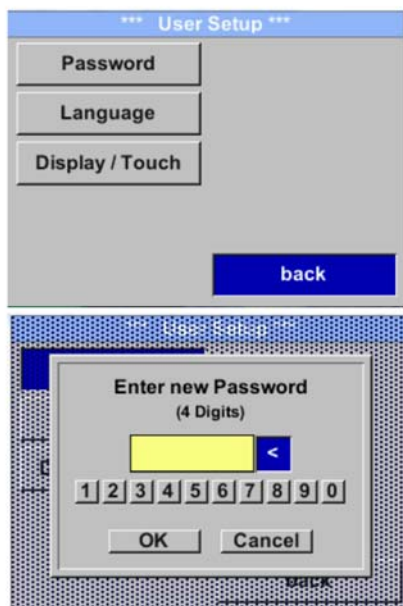


To make changes, first select a menu with button „△" and confirm selection by pressing „OK" .

It is possible to define a password. The required password length is 4 digits. Please select with button „△"a figure and confirm it with „OK" .Repeat this 4 times.

With „△" the last figure could be deleted. Password input have to be inserted twice.

Confirmation of input/password by pressing „OK".

**Factory settings for password at the time of delivery: 0000 (4 times zero).**

### 11.3.4.2  Language
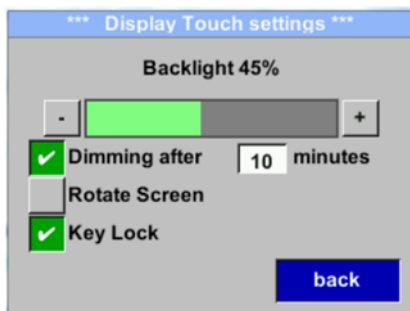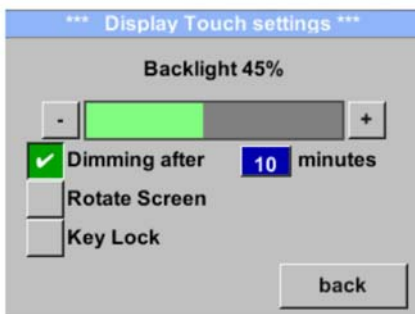*Settings → User Setup. → Language*



Currently 4 languages have been implemented and could be selected with button „△".

Change of language by confirming with "OK". Leaving the menu with button "back".

### 11.3.4.3    Display/Touch
*Settings → User Setup. → Display / Touch*



With the button „-" and with button „+" it is possible to adjust the backlight / display brightness. The actual / adjusted backlight brightness is showed in the graph „*Backlight.*"

By activation *"Dimming after"* and entering a time a display dimming could be set.

With „*Rotate Screen*" the display information could be rotated by 180°.

By activation of „*Key Lock*" the operation of the sensor locked.

Unlocking the keyboard is only possible by restarting the sensor and calling the operating menu within the first 10s. To do this, use the *"OK"* button to enter the operating menu during this period

### 11.3.5    Advanced
*Settings → Advanced*
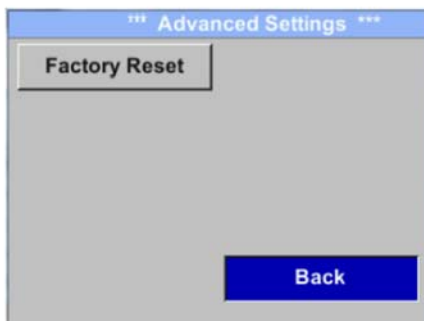


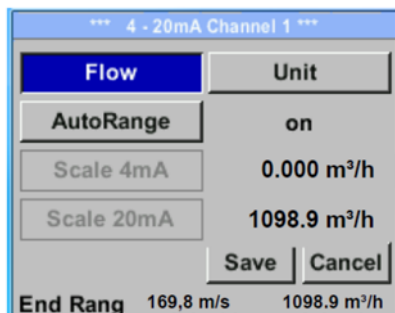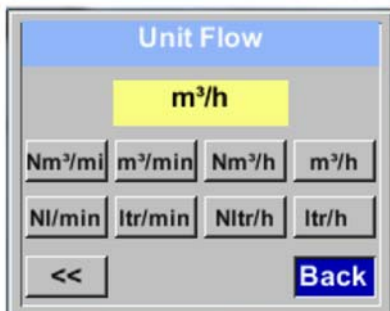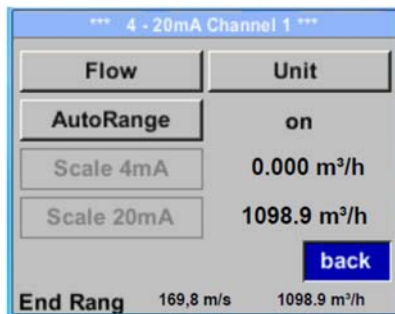By pressing „*Factory Reset*" the sensor is set back to the factory settings.

### 11.3.6    4 -20 mA
*Settings → 4-20mA*



To make changes, first select a menu with button „△" and confirm selection by pressing „*OK*" .

***Settings →4-20mA → Channel 1***



The 4-20 mA Analogue output of the Sensor VA 500 can be individually adjusted.

It is possible to assign following values *„Temperature"*, *„Velocity"* und *„Flow"* to the channel CH 1.

To make changes, first select the value item with button *„△"* .and confirm
Moving between the different measurements values or to deactivate the 4-20mA with setting to *„unused"* by pressing *„OK"*.

To the selected measurement value a corresponding / appropriate unit needs to be defined. Select *„Unit"* with *„△"* and open menu with *„OK"*.
Select required unit with *„△"* and take over by pressing *„OK"*.

Here e.g. for the measurement value Flow, procedure for the other measurements values is analog.

For saving the changes done press button *„Save"* to discard the changes press button *"Cancel"*.

Leaving the menu with *„Back"*.

*Settings → 4-20mA→ Channel 1→ AutoRange*



The scaling of the 4-20mA channel can be done automatically "Auto Range = on" or manual "AutoRange = off".

With button „△" select the menu item „AutoRange" select with „*OK*" the desired scaling method. (Automatically or manually)

In case of *AutoRange = off* with „*Scale 4mA*" und „*Scale 20mA*" the scale ranges needs to be defined.

Select with button „△" the item „Scale 4mA" or „Scale 20mA" and confirm with „*OK*".

Input of the scaling values will be analogous as described before for value settings.

Using „*CLR*" clears up the complete settings at once.

For *„Auto on"*, the max. scaling is calculated based on the inner tube diameter, max. measurement range and the reference conditions settings.

Take over of the inputs with „*Save*" and leaveing the menu with „*Back*".

*Settings → 4 -20mA → Error Current*



This determines what is output in case of an error at the analog output.

- 2 mA    Sensor error / System error
- 22 mA   Sensor error / System error
- None    Output according Namur (3.8mA – 20.5 mA)
  < 4mA to 3.8 mA Measuring range under range
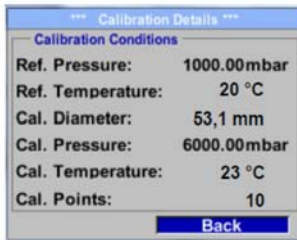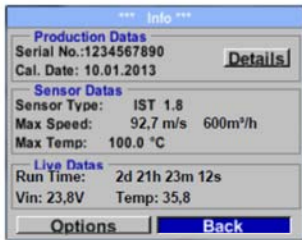  >20mA to 20.5 mA Measuring range exceeding

To make changes first select a menu item "Current Error" with button „△" and then select by pressing the „*OK*" the desired mode

For saving the changes done press button „*Save*" to discard the changes press button *"Cancel"*.

Leaving the menu with „*Back*".

### 11.3.7 KEP-2 Info

**Setup → Sensor Setup → Info**



Here you get a brief description of the sensor data incl. the calibration data.

Under *Details,* you are able to see in addition the calibration conditions.

# 12. Status/Error messages

## 12.1 Status messages

- **CAL**

On the part of Kobold Messring, a regular re-calibration is recommended, see chapter 15.

At delivery, the date at which the next recalibration is recommended is internally entered. When this date is reached, a message appears in the display with the status message „CAL".

**Note: The measurement will continue without interruption or restriction.**

**Status messages:**

## 12.2 Error messages

- **Low Voltage**

If the supply voltage is less than 11 V, the warning message „Low Voltage" is displayed. This means that the sensor can no longer work / measure correctly and thus there are none measured values for flow, consumption and speed are available.

- **Heater Error**

The error message *„Heater Error"* occurs in case of failure of the heating sensor.

- **Internal Error**

In the case of this message „Internal Error", the sensor has an internal read error on e.g. EEProm, AD converter etc. detected.I.

- **Temp out of Range**

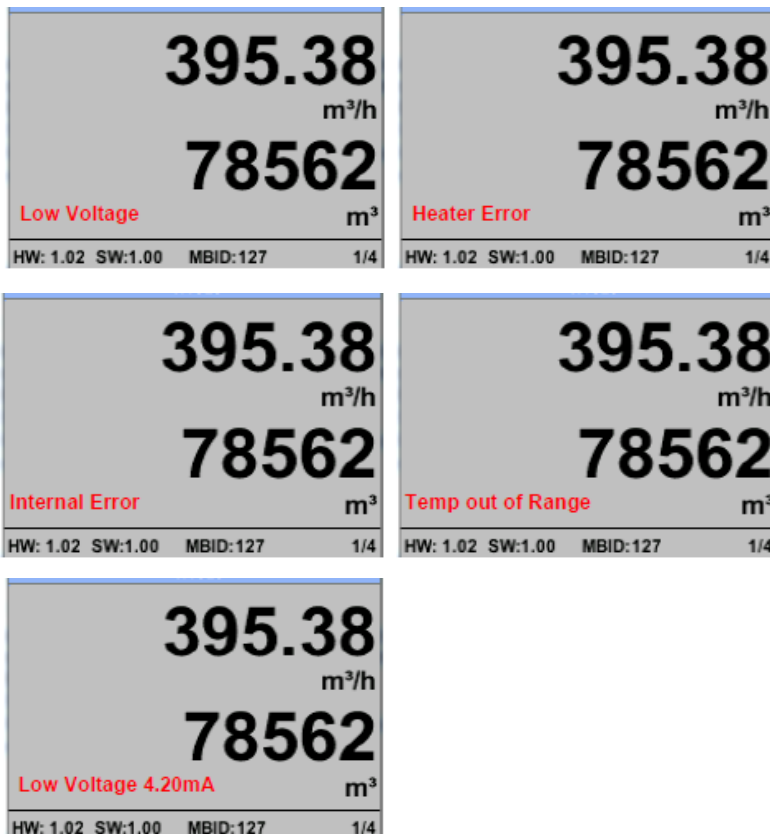At media temperatures outside the specified temperature range, the status message „Temp out of Range" occurs.
This temperature overshoot leads to incorrect measurement values (outside the sensor specification).

- **Low Voltage 4-20 mA**

For sensors with a galvanically isolated 4-20 mA output, a min. Supply voltage of 17.5 V is required. If this value is undershot, the error message *„Low Voltage 4-20 mA"* is displayed.

**Error messages:**

| 395.38 m³/h | 395.38 m³/h |
|---|---|
| 78562 m³ | 78562 m³ |
| Low Voltage | Heater Error |
| HW: 1.02  SW:1.00    MBID:127    1/4 | HW: 1.02  SW:1.00    MBID:127    1/4 |
| 395.38 m³/h | 395.38 m³/h |
| 78562 m³ | 78562 m³ |
| Internal Error | Temp out of Range |
| HW: 1.02  SW:1.00    MBID:127    1/4 | HW: 1.02  SW:1.00    MBID:127    1/4 |
| 395.38 m³/h | |
| 78562 m³ | |
| Low Voltage 4.20mA | |
| HW: 1.02  SW:1.00    MBID:127    1/4 | |

# 13. Maintenance

The sensor head should be checked regularly for dirt and cleaned if necessary. Should dirt, dust or oil accumulate on the sensor element, a deviation will occur in the measuring value. An annual check is recommended. Should the compressed air be heavily soiled this interval must be shortened.

# 14. Cleaning of the sensor head

The sensor head can be cleaned by carefully moving it back and forth in warm water with a small amount of washing-up liquid. Avoid physical intervention on the sensor (e.g. using a sponge or brush). If soiling cannot be removed, the manufacturer must carry out service and maintenance.

# 15. Re-Calibration

If no customer specifications are given then we recommend carrying out calibration every 12 months. For this purpose, the sensor must be sent to the manufacturer.

# 16. Spare parts and repair

For reasons of measuring accuracy spare parts are not available. If parts are faulty, they must be sent to the supplier for repair.

If the measuring device is used in important company installations, we recommend keeping a spare measuring system ready.

# 17. Calibration

According to DIN ISO certification of the measuring instruments we recommend to calibrate and if applicable to adjust the instruments regularly from the manufacturer. The calibration intervals should comply with your internal specification. According to DIN ISO we recommend a calibration interval of one year for the instrument KEP-2.

On request and additional payment, calibration-certificates could be issued. The precision is given due to use DKD-certified flow meters and verifiable

# 18. Warranty

If you have reason for complaint, we will of course repair any faults free of charge if it can be proven that they are manufacturing faults. The fault should be reported immediately after it has been found and within the warranty time guaranteed by us. Excluded from this warranty is damage caused by improper use and non-adherence to the instruction manual.

The warranty is also cancelled once the instrument has been opened - as far as this has not been mentioned in the instruction manual for maintenance purposes - or if the serial number in the instrument has been changed, damaged or removed.

The warranty time for the KEP-2 is 12 months. If no other definitions are given the accessory parts have a warranty time of 6 months. Warranty services do not extend the warranty time.

If in addition to the warranty service necessary repairs, adjustments or similar are carried out the warranty services are free of charge but there is a charge for other services such as transport and packaging costs. Other claims, especially those for damage occurring outside the instrument, are not included unless responsibility is legally binding.

**After sales service after the warranty time has elapsed**

We are of course there for you even after the warranty time has elapsed. In case of malfunctions, please send us the instrument with a short-form description of the fault. Please do not forget to indicate your telephone number so that we can call you in case of any questions

# 19. Technical Information

Operating instructions, data sheet, approvals and further information via the QR code on the device or via www.kobold.com

# 20. Order Codes

Operating instructions, data sheet, approvals and further information via the QR code on the device or via www.kobold.com

# 21. Dimensions

Operating instructions, data sheet, approvals and further information via the QR code on the device or via www.kobold.com

# 22. Disposal

<u>**Note!**</u>

- Avoid environmental damage caused by media-contaminated parts

- Dispose of the device and packaging in an environmentally friendly manner

- Comply with applicable national and international disposal regulations and environmental regulations.

<u>**Batteries**</u>

Batteries containing pollutants are marked with a sign consisting of a crossed-out garbage can and the chemical symbol (Cd, Hg, Li or Pb) of the heavy metal that is decisive for the classification as containing pollutants:



$Cd^1$      $Hg^2$      $Pb^3$      $Li^4$
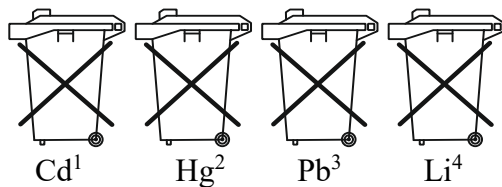
1. „Cd" stands for cadmium
2. „Hg" stands for mercury
3. „Pb" stands for lead
4. „Li" stands for lithium

<u>**Electrical and electronic equipment**</u>
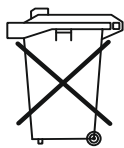
# 23. EU Declaration of Conformance

We, KOBOLD Messring GmbH, Nordring 22-24, 65719 Hofheim, Germany, declare under our sole responsibility that the product:

**Thermal Mass Flow Meter for Gas**    **model: KEP-2**

to which this declaration relates is in conformity with the following EU directives stated below:

| | |
|---|---|
| **2014/30/EU** | **EMC Directive** |
| **2011/65/EU** | **RoHS** (category 9) |
| **2015/863/EU** | Delegated Directive (RoHS III) |

Also, the following standards are fulfilled:

**EN 61326-1:2013**
Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements

**EN 55011:2016 + A1:2017 + A11:2020 + A2:2021**
Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement

Hofheim, 24 Jan. 2024

H. Volz                J. Burke
General Manager    Compliance Manager