# Instruction manual
# VA 521

## Compact inline flow sensor with integrated flow straightener

### with Display, 4 ... 20 mA and pulse output (galv. isolated)

# I. Foreword

Dear customer,

thank you very much for deciding in favour of the VA 521. Please read this installation and operation manual carefully before mounting and initiating the device and follow our advice. A riskless operation and a correct functioning of the VA 521 are only guaranteed in case of careful observation of the described instructions and notes


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# II. Table of Contents

# 1 Safety instructions

- **Please check whether this manual also corresponds to the device type.**
- This manual must be read before installation, commissioning and maintenance.
- Please observe all instructions given in this operating manual. It contains basic information that must be observed during installation, operation and maintenance.
- In addition to these operating instructions, local or national regulations must be observed where applicable.
- Warning: Do not exceed the pressure range of 16 bar!
- Observe the measuring range of the sensor!
- Overheating destroys the sensor.
- The screwed fixture must be pressure tight.
- 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 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.
- 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.

**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 injuri

**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.

# 2 Instruments description

The newly developed VA 521 combines modern digital interfaces for connection to energy monitoring systems with a small, compact design. The VA 521 is always used when many machines (compressed air consumers) are to be connected/integrated to a energy monitoring network.

**Special features**:

- Compact, small design - for use in machines, behind the maintenance unit on the final consumers
- Screw-in thread for easy installation in existing pipelines due to integrated measuring block
  - Sizes : ¼", ½" ¾", 1" 1 ¼" , 1 ½" and 2"
- Integrated flow straighteners (no inlet runs necessary, except ¼")
- Integrated display with presentation of 2 values
  - Flow & Consumption,
  - Speed & Temperature
- Operation via integrated keyboard
  - Units selection
    freely selectable. m³/h, m³/min, l/min, l/s, kg/h, kg/min, g/s, lb/min, lb/h
    cfm, m/s,ft/min
- Digital interfaces
  - Modbus RTU (RS485)
  - Ethernet
  - MBus
- Analog interfaces
  - 4..20mA
  - Pulse output galv. insulated.
- Pressure measurement (optional)

**Noze The optional CS Instruments Service Software enables you to:**

- Selection/conversion of gas type (air, nitrogen, argon, nitrous oxide, CO2, oxygen)
- Scaling Analog output 4..20mA
- Read out service data
- Sensor diagnosis

# 3 Intended use

The VA 521 consumption sensor is used for continuous flow measurements.

The VA 525 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.

**Operating principle:**

The VA 521 consumption probe operates according to the calorimetric measuring method.

The basis of this measuring method is the electrical heating of the mechanically protected built-in sensor. The mass flow, the volume flow and the flow velocity can be measured and determined by the resulting heat flow to the passing medium (gas).

With the calorimetric measurement method (based on the measurement principle), the operating temperature and pressure of the medium have no influence on the measurement result, only the material data of the gas component are decisive.

# 4 Technical data

| | |
|---|---|
| **Measurement:** | **Flow and consumption** |
| **Reference Standard:** | Standard settings ex works:<br>DIN 1945, ISO 1217 at 20°C and 1000 mbar |
| **Selectable Units** | **m³/h** (Standard settings ex works)<br>m³/min, l/min, l/s, ft/min, cfm, m/s, kg/h, kg/min, kg/s |
| **Measuring principle:** | calorimetric measurement |
| **Sensor:** | Pt45, Pt1000 |
| **Measuring medium:** | Air, gases |
| **Operating temperature:** | -30 ... 80°C probe tube |
| | -20 ... 70°C housing |
| **Operating pressure:** | up to 16 bar, special version PN 40 (40 bar) |
| **Power supply:** | 12 to 36 VDC |
| **Power consumption:** | max. 5W |
| **Digital output:** | RS 485 (Modbus RTU) |
| **Analog output:** | 4...20 mA (see chapter 4), max. burden < 500 Ohm |
| **Pulse output:** | pulse output potential free (dry contact) |
| | passive: max. 48Vdc, 150mA |
| | 1 pulse pro m³ resp. pro l,<br>Valency adjustable with the display keys |
| **Accuracy:** | ± 1,5 % m.v., ± 0,3 % f. s.* |
| **Display:** | TFT 1.8 Resolution 220 x 176 |
| **Mounting thread: measuring block** | G ¼”**,**, G ½”, G ¾”, G1", G 1¼” G 1½”, G 2” |
| **Material measuring block:** | Aluminium |
| **Protection class:** | IP65 |

* m.v. = measured values
f.s. = full scale

## 5 Scope of delivery

1x Flow sensor VA 521 with measuring section and integrated flow straightener

1x Calibration certificate

1x Instruction manual

# 6 Scaling Analogue output Compressed Air

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

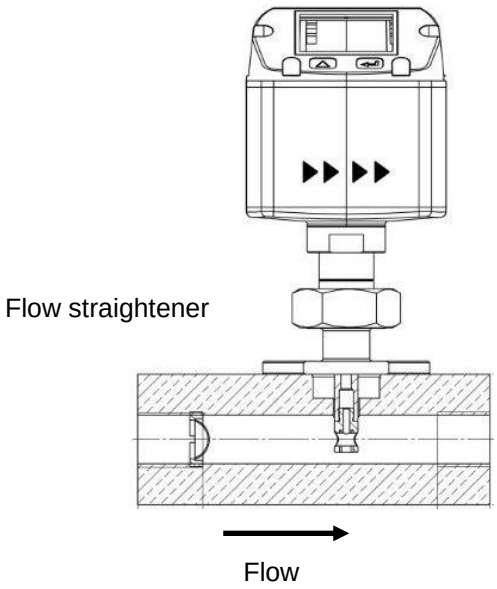
| Description | Version | Analogue output | |
|---|---|---|---|
| VA 521 with integrated ½" measuring block | Low Speed | 4… 20 mA = | 0...20 m³/h |
| | Standard | | 0...45 m³/h |
| | Max | | 0...90 m³/h |
| | High Speed | | 0...110 m³/h |
| VA 521 with integrated ¾" measuring block | Low Speed | 4… 20 mA = | 0...45 m³/h |
| | Standard | | 0...85 m³/h |
| | Max | | 0...175 m³/h |
| | High Speed | | 0...215 m³/h |
| VA 521 with integrated 1" measuring block | 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 |
| VA 521 with integrated 1¼" measuring block | 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 |
| VA 521 with integrated 1½" measuring block | 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 |
| VA 521 with integrated 2" measuring block | Low Speed | 4… 20 mA = | 0...320 m³/h |
| | Standard | | 0...600 m³/h |
| | Max | | 0…1195m³/h |
| | High Speed | | 0...1450 m³/h |

# 7 Installation Description

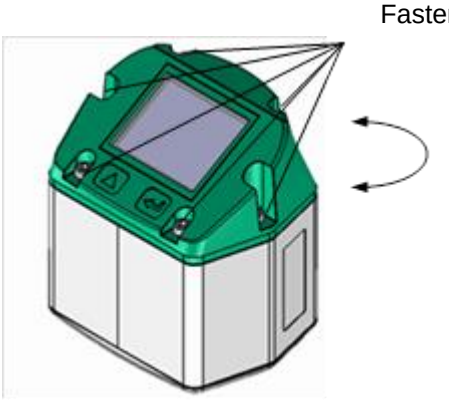
## 7.1 Installation of VA 521

**The sensor VA 521 is pre-supplied with the measuring block.**

- An installation at customer site is only allowed in the unpressurized state of the system.
- Tightness of the connection must be checked and ensured
- The connecting nut is tightened to a torque of 25 -30 Nm.
- It has to be checked whether the VA 521 is correctly installed in the measuring section, the flow direction arrows must point from the integrated flow straightener away.
- The installation of the measuring block into the system is to be carried out using an appropriate tool, e.g. a wrench.
  **It is not permitted to use the measuring head as an auxiliary tool (lever).**




## 7.2 Display head Position




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.

# 8 Flow measuring ranges

## 8.1 Flow for different gases

| | | 1/2" | 3/4" | 1" | 1 ¼" | 1 ½" | 2" |
|---|---|---|---|---|---|---|---|
| | | Analog output 20mA | Analog output 20mA | Analog output 20mA | Analog output 20mA | Analog output 20mA | Analog output 20mA |
| | | [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 | **20** | **45** | **75** | **140** | **195** | **320** |
| | Standard | **45** | **85** | **145** | **265** | **365** | **600** |
| | Max | **90** | **175** | **290** | **530** | **730** | **1195** |
| | High Speed | **110** | **215** | **355** | **640** | **885** | **1450** |
| **Adjustment to DIN 1343: 0°C, 1013,25 mbar** | | | | | | | |
| **Air** | Low Speed | **20** | **40** | **70** | **130** | **180** | **295** |
| | Standard | **40** | **80** | **135** | **240** | **335** | **550** |
| | Max | **80** | **160** | **270** | **485** | **670** | **1100** |
| | High Speed | **100** | **195** | **325** | **590** | **815** | **1330** |
| Argon (Ar) | Low Speed | 35 | 75 | 120 | 220 | 305 | 505 |
| | Standard | 70 | 135 | 230 | 415 | 570 | 935 |
| | Max | 140 | 275 | 460 | 830 | 1140 | 1870 |
| | High Speed | 170 | 335 | 555 | 1005 | 1385 | 2265 |
| Carbon dioxide ($CO_2$) | Low Speed | 20 | 45 | 75 | 140 | 195 | 320 |
| | Standard | 45 | 85 | 145 | 260 | 360 | 590 |
| | Max | 90 | 175 | 290 | 525 | 720 | 1185 |
| | High Speed | 105 | 210 | 350 | 635 | 875 | 1430 |
| Nitrogen ($N_2$) | Low Speed | 20 | 40 | 70 | 130 | 180 | 295 |
| | Standard | 40 | 80 | 135 | 240 | 335 | 550 |
| | Max | 80 | 160 | 270 | 485 | 670 | 1100 |
| | High Speed | 100 | 195 | 325 | 590 | 815 | 1330 |
| Oxygen f ($O_2$) | Low Speed | 20 | 45 | 75 | 135 | 185 | 305 |
| | Standard | 40 | 80 | 140 | 250 | 345 | 570 |
| | Max | 85 | 165 | 280 | 505 | 695 | 1140 |
| | High Speed | 105 | 205 | 340 | 610 | 845 | 1380 |
| Nitrous oxide ($N_2O$) | Low Speed | 20 | 45 | 75 | 140 | 190 | 315 |
| | Standard | 40 | 85 | 140 | 260 | 355 | 585 |
| | Max | 85 | 170 | 285 | 520 | 715 | 1170 |
| | High Speed | 105 | 210 | 345 | 630 | 865 | 1420 |

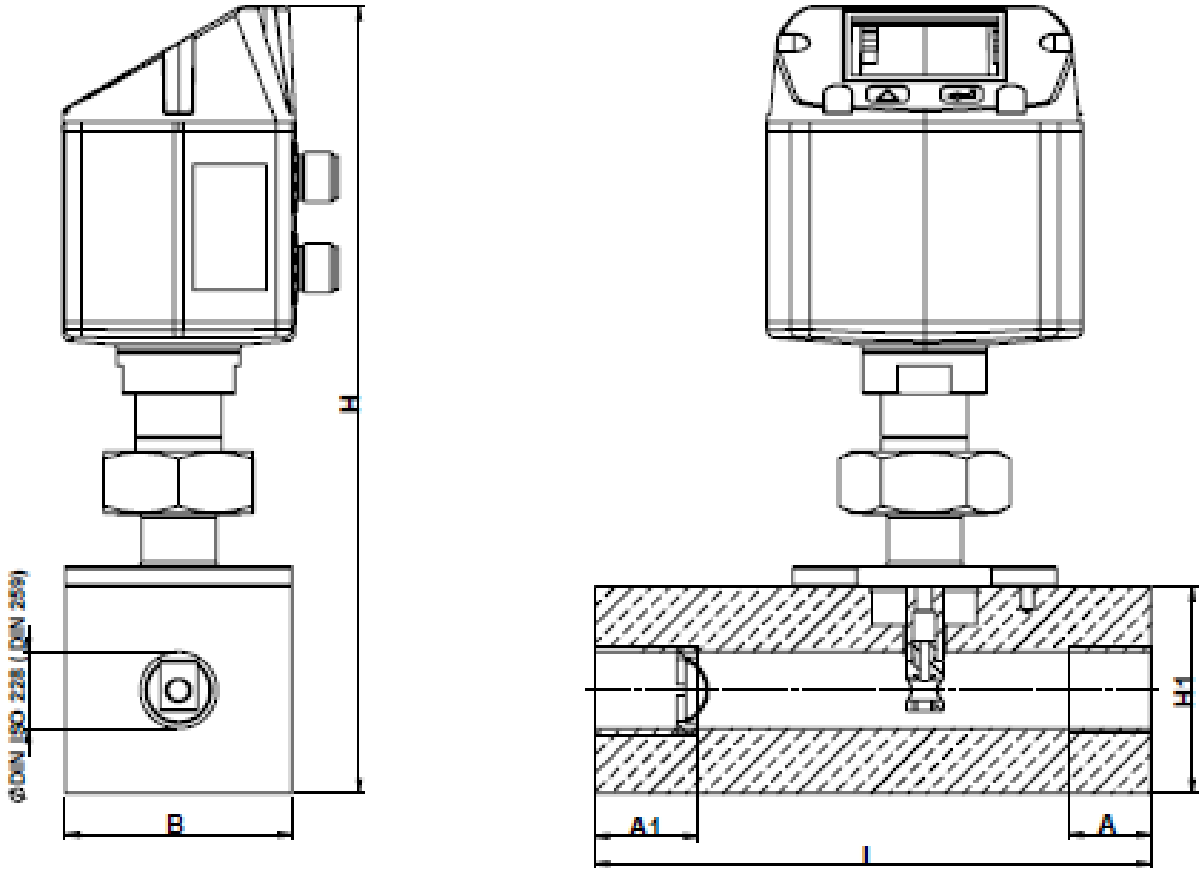
Other gases on request

**Please note:**

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

# 9 Dimensions

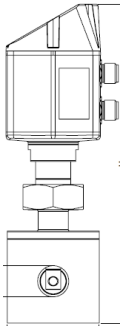
## 9.1 With measurement section and screw-in thread




| | Pipe size | Thread | L (mm) | B (mm) | H (mm) | H1 (mm) | A1 (mm) | A (mm) |
|---|---|---|---|---|---|---|---|---|
| VA 521 1/2“ | DN 15 | G1/2" | 135 | 55 | 190,65 | 50 | 25 | 20 |
| VA 521 3/4“ | DN 20 | G3/4" | 135 | 55 | 190,65 | 50 | 26 | 20 |
| VA 521 1“ | DN 25 | G1" | 135 | 55 | 190,65 | 50 | 33 | 25 |
| VA 521 1 1/4" | DN 32 | G1 1/4" | 135 | 80 | 215,45 | 80 | 35 | 25 |
| VA 521 1 1/2“ | DN 40 | G 1 1/2" | 135 | 80 | 215,45 | 80 | 36 | 25 |
| VA 521 2“ | DN 50 | G2" | 135 | 80 | 215,45 | 80 | 44 | 30 |

# 10 Electrical wiring

## 10.1 Modbus RTU, 4…20mA, Pulse or MBus



Connector plug A
Connector plug B

**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) | -VB | RS 485 (B) | I+<br>4..20 mA |
| **Connector plug B**<br>Pulse output (standard) | NC | GND | DIR | Pulse<br>galv. isolated | Pulse<br>gavl. 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 signal |
| RS 485 (A)<br>RS 485 (B) | Modbus RTU A<br>Modbus RTU A |

| | |
|---|---|
| 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.

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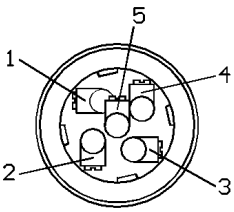
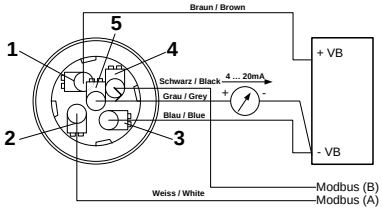


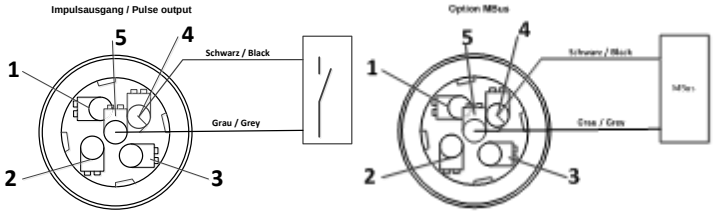

**M12 Connector plug**

View from back side (terminal side)

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



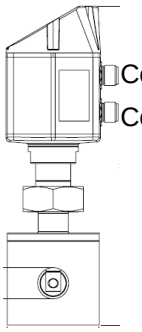

**Connector plug B (M12 - A-coding)**




**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, see also chapter 6.2.

Alternatively, a 120R resistor can be installed in the plug between pin 2 and pin 4.

### 10.2 Ethernet (optional PoE)

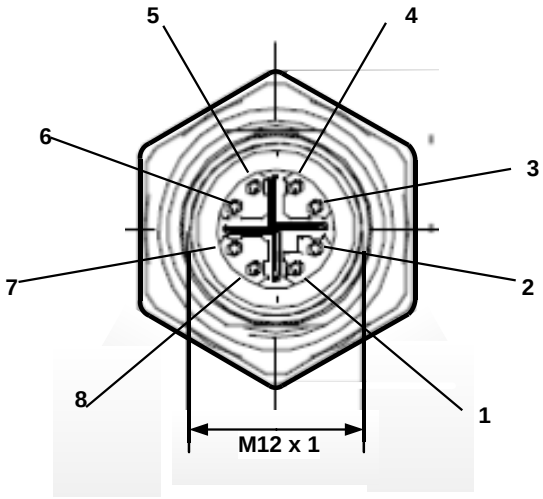


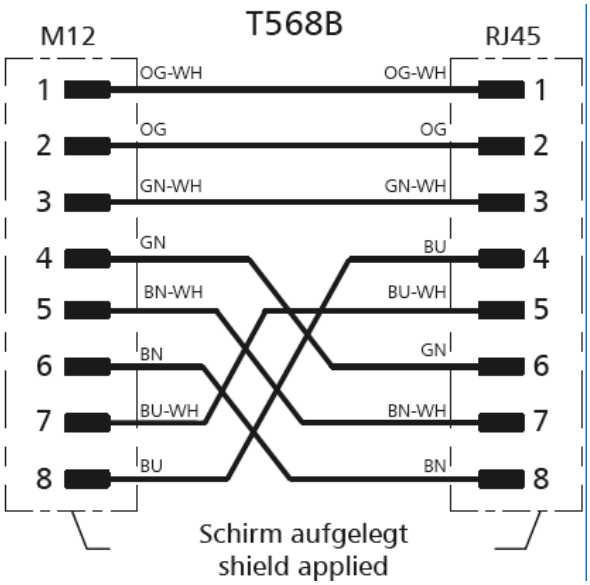
Connector plug A
Connector plug B (M12 c-coded

Connector plug B
M12 x-coded 8 pole

Data LINES: 1,2 und 3,4
PoE LINES: 5,6 und 7,8

Connection cable
M12 x-coded to RJ45




**Connection cable:** Cat 6.

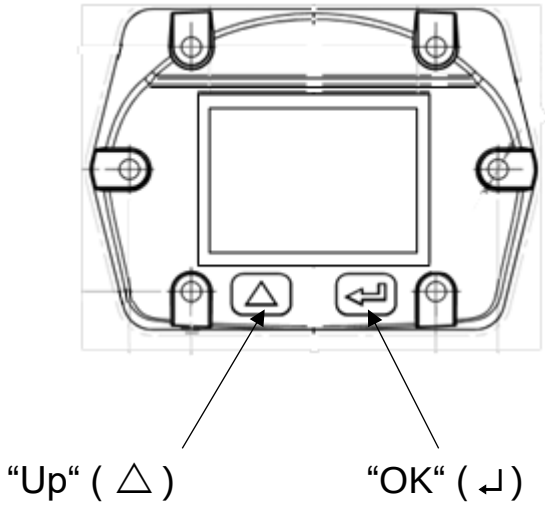
## Remark:

VA521 Power Classification acc. IEEE 802.3af: Class 2 (3,84W – 6,49W)

*PoE: Power over Ethernet

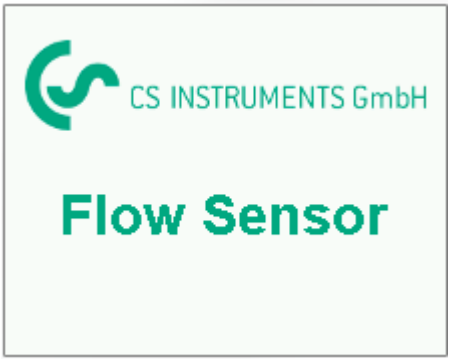
# 11 Operation

**Remark:** Only for version with display



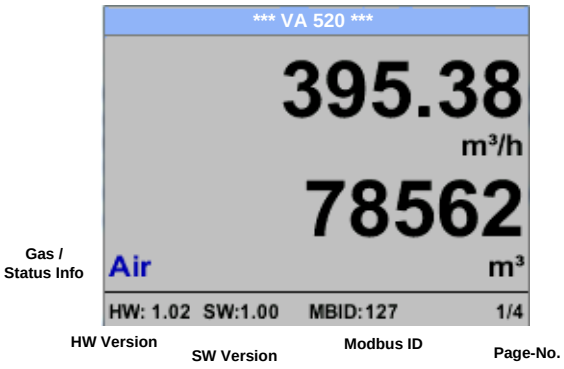

The operation of the VA 521 is done by the two capacitive key buttons Up (△) and Enter (↵)

## 11.1 Initialization

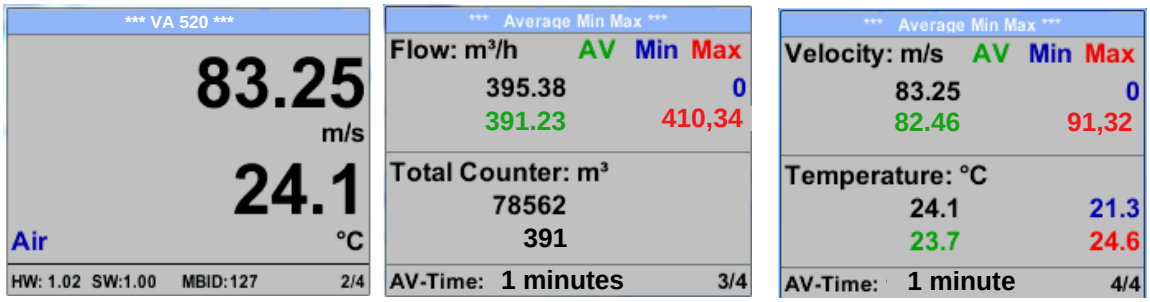



After switching on the VA 521, the initialized screen is displayed followed by the main menu.

## 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*.
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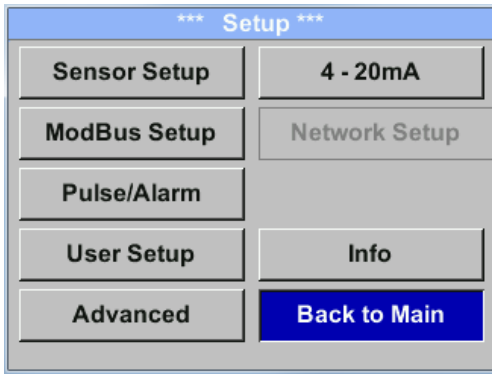
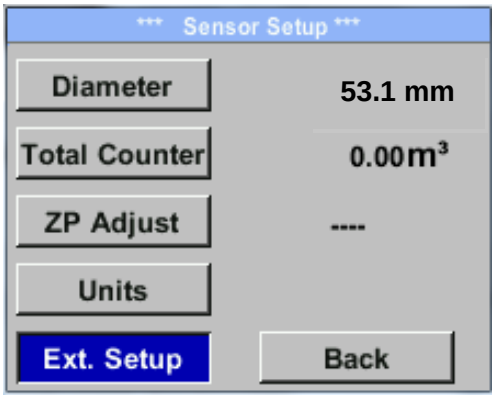



Selection of a menu item or to change a value is done with the key **„△ “,** a final move to the chosen menu item or takeover of the value change needs the confirmation by pressing the key ***„OK“***

### 11.3.1 Sensor Setup

***Setup → Sensor Setup***



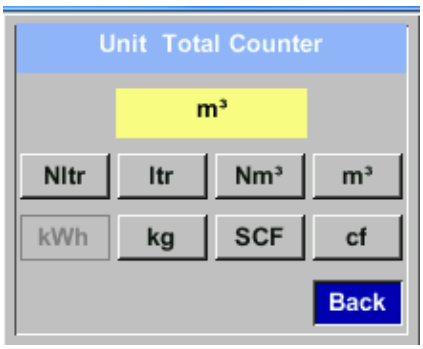

For changes, first select the menu item with key **„△ “ and** then confirm it with ***“OK“.***

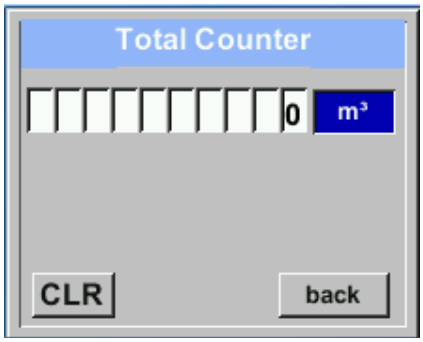
#### 11.3.1.1 Input / change tube diameter

For VA 521 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“***.

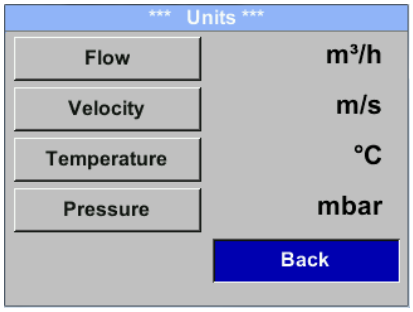
Entering / changing the consumption counter via button ***„△“***, select the respective position and activate the position with the ***"OK"*** button.
By pressing ***„△“*** the position value is incremented by 1. Complete with ***"OK"*** and activate next number position.

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***



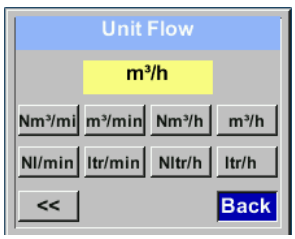

To make changes to the unit for the respective measurement value, first select by pressing ***„△“*** the field of the „measurement value“ and activate „it with ***„OK“*** .

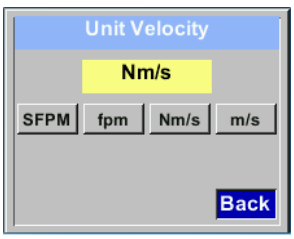
Selection of the new unit with ***„△“***

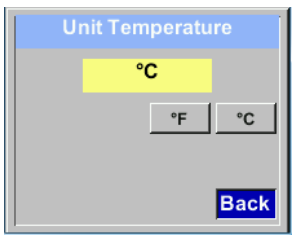
In case the quantity of units selectable are not presentable on one page, pleas move to next page by pressing ***„<<“*** .

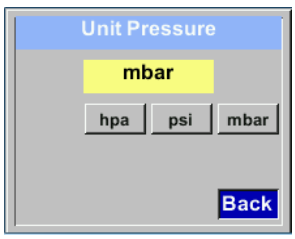
Confirm selection by pressing 2x ***„OK“***.

Procedure for all 4 measurement variables is analogous.



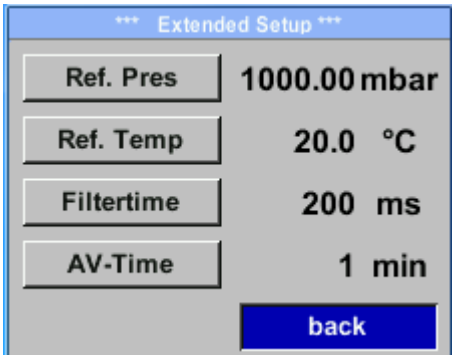



### 11.3.1.4 Definition of the reference conditions

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

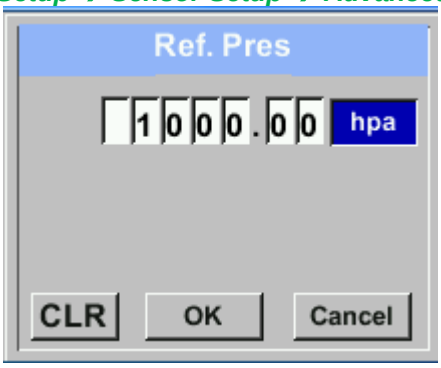
- Factory pre-setting for reference temperature and reference pressure are 20 °C, 1000 hPa
- All volume flow values (m³/h) and consumption values indicated in the display are related to 20 °C and 1000 hPa (according to ISO 1217 intake condition)
- Alternatively 0 °C and 1013 hPa (=standard cubic meter)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

***Setup → Sensor Setup→ Advanced***

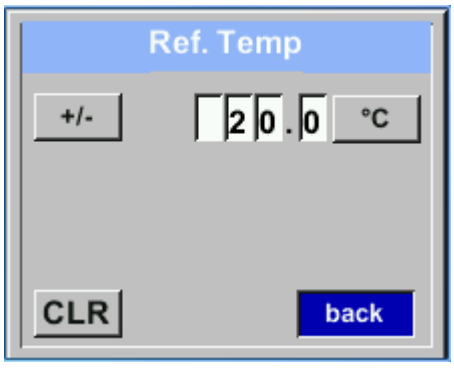



To make changes, first select a menu with button „△“ and confirm selection by pressing ***„OK“*** .

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




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




In order to change, e.g. the unit, first select by pressing key ***„△ “*** the field ***“Units”*** and then key “***OK”***.

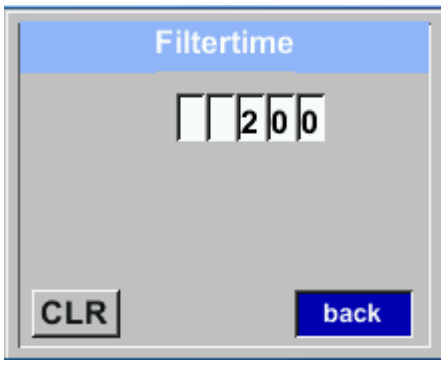
Select with the key ***„△ “*** the correct unit and then confirm selection by pressing 2x ***„OK“***.

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.

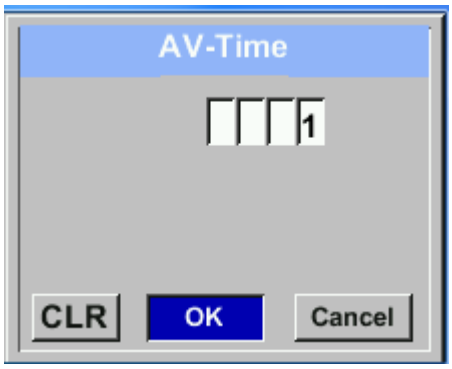
Procedure for changing the reference temperature is the same.

***Setup → Sensor Setup→ Advanced → Filtertime***




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

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



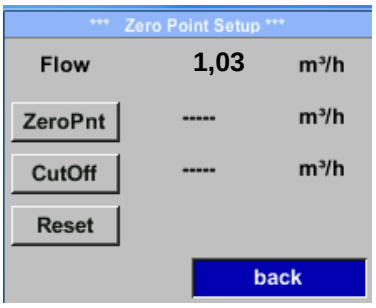

The time period for averaging can be entered here.

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

For average values see display window 3 + 4

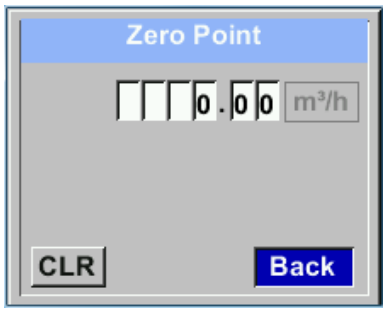
### 11.3.1.5 Setting of Zero point and Low-flow cut off

***Setup → Sensor Setup→ ZP Adjust***




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

***Setup → Sensor Setup → ZP Adjust → ZeroPnt***



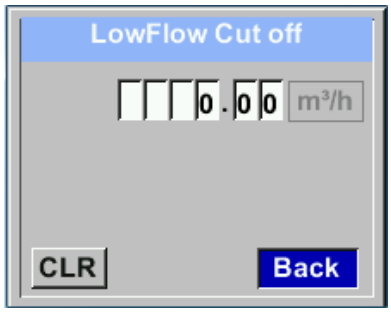

When, without flow, the installed sensor shows already a flow value of > 0 m³/h herewith the zero point of the characteristic could be reset.

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***



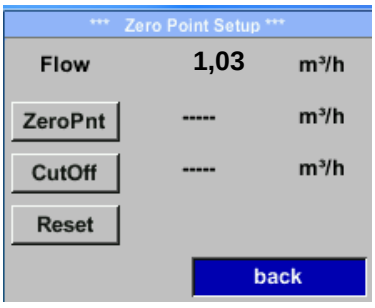

With the low-flow cut off activated, the flow below the defined "LowFlow Cut off" value will be displayed as 0 m³/h and not added to the consumption counter.

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***




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

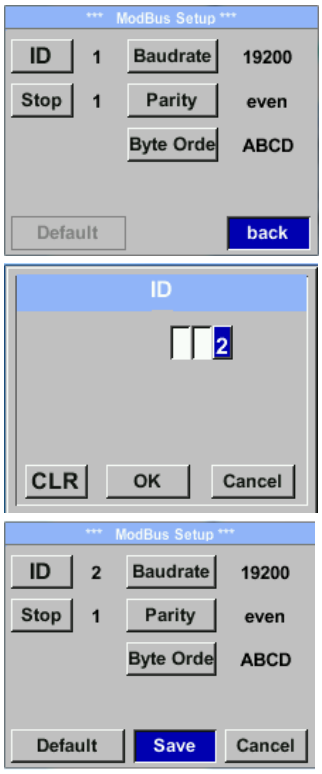
#### 11.3.2.1 Modbus RTU Setup

The Flow sensors VA 521 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 baud rate, stop bit 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".***

**Default values out of factory:**

| | |
|---|---|
| Modbus ID: | 1 |
| Baud rate: | 19200 |
| Stop bit: | 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 TCP (Optional)

The Flow sensors VA 521 comes optional with a Modbus TCP Interface
(HW Interface: M12 x 1 X-coded connector).

Device supports with this option the Modbus TCP protocol for communication with SCADA systems.
TCP port is set to 502 by default. Port can be changed at the sensor or using PC Service Software

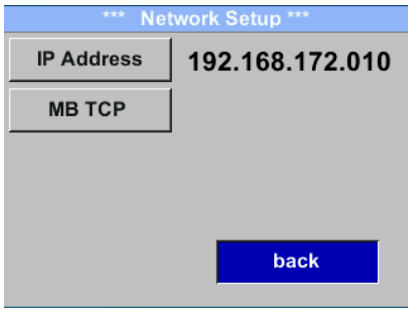
Modbus device address (Unit Identifier) can be set in the range of 1- 255.
Specification and description of the Modbus protocol is free to download on: www.modbus.org.

Supported Modbus commands (functions):

| Command | Code | Description |
|---|---|---|
| Function Code | 3 | (Read holding register) |
| Function code | 16 | (Write multiple registers) |

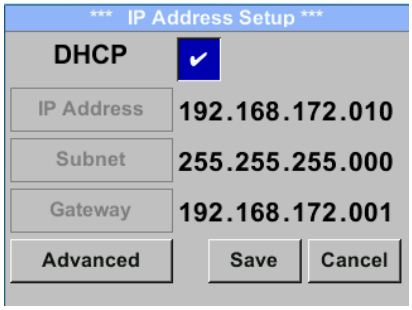
For more details, please see **VA 5xx Modbus RTU_TCP Installation V1.04**

***Settings → Network Setup***




##### *11.3.2.2.1 Network Setup DHCP*

***Settings → Network Setup Settings → IP Address***



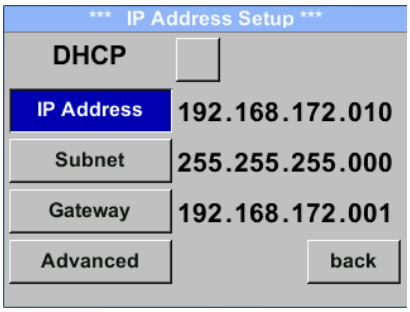

Here you can set up and made a connection, with or without *DHCP*, to a computer.

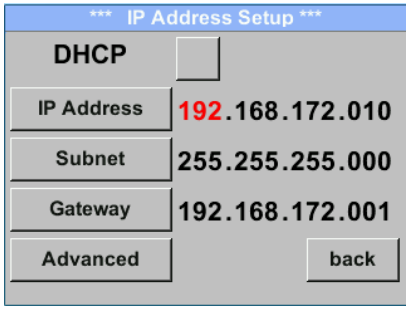
**Remark:**
With activated DHCP the automatic integration of the sensor in an existing network is possible, without a manual configuration.

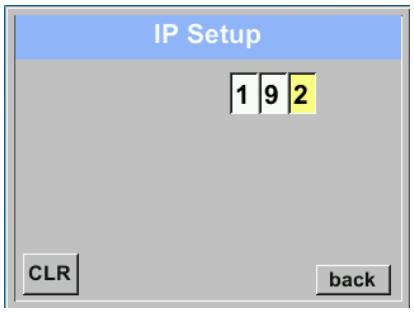
Storing of settings by pressing ***"Save"***

### *11.3.2.2.2 Network Settings static IP*

***Settings → Network Setup Settings → IP Address → IP Address***
***Settings → Network Setup Settings → IP Address → Sub Net***
***Settings → Network Setup Settings → IP Address → Gateway***




For manual (static) IP, the ***"IP Address", "Subnet"*** and ***"Gateway"*** selection keys must be selected and activated with ***"OK".***

The first data field of the selection, in this case the IP address, is then marked (red).

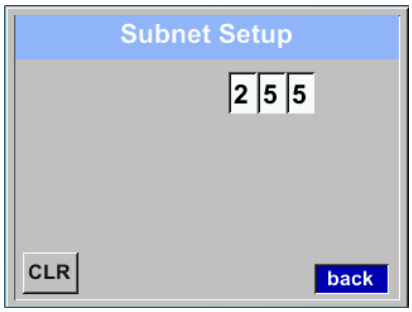
Confirm with ***"OK"*** the corresponding input menu is opened.

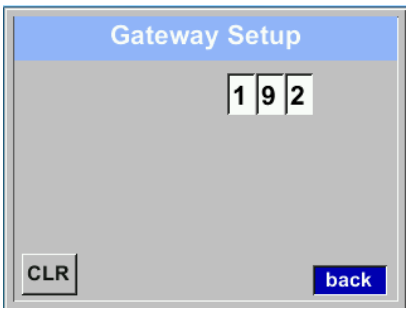
By means of ***">"***, the next data field is changed.

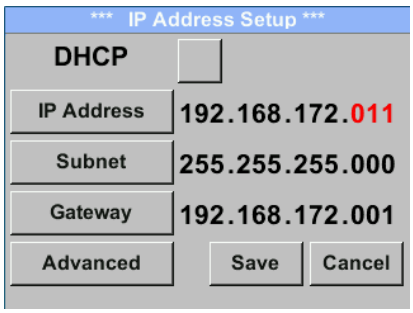
Select the desired position with the ***">"*** key and activate it with the ***"OK"*** key.

Change the values with the ***">"*** key, and accept the values with the ***"OK"*** key.

Procedure for ***"Subnet"*** and ***"Gateway"*** is analogous.



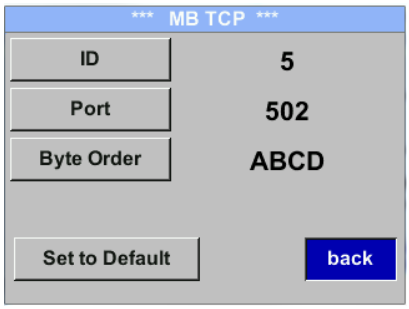



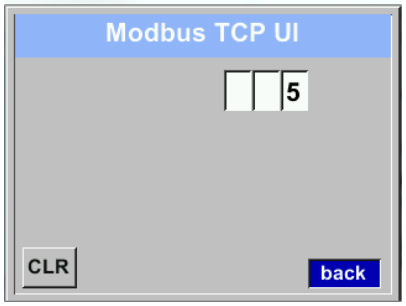

Store the settings by ***„Save“***

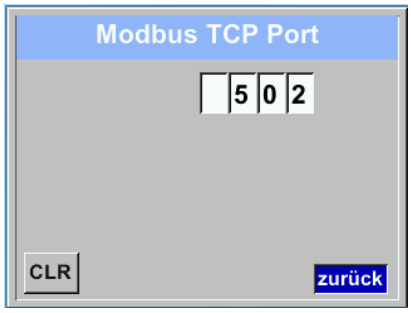
### 11.3.2.3 Modbus TCP Settings

***Settings → Network Setup Settings → IP Address → MB TCP***




***Settings → Network Setup Settings → IP Address → ID***
***Settings → Network Setup Settings → IP Address → Port***




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".***

Input for the port is done analogue.

By means of the button ***"Byte Format"*** 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".***
Reset to the default settings by activating ***"Set to Default"-***

#### 11.3.2.4 Modbus Settings (2001…2005)

| Modbus Register | Register Address | 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 | Baud rate | 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 Stop bits | | 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 |

#### 11.3.2.5 Values Register (1001 …1500)

| Modbus Register | Register Address | 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 Address | 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:**

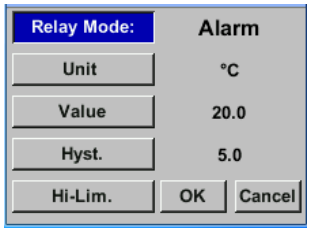
- **For DS400 / DS 500 / Handheld devices - Modbus Sensor Datatype**

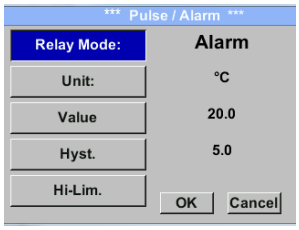
  „Data Type R4-32“ match with „Data Type Float“

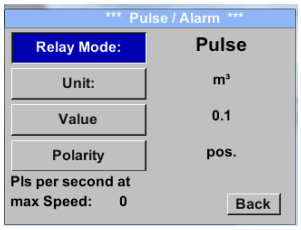
- For more additional Modbus values please refer to VA5xx_Modbus_RTU_Slave_Installation_1.04_EN.doc

### 11.3.3 Pulse /Alarm

***Setup → Sensor Setup → Pulse/ 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


#### 11.3.3.1 Pulse output

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

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

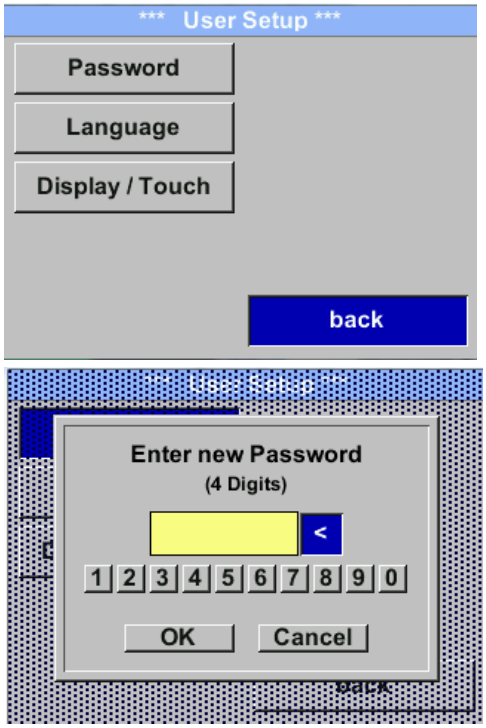
**Table 1 Maximum flow for pulse output**

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 → UserSetup → 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.

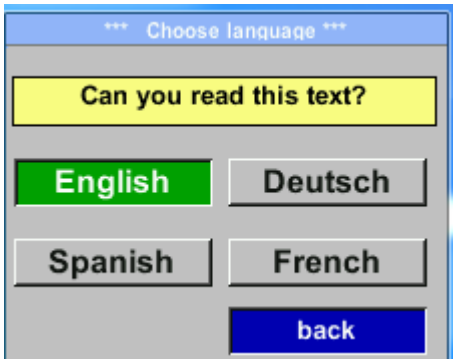
With ***„△“*** the last figure could be deleted.
Password input have to be inserted twice.

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 → UserSetup → Language***

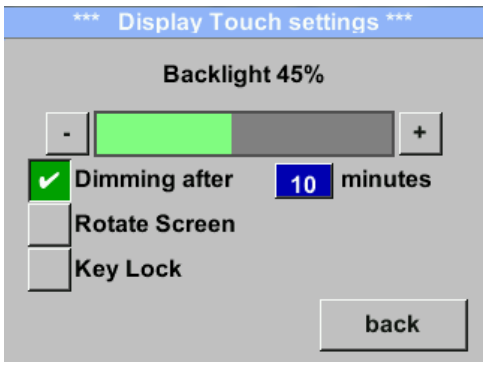


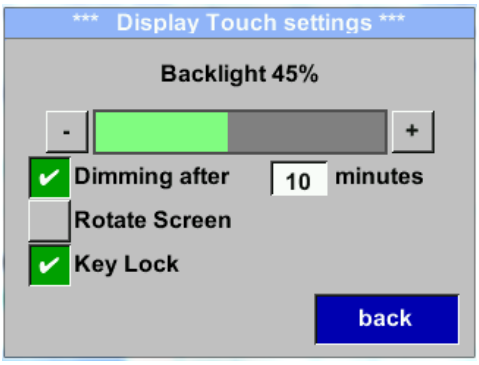

Currently 4 languages have been implemented and could be selected with button ***„△“***

Change of language by confirming with ***“OK***”.
Leaving the menu with button ***“back”.***

### 11.3.4.3 Display / Touch

***Settings → UserSetup → 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.

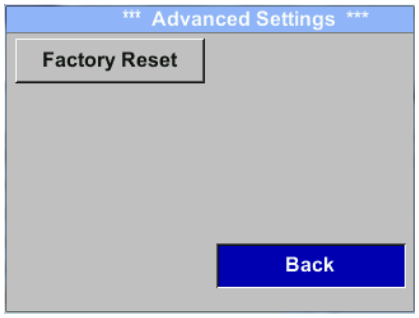
With ***„Rotate Screen“*** the display information could be rotated by 180°.

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

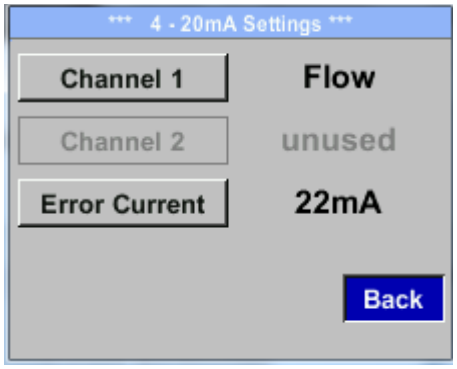
***Settings→ Advanced***




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

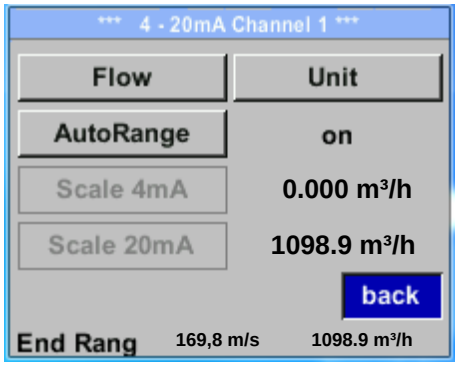
### 11.3.6 4 -20mA

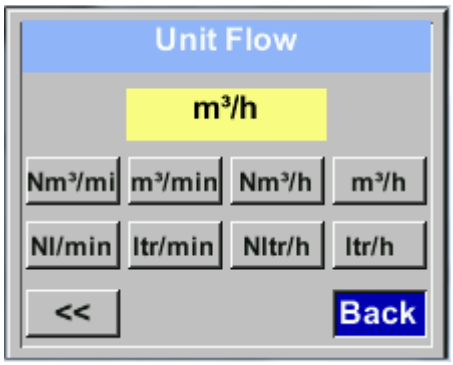
***Settings → 4-20mA***

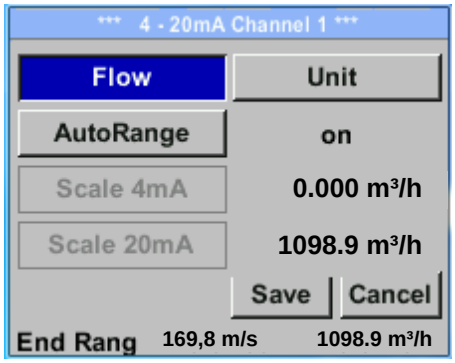



To make changes, first select a menu with button „△“ and confirm selection by pressing ***„OK“*** .

***Settings → 4-20mA → Channel 1***




The 4-20 mA Analogue output of the Sensor VA 521 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“***.

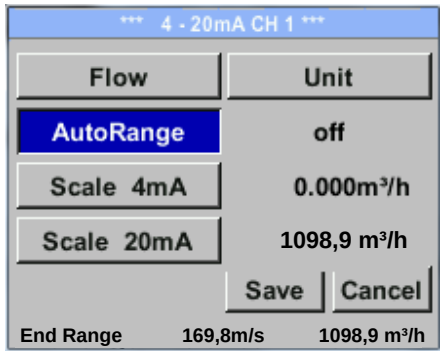
To the selected measurement value a corresponding / appropriate unit needs to be defined. Select ***„Unit“*** with „△“ and open menu with ***„OK“.***
Select required unit with „△“ and take over by pressing ***„OK“.***

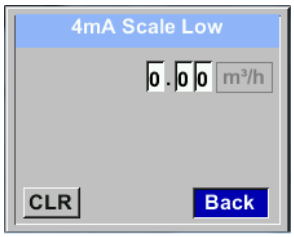
Here e.g. for the measurement value Flow, procedure for the other measurements values is analog.

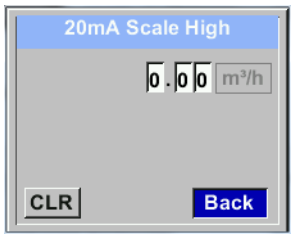
For saving the changes done press button ***„Save“*** to discard the changes press button ***“Cancel”.***

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“*** .

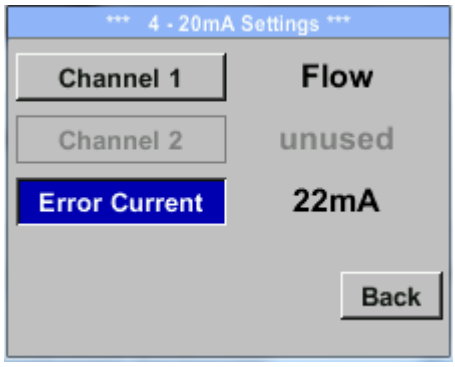
Input of the scaling values will be analogous as described before for value settings.

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.

Takeover of the inputs with ***„Save***“ and leaving the menu with ***„Back***“.

### *Settings → 4-20mA → Error Current*




This determines the 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

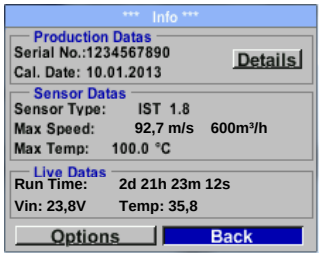
To make changes first select a menu item "Current Error" with button ***„△“*** and then select by pressing the ***„OK“*** the desired mode

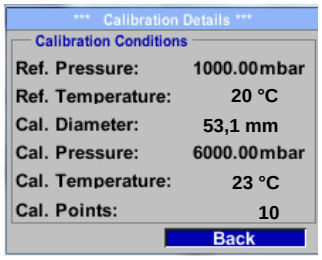
For saving the changes done press button ***„Save“*** to discard the changes press button ***“Cancel”.***

Leaving the menu with ***„Back***“.

### 11.3.7 VA 521 Info

***Settings → Info***

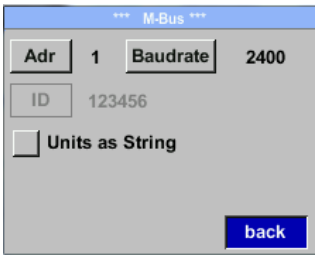


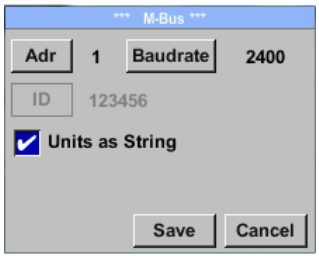




Here you get a brief description of the sensor data incl. the calibration data.

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

## 11.4 MBus




The Sensor offers two possibilities for coding the Value Information Field (VIF).

- Primary VIF (The units and multiplier correspond to MBus specification 4.8 chapter 8.4.3
- Plain text VIF ((units are transmitted as ASCCII characters. So units that are not included in MBus specification chapter 8.4.3 are possible

Switch to Plain Text VIF by activation of ***„Units as String“.***

### 11.4.1 Default Settings communication

| | |
|---|---|
| Primary Address*: | 1 |
| ID: | Serial number of Sensor |
| Baud rate*: | 2400 |
| Medium*: | depending on medium (Gas or Compressed Air) |
| Manufacturer ID: | CSI |
| VIF coding: | Primary VIF |

Both addresses, Primary address and ID, could be automatic searched in the M-Bus system.

### 11.4.2 Default values transmitted

| | |
|---|---|
| Value 1 with [Unit]*: | Consumption [m³] |
| Value 2 with [Unit]*: | Flow [m³/h] Consumption [m³] |
| Value 3 with [Unit]*: | Gas temperature [°C] |

*****All Values could be changed / preset in production or with CS Service software (Order-No. 0554 2007)

# 12 Status / Error messages

## 12.1 Status messages

- **CAL**

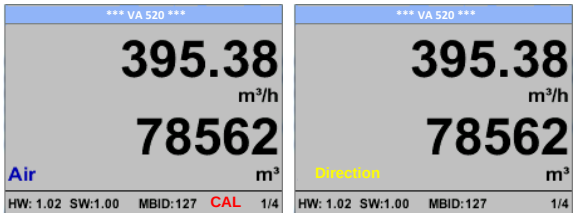
On the part of CS Instruments GmbH & Co.KG a regular re-calibration is recommended, see chapter 13.
At delivery, the date at which the next recalibration is recommended is internally entered.
When this date is reached, a message appears in the display with the status message „***CAL“***.

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

- **Direction**

When used in conjunction with a direction switch VA409, the status message "Direction" is displayed in case of opposite flow direction and no measurement may take place.

**Status messages:**



## 12.2 Error messages

- **Low Voltage**

If the supply voltage is less than 11V, 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.

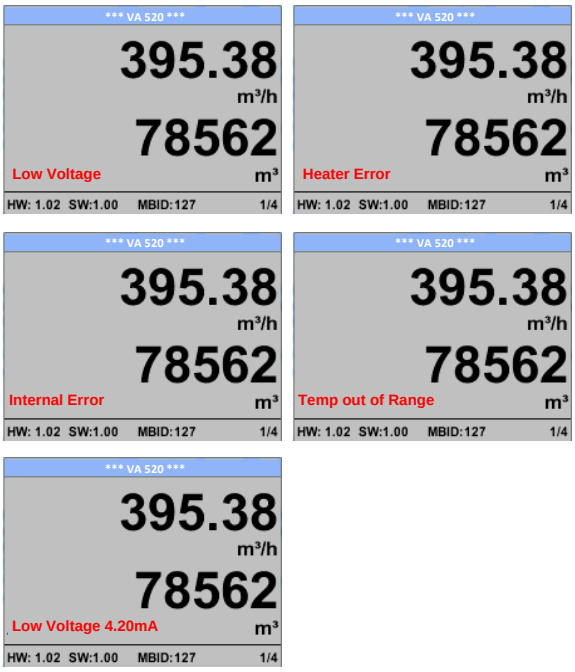
- **Temp out of Range**

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 4-20mA**

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

**Error messages:**



# 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 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, service and maintenance must be carried out by the manufacturer.

# 15 Re-Calibration

If no customer specifications are given then we recommend to carry 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 VA 521.

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 VA 521 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.

CS INSTRUMENTS GmbH & Co. KG

# KONFORMITÄTSERKLÄRUNG

DECLARATION OF CONFORMITY

Wir / We: CS Instruments GmbH & Co.KG, Gewerbehof 14, 24955 Harrislee

Erklären in alleiniger Verantwortung, dass das Produkt
Declare under our sole responsibility that the product

Verbrauchs-/ Durchflusssensor VA 521
Flow Sensor VA 521

den Anforderungen folgender Richtlinien entsprechen:
We hereby declare that above mentioned components comply with requirements of the following EU directives:

| | |
|---|---|
| Elektromagnetische Verträglichkeit<br>Electromagntic compatibility | 2014/30/EU<br>2014/30/EC |
| RoHS (Restriction of certain Hazardous Substances) | 2011/65/EC |

Angewandte harmonisierte Normen:
Harmonised standards applied:

| | |
|---|---|
| EMV-Anforderungen<br>EMC requirements | **EN 55011: 2011-04**<br>**EN 61326-1: 2013-07** |

Anbringungsjahr der CE Kennzeichnung: 20
Year of first marking with CE Label: 20

Das Produkt ist mit dem abgebildeten Zeichen gekennzeichnet.
The product is labelled with the indicated mark.

CE

Harrislee, den 04.03.2020

Wolfgang Blessing Geschäftsführer