

# VA 420

## consumption counter with display, 4 ... 20 mA and pulse output (galvanically isolated)

Stationary

Flow and consumption measurement for compressed air  
and gases



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**INTRODUCTION**

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Dear customer,

Thousands of customers buy our high standard products every year. There are a few good reasons for doing so:

- The cost-performance ratio - reliable quality at a fair price.
- We have the ideal solutions for your measuring tasks based on our expert experience gained over 20 years.
- Our high quality standard.
- Of course, our instruments carry the CE symbol required by the EU.
- We issue calibration certificates and hold seminars.

Our service guarantees fast help.



Measuring instrument conform to **DIN EN 61326-1** and **DIN EN 61010-1**



**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 instruments family VA 420 which you would like to dispose of.

Adjustments and calibrations should only be carried out by qualified employees from the measurement and control technology branch.



The consumption sensor VA 420 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.

If the sensor is used e.g. in the medium natural gas, the sensor will be adjusted for natural gas. The calibration protocol (inspection certificate) will be included in the scope of delivery.

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

The installation has to be carried out by authorized professionals.

## INSTRUMENTS DESCRIPTION

VA 420 is a compact consumption counter for compressed air and gases.

### Special features:

- Optimum accuracy due to compact design
- Integrated in- and outlet section
- Less flow due to measuring section
- Integrated display for Nm<sup>3</sup>/h and Nm<sup>3</sup>

### Programming via Service Software SFA 300

- Analogue output 4...20 mA scalable
- Selection of gas type (air, nitrogen, argon, nitrous oxide, CO<sub>2</sub>, oxygen, natural gas)
- Read-out the service data

## INSTALLATION DESCRIPTION

The following table shows the required inlet sections depending on the existing disturbance / flow disturbance.

**Table of additionally required inlet sections**

Flow obstruction <b>in front of</b> the measuring section	Minimum length inlet section (L1)	Minimum length outlet section (L2)
Slight curve (bend < 90°)	<b>12 x D</b>	<b>5 x D</b>
Reduction (pipe narrows towards the meas. section)	<b>15 x D</b>	<b>5 x D</b>
Expansion (pipe expands towards the meas. section)	<b>15 x D</b>	<b>5 x D</b>
90° bend or T-piece	<b>15 x D</b>	<b>5 x D</b>
2 bends á 90° on one level	<b>20 x D</b>	<b>5 x D</b>
2 bends á 90° 3-dimensional change of direction	<b>35 x D</b>	<b>5 x D</b>
Shut-off valve	<b>45 x D</b>	<b>5 x D</b>

The respective minimum values required are indicated here. If it is not possible to observe the stipulated equalising sections, considerable deviations in the measuring results must be expected.

### Attention:

The measuring sections of VA 420 consumption counters with 1 1/2" and 2" measuring section have reduced inlet and outlet sections. Please take into consideration the recommended inlet and outlet sections. Dimensions please see page 7 and 8.

**TECHNICAL DATA**

<b>Parameters:</b>	flow and consumption (Standard: DIN 1945, ISO 1217 at 20°C and 1000 mbar)
<b>Selectable units for flow:</b>	m <sup>3</sup> /h (standard - factory setting), m <sup>3</sup> /min, l/min, l/s, kg/s, kg/min, kg/h, cfm
<b>Measuring principle:</b>	calorimetric measurement
<b>Sensor:</b>	Pt45, Pt1000
<b>Measuring medium:</b>	air, gases
<b>Operating temperature:</b>	-30 ... 80°C
<b>Operating pressure:</b>	up to 16 bar, special version PN 40 (40 bar)
<b>Power supply:</b>	12 to 30 VDC smoothed ± 15%
<b>Power input:</b>	max. 80 mA at 24 VDC
<b>Analogue output:</b>	4...20 mA (see table below), max. burden < 500 Ohm

Order no. stainless steel 1.4404	Order no. stainless steel 1.4301	Description	Analogue output
0695.1420	0695.0420	VA 420 with integrated 1/4" meas. section	4... 20 mA = 0...90 l/min
0695.1421	0695.0421	VA 420 with integrated 1/2" meas. section	4... 20 mA = 0...90 m <sup>3</sup> /h
0695.1422	0695.0422	VA 420 with integrated 3/4" meas. section	4... 20 mA = 0...170 m <sup>3</sup> /h
0695.1423	0695.0423	VA 420 with integrated 1" meas. section	4... 20 mA = 0...290 m <sup>3</sup> /h
0695.1426	0695.0426	VA 420 with integrated 1 1/4" meas. section	4... 20 mA = 0...480 m <sup>3</sup> /h
0695.1424	0695.0424	VA 420 with integrated 1 1/2" meas. section	4... 20 mA = 0...550 m <sup>3</sup> /h
0695.1425	0695.0425	VA 420 with integrated 2" meas. section	4... 20 mA = 0...900 m <sup>3</sup> /h

<b>Pulse output:</b>	1 pulse per m <sup>3</sup> resp. per l, pulse output potential-free max. 30 VDC, 20 mA (pulse length see page 10)
<b>Accuracy:</b>	± 1.5 % m. v., ± 0.05 % f. s.
<b>Display:</b>	Flow in m <sup>3</sup> /h, counter in m <sup>3</sup> Other units selectable via display Flow values max. 6 digits, counter max. 1,999,999,999 m <sup>3</sup> then it drops back to 0

*Display operation please see pages 12-15*

<b>Mounting thread:</b>	R 1/4", R1/2", R3/4", R1", R 1 1/4", R1 1/2", R 2" DIN EN 10226 (ISO 7-1)
<b>Material:</b>	Stainless steel 1.4301 / 1.4404 Version with flange DIN EN 1092-1: Stainless steel 1.4404

**Flow measuring ranges**

Pipe size	Inner pipe Ø	Pipe size	VA 420	Consumption
Inch	mm		Meas. ranges from ... to	Standard setting
1/4"	8.5	DN 8	0,8 ... 90 l/min	l
1/2"	16.1	DN 15	0,2 ... 90 m³/h	m³
3/4"	21.7	DN 20	0,3 ... 170 m³/h	m³
1"	27.3	DN 25	0,5 ... 290 m³/h	m³
1 1/4"	36.8	DN 32	0,7 ... 480 m³/h	m³
1 1/2"	41.8	DN 40	1 ... 550 m³/h	m³
2"	53.1	DN 50	2 ... 900 m³/h	m³

Reference DIN 1945/ ISO 1217: 1000mbar /20°C; Air

**MEASURING RANGES FOR DIFFERENT GASES**

	1/4"	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"
	Analogue-output 20mA	Analogue-output 20mA	Analogue-output 20mA	Analogue-output 20mA	Analogue-output 20mA	Analogue-output 20mA	Analogue-output 20mA
	l/min	[m³/h]	[m³/h]	[m³/h]	[m³/h]	[m³/h]	[m³/h]
<b>Reference DIN1945/ ISO 1217: 20°C, 1000 mbar (Reference during calibration)</b>							
<b>Air</b>	<b>90</b>	<b>90</b>	<b>170</b>	<b>290</b>	<b>480</b>	<b>550</b>	<b>900</b>
<b>Adjustment to DIN 1343: 0°C, 1013,25 mbar</b>							
<b>Air</b>	<b>80</b>	<b>80</b>	<b>155</b>	<b>265</b>	<b>440</b>	<b>505</b>	<b>825</b>
Argon	Ar	140	140	265	450	750	1400
Carbon dioxide	CO <sub>2</sub>	85	85	165	285	470	890
Nitrogen	N <sub>2</sub>	80	80	150	255	425	800
Oxygen	O <sub>2</sub>	85	85	160	275	455	855
Nitrous oxide	N <sub>2</sub> O	85	85	165	280	470	880
Natural gas	NG	50	50	100	170	280	530

Other gases on request

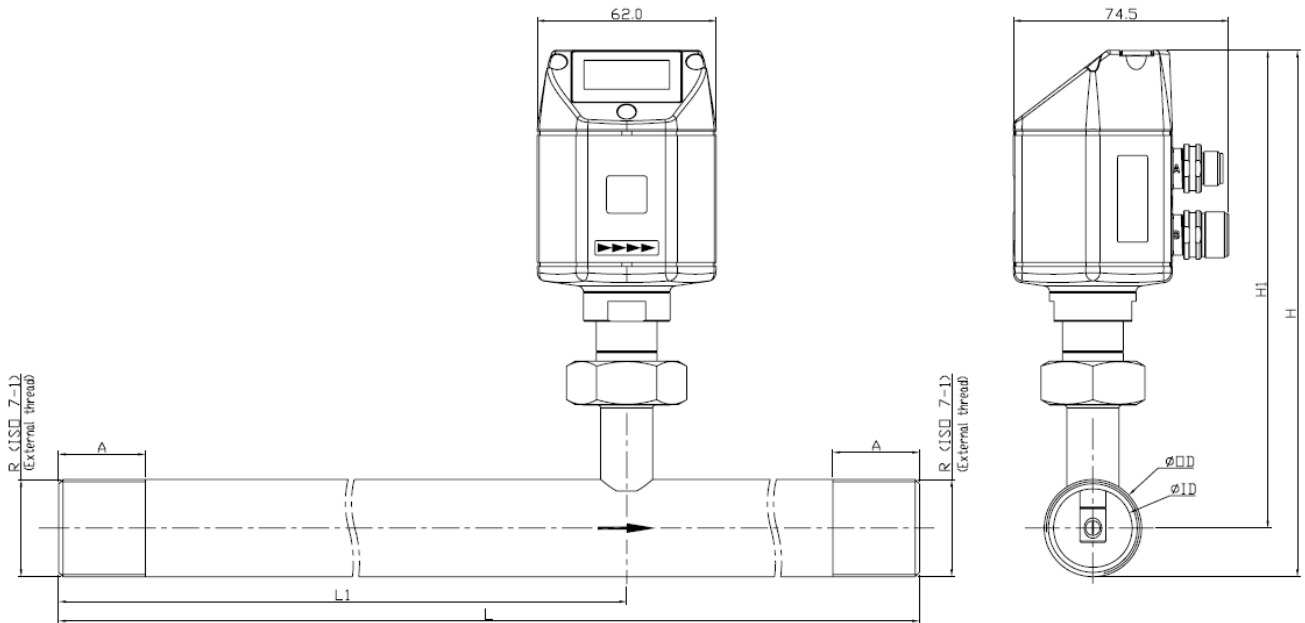
**Please note:**

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.

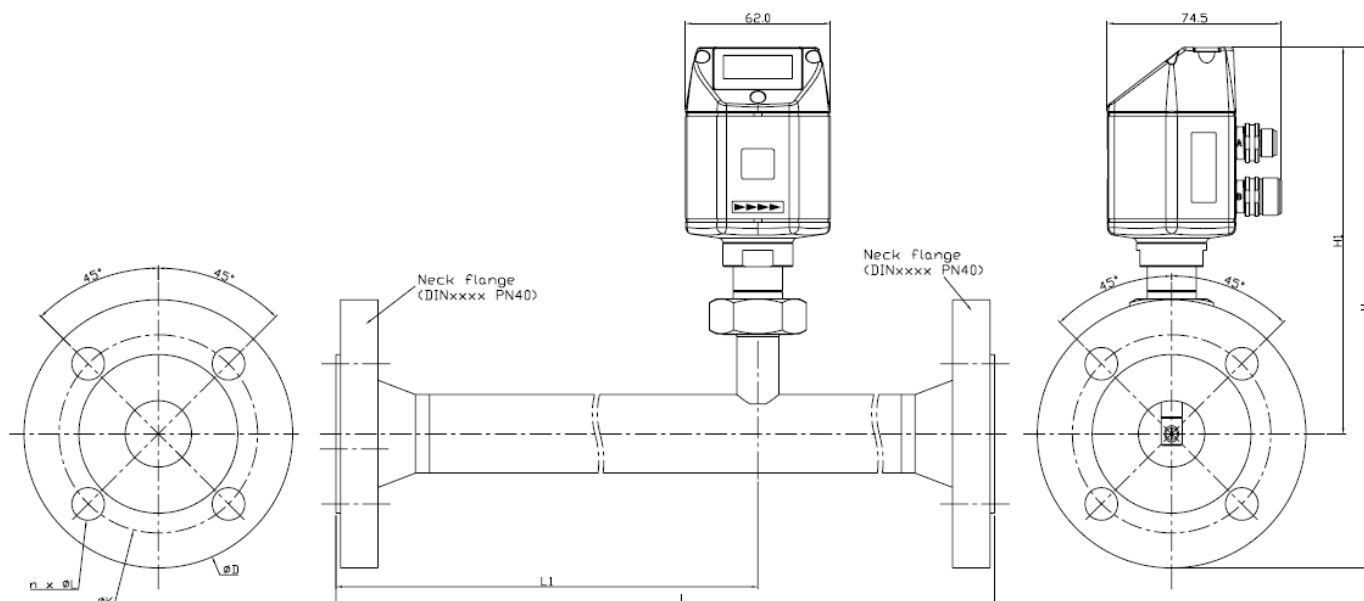
The area outside the pipeline (ambient area of the sensor) must not be an explosive area.

**DRAWING OF THE INSTRUMENT / INSTRUMENTS DIMENSIONS**



	Pipe size	outer diam/ inner diam (mm)	L (mm)	L1 (mm)	H (mm)	H1 (mm)	R	A (mm)
VA 420 1/4"	DN 8	13.7 / 8.5	194	137	176.0	165.7	R 1/4"	15
VA 420 1/2"	DN 15	21.3 / 16.1	300	210	176.4	165.7	R 1/2"	20
VA 420 3/4"	DN 20	26.9 / 21.7	475	275	179.2	165.7	R 3/4"	20
VA 420 1"	DN 25	33.7 / 27.3	475	275	182.6	165.7	R 1"	25
VA 420 1 1/4"	DN 32	42.4 / 36.8	475	275	186.9	165.7	R 1 1/4"	25
VA 420 1 1/2"	DN 40	48.3 / 41.9	475	275	189.9	165.7	R 1 1/2"	25
VA 420 2"	DN 50	60.3 / 53.1	475	275	195.9	165.7	R 2"	30

**VA 420 Version with weld neck flange (material stainless steel 1.4404):**

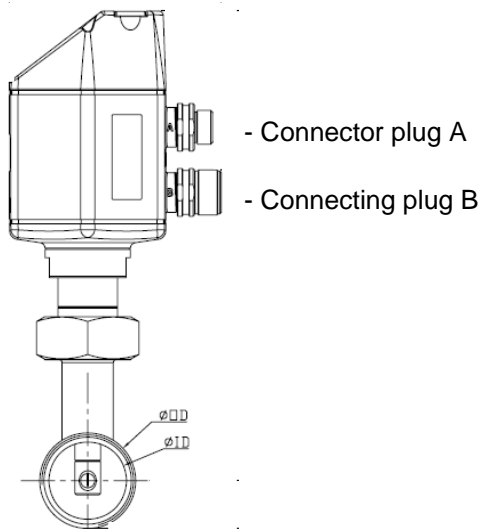


							Flange DIN EN 1092-1		
	Pipe size	AD/ID (mm)	L (mm)	L1 (mm)	H (mm)	H1 (mm)	Ø D in mm	Ø K in mm	nxØL in mm
VA 420 1/2"	DN 15	21.3 / 16.1	300	210	213.2	165.7	95	65	4 x 14
VA 420 3/4"	DN 20	26.9 / 21.7	475	275	218.2	165.7	105	75	4 x 14
VA 420 1"	DN 25	33.7 / 27.3	475	275	223.2	165.7	115	85	4 x 14
VA 420 1 1/4"	DN 32	42.4 / 36.8	475	275	235.7	165.7	140	100	4 x 18
VA 420 1 1/2"	DN 40	48.3 / 41.8	475	275	240.7	165.7	150	110	4 x 18
VA 420 2"	DN 50	60.3 / 53.1	475	275	248.2	165.7	165	125	4 x 18

Order no.	Description	Analogue output	
		4... 20 mA =	0... m <sup>3</sup> /h
0695.2421	VA 420 with integrated 1/2" meas. section with weld neck flange	4... 20 mA =	0...90 m <sup>3</sup> /h
0695.2422	VA 420 with integrated 3/4" meas. section with weld neck flange	4... 20 mA =	0...170 m <sup>3</sup> /h
0695.2423	VA 420 with integrated 1" meas. section with weld neck flange	4... 20 mA =	0...290 m <sup>3</sup> /h
0695.2426	VA 420 with integrated 1 1/4" meas. section with weld neck flange	4... 20 mA =	0...480 m <sup>3</sup> /h
0695.2424	VA 420 with integrated 1 1/2" meas. section with weld neck flange	4... 20 mA =	0...550 m <sup>3</sup> /h
0695.2425	VA 420 with integrated 2" meas. section with weld neck flange	4... 20 mA =	0...900 m <sup>3</sup> /h



**ELECTRICAL WIRINGS**



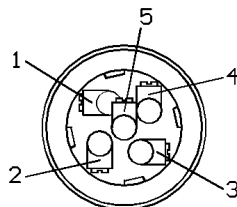
**Attention:** Not required connections NC must not be connected to a voltage and/or to protection earth. Cut and insulate cables.

	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5
<b>Connector plug A</b>	NC (SDI)	-VB	+VB	I+ 4..20 mA	NC
Colours connection cables 0553 0104 (5 m) 0553.0105 (10 m)	brown	white	blue	black	grey
<b>Connector plug B</b>	NC (SDI)	NC	NC	Isolated pulse	Isolated pulse
Colours pulse cables 0553 0106 (5 m) 0553.0107 (10 m)	brown	white	blue	black	grey

**Legend:**

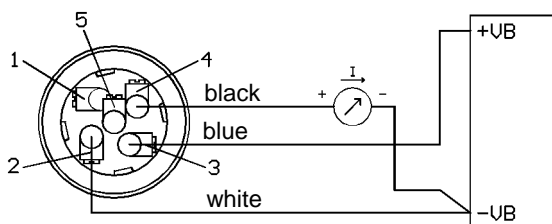
-VB	Negative supply voltage 0 V	Pulse	Pulse for consumption
+VB	Positive supply voltage 12...30 VDC smoothed	NC	Must not be connected to a voltage and/or to protection earth. Please cut and isolate cables.
I +	Current signal 4...20 mA - actual flow		

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.

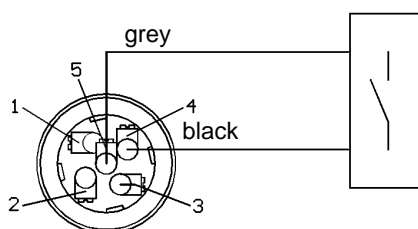


**M12 Connector plug**  
View from back side (terminal side)

**Connector plug A**



**Connector plug B**

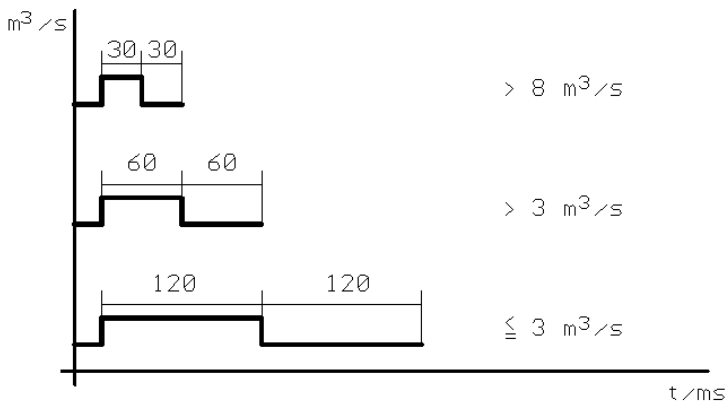


Pulse lengths are indicated consumption-relatedly.

Pulses, one pulse per set consumption unit, are summed up within the sensor and indicated in one second intervals, please see below

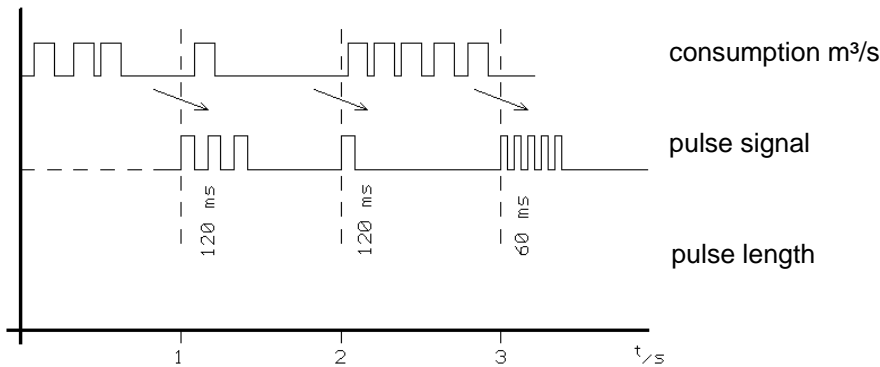
Pulse : There is an isolated contact available. This is closed for the duration of the pulse .  
 Max. switching capacity : 30 VDC, 20 mA (semi-conductor relay galvanically isolated by optocoupler).

Pulse lengths consumption-dependent



Internal pulse receiver:

The numbers of  $m^3$  per second are summed up and indicated after one second. Pulse lengths consumption-independent  
 Pulse lengths depending on consumption



148h05

**Pulse lengths and maximum flow rates**

Pulse length [ms]	[ $m^3/h$ ]	[ $m^3/min$ ]	[l/min]	[cfm]	[kg/h]	[kg/min]	[kg/s]
120	10,800	180	180	180	10.800	180	3
60	21,600	360	360	360	21.600	360	6
30	39,600	660	660	660	39.600	660	11
10	129,600	2,160	2,160	2,160	129,600	2,160	36
<b>Max. flow</b>	<b>129,600</b>	<b>2,160</b>	<b>2,160</b>	<b>2,160</b>	<b>129,600</b>	<b>2,160</b>	<b>36</b>

Maximum number of pulses per second: 36.

**Please note:** If the maximum flow is exceeded there will be no more signals!  
 In this case please change the units e.g. from l/min to  $m^3/h$ .



**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.

**Cleaning of the sensor head**

The sensor head can be cleaned by carefully moving it to and fro 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.

**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.

**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 to keep a spare measuring system ready.

**Calibration certificates**

Calibration certificates are issued by the manufacturer on request. This is a fee-paying service. Precision is tested with PTB (German National Metrology Institute) volume flow nozzles.

**Display**

VA 420 can display up to 3 measured values. This are volumetric flow/mass flow, velocity and total consumption. For better reading only one measured value is displayed. The measured values are toggled during normal operation mode every 3 seconds.

**The following changes can be made :**

- Unit volume flow (m<sup>3</sup>/min, m<sup>3</sup>/h, l/min, l/s, kg/s, kg/min, kg/h, cfm)
- Display of measured value (Volumenstrom, Geschwindigkeit, Gesamtverbrauch)
- Zero consumption
- Display contrast
- Display upside down

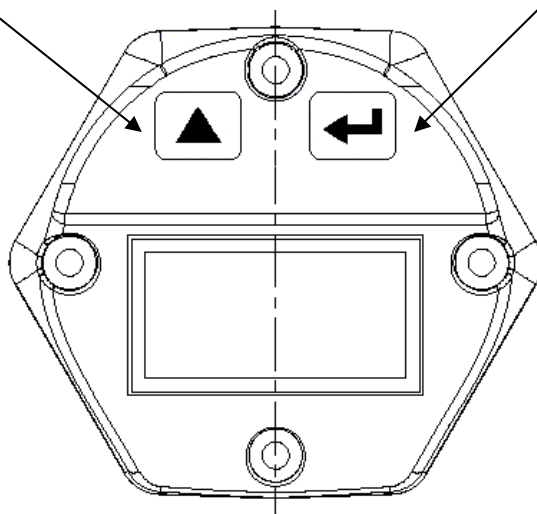
**Settings ex works:**

- Volume flow in m<sup>3</sup>/h  
( If the sensor is calibrated for reference DIN 1343, the unit is Nm<sup>3</sup>/h.  
This unit is only adjustable in the factory or with the CS Service Software.)
- Total consumption in m<sup>3</sup>

On the top of the VA 420 are the capacitive key buttons to operate the display menu.

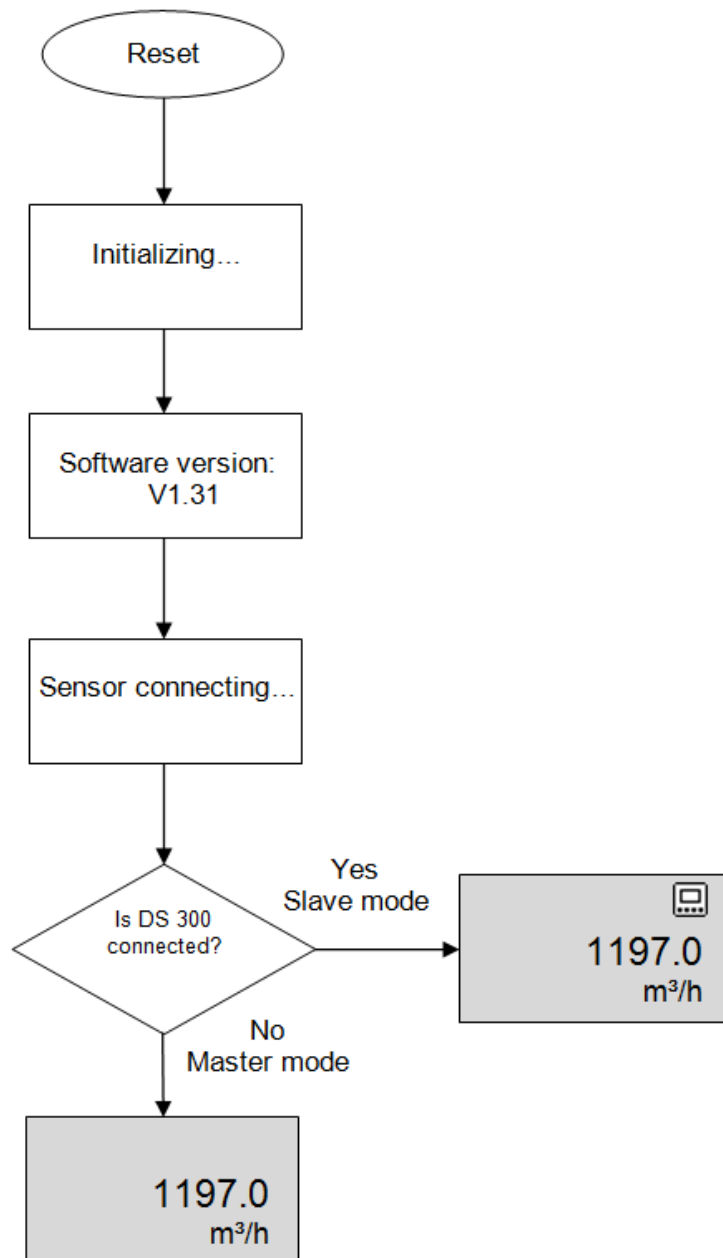
“Up“ ( △ )

“Enter“ ( ↵ )



**Connection VA 420**

After power on, the display will go through an initialisation procedure and will finally show the actual online values.



**Slave mode**

Changing the settings only with DS 300

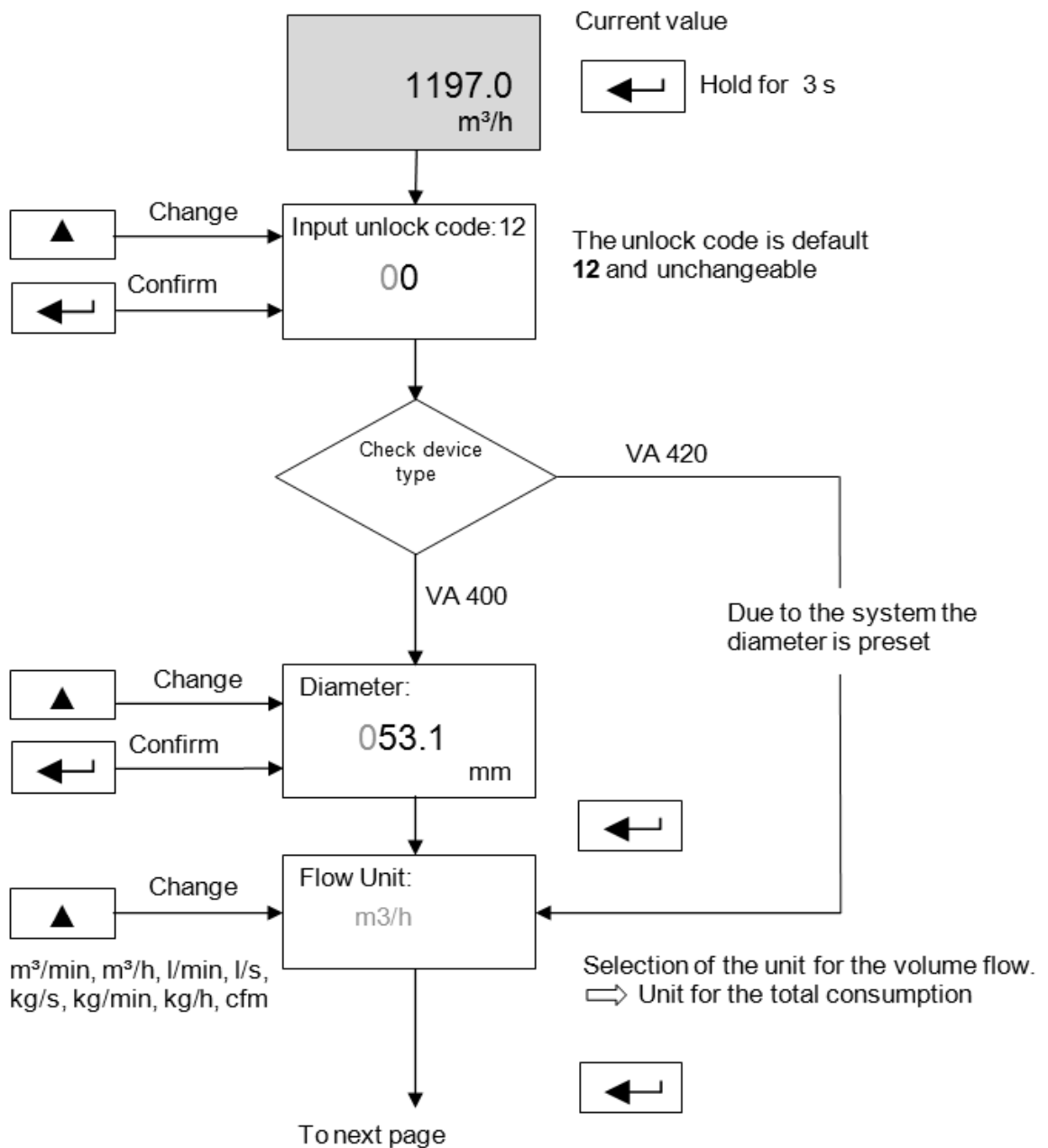
**Master mode**

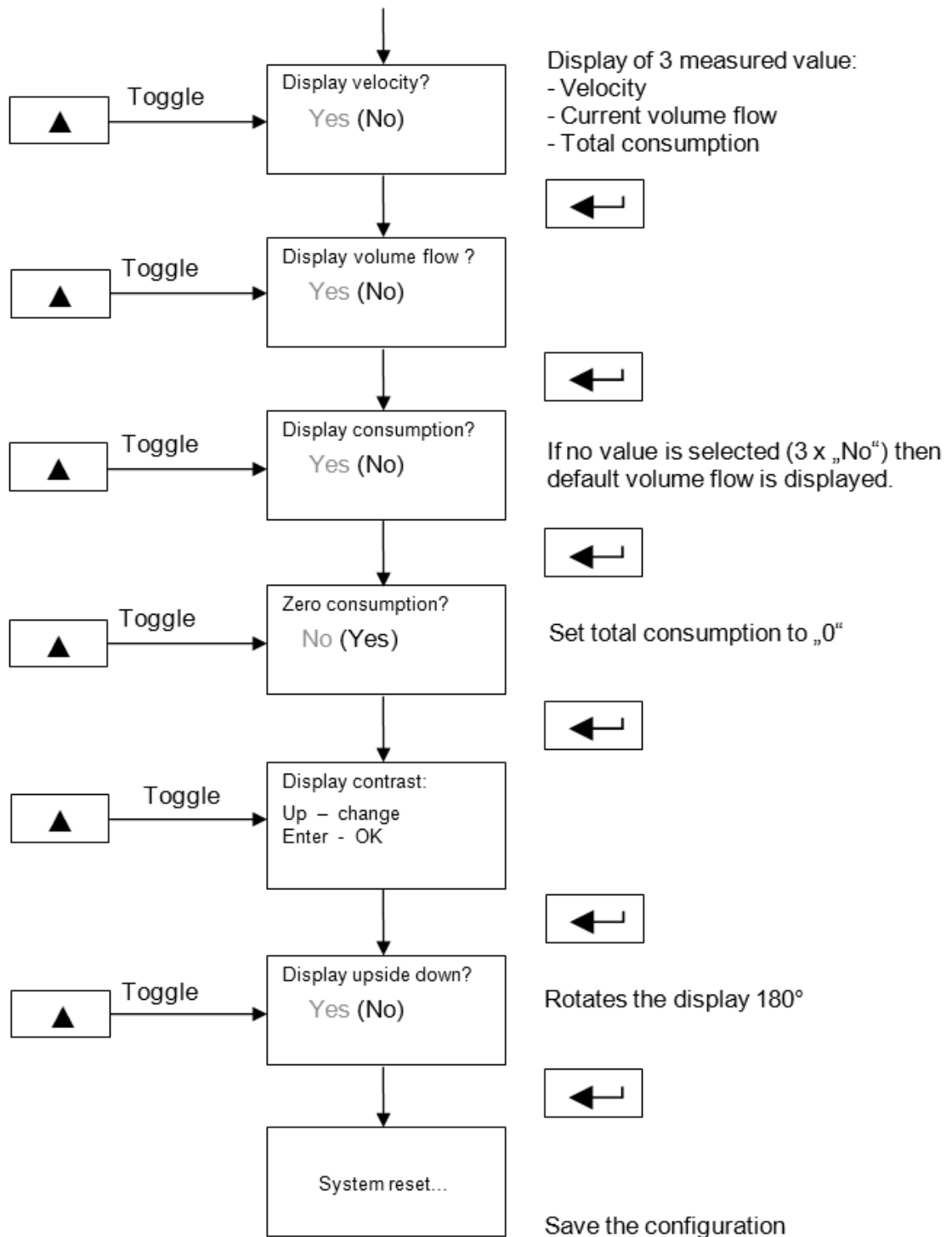
Changing the settings with pushbuttons VA 420.

### Configuration settings

In order to change the configuration, keep the „Enter“ button pressed for 3 seconds. After input of the unlock code the menu begins with the volume flow unit setting. The first unit will start blinking and can be changed with the „Up“ key. The selected unit has to be confirmed with the „Enter“ button.

### Configuration menu





**Menu**

You can exit the configuration process by pressing and keeping the “Enter” key for 3sec or no key event for 20sec. The configuration before this picture will be save and effected late.

**At CS Instruments**

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 420.

**WARRANTY**

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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 420 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.



<b>Order no. Stainless steel 1.4301</b>	<b>Order no. Stainless steel 1.4404</b>	<b>Order no. with weld neck flange Stainless steel 1.4404</b>	<b>Description</b>
0695.0420	0695.1420		VA 420 consumption counter with integrated 1/4" measuring section
0695.0421	0695.1421	0695.2421	VA 420 consumption counter with integrated 1/2" measuring section
0695.0422	0695.1422	0695.2422	VA 420 consumption counter with integrated 3/4" measuring section
0695.0423	0695.1423	0695.2423	VA 420 consumption counter with integrated 1" measuring section
0695.0426	0695.1426	0695.2426	VA 420 consumption counter with integrated 1 1/4" measuring section
0695.0424	0695.1424	0695.2424	VA 420 consumption counter with integrated 1 1/4" measuring section
0695.0425	0695.1425	0695.2425	VA 420 consumption counter with integrated 2" measuring section
0553.0104			Connection cable* for VA/FA Series 400, 5 m, with M12 plug
0553.0105			Connection cable* for VA/FA Series 400, 10 m, with M12 plug
0553.0106			Pulse cable for consumption sensor with M12 plug, length 5 m
0553.0107			Pulse cable for consumption sensor with M12 plug, length 10 m
0190.0001			Closing cap for measuring section VA 420 (Material: Aluminium)
0190.0002			Closing cap for measuring section VA 420 (Material: Stainless steel 1.4404)
3200.0001			5 point precision calibration with ISO certificate
0554.2005			CS Service Software for VA/FA 400 sensors including PC connection set, USB connection and interface adapter as well as CS Soft Professional software for recording the measured data
0554.0108			Mains unit in wall housing 100-240V 10VA 50/60 Hz / 24 VDC 0.35 A
0554.0107			AC adapter plug 100-240 VAC / 24 VDC, 0.35 A for VA/FA 400 Series, 2 m cable
On request			External wall display

\* (voltage supply, analogue output)

# CS Instruments GmbH

## Declaration of Conformity

for

**DIRECTIVE 2002/96/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27. January 2003  
on waste electrical and electronic equipment (WEEE)**

and

**DIRECTIVE 2002/95/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27. January 2003  
on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)**

of the down mentioned instruments from CS Instruments GmbH:

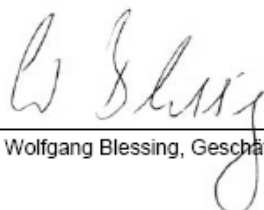
Pressure dew point meter	series <b>FA 4xx</b> and accessories
Flow and consumption meter	series <b>VA 4xx</b> and accessories
Pressure dew point meter	<b>DP 300</b> and accessories
Leak detector	<b>LD 300</b> and accessories
Multifunction measuring instrument	<b>DS 300</b> and accessories
Multi-channel display	<b>DS 300 mobile</b>

**CS Instruments GmbH as the manufacturer herewith declares that the above instruments and accessories belongs to the category 9 (WEEE 2002/96/EC). Therefore the above instruments do not fall upward aforementioned directive RoHS 2002/95/EC and are not affected by the material restriction.**

**In accordance with directive WEEE 2002/96/EC the measuring instruments specified above are taken back from CS Instruments GmbH to the disposal.**

**CS Instruments GmbH**  
Zindelsteiner Str. 15  
78052 VS-Tannheim  
  
Tel. 07705 978 99-0  
Fax 07705 978 99-20

Tannheim, 24. April 2008



Wolfgang Blessing, Geschäftsführer

# CS Instruments GmbH

## Declaration of Conformity

Consumption counter    **VA 420**

CS Instruments GmbH as the manufacturer herewith declares that the above consumption counter complies with the following directives :

<b>Electro-magnetic compliance</b>	<b>2004/108/EG</b>
<b>Low voltage directive</b>	<b>2006/95/EG</b>

For assessing the instrument, the following standards have been referred to:

Electromagnetic compatibility

<b>Emitted interference:</b>	<b>EN 61326-1: 2006-10 + EN 61326-1/Ber.1: 2008-07</b>
<b>Interference resistance:</b>	<b>EN 61326-1: 2006-10 + EN 61326-1/Ber.1: 2008-07</b>

Low voltage directive

<b>Reliability</b>	<b>EN 61010-1: 2002-08 + EN 61010-1/Ber.1:2002-11 + EN 61010-1/Ber.2:2004-01</b>
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Year of first marking with CE label: 09

The product is labeled with the indicated mark



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