





























































































## Value range for NAMUR

	NC contact ①	NO contact ②
Switching value reached	< 1 mA	> 3 mA
Switching value not reached	> 3 mA	< 1 mA

① C2.2.6 Invert Signal On

② C2.2.6 Invert Signal Off

Value range applies only when connected to a switching amplifier with the following reference values:

- Open-circuit voltage  $U_0 = 8.2$  VDC- Internal resistance  $R_i = 1$  k $\Omega$ 

## Value range for transistor output

	$U_L$	$I_L$	$U_H$	$I_H$
via load $R_L$	0...2 V	0...2 mA	16...30 V	20...100 mA

To ensure the value ranges, a load  $R_L$  between 250  $\Omega$  and 1 k $\Omega$  is recommended for the passive transistor output with a nominal voltage of 24 VDC. If other loads are used, caution is advised as the range of values of the signal voltages then no longer corresponds to the range of values for the inputs of process control systems and controls (DIN IEC 946).

**CAUTION!**

*The upper limit of the signal current must not be exceeded as this may damage the transistor output.*

For selection of measurement variable and adjustable data of the limit switch refer to chapter "Menu description C - Setup", menu "C2.2.5 Limit Switch" and appropriate submenus.

### 4.3.6 Pulse output / Frequency output

The maximum frequency of both pulse output and frequency output is 1000 Hz.

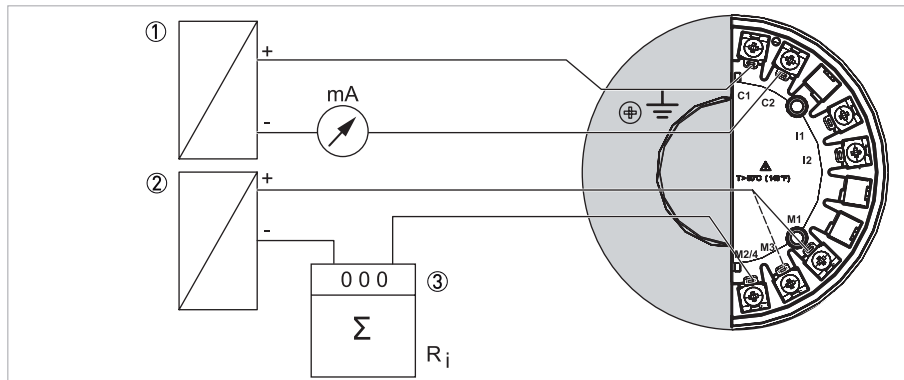


Figure 4-5: Electrical connection pulse output

- ① Signal converter power supply
- ② Pulse output power supply
- ③ Pulse counter or frequency meter

The connection is made between terminal M2/4 Common (-) and M1 for Hi Current (+) or M3 NAMUR (+). Only one of the two connections M1 or M3 can be selected in menu C2.2. The output is selected as pulse or frequency output in menu C2.2. The output is a passive "open collector" output which is electrically separated from the current interface and the flow sensor. It requires its own power supply ②. The total resistance must be adapted so that the total current  $I_{tot}$  does not exceed 120 mA.

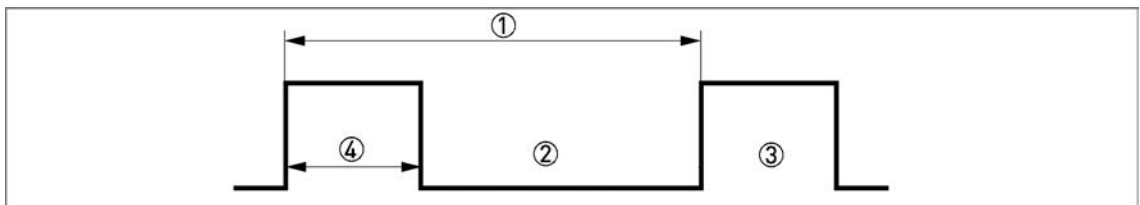


Figure 4-6: Pulse output signal definition

- ①  $T_{max}$
- ② Closed
- ③ Open
- ④ Pulse width  $\geq 0.5$  ms

For selection of measurement variable and adjustable data of the pulse or frequency output refer to chapter "Menu description C - Setup", menu "C2.2.2 Pulse Output" or menu "C2.2.3 Frequency Output" and appropriate submenus.



*Make sure the pulse width is in line with the pulse rate.*

### 4.3.7 Status output

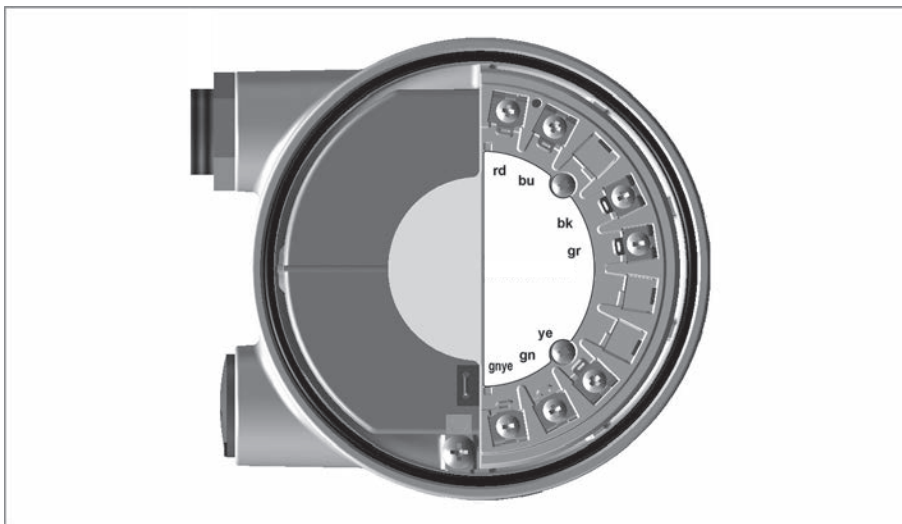
The + pole of the high current output is on the M1 terminal connection. The + pole of the NAMUR output is on the M3 connection terminal. Terminal M2/4 is the common - pole of the status output.

High current terminal M1...M2/4		
Open	Maximum voltage $U_{\max} = 36 \text{ VDC}$	Closed current $I_R < 1 \text{ mA}$
Closed	Maximum current $I_{\max} = 100 \text{ mA}$	Voltage $U < 2 \text{ VDC}$

NAMUR terminal M3...M2/4	
$R_T = 900 \Omega$	$U_{\max} = 36 \text{ VDC}$

For selection of status function and adjustable data of the status output refer to chapter "Menu description C - Setup", menu "C2.2.4 Status Output" and appropriate submenus.

## 4.4 Connection of remote version



The connection terminals in the connection box of the flow sensor and the wall bracket are identical in construction.

### Connection cable strand colour

Terminals	Strand colour
rd	red
bu	blue
bk	black
gr	grey
ye	yellow
gn	green
gnye	Shielding

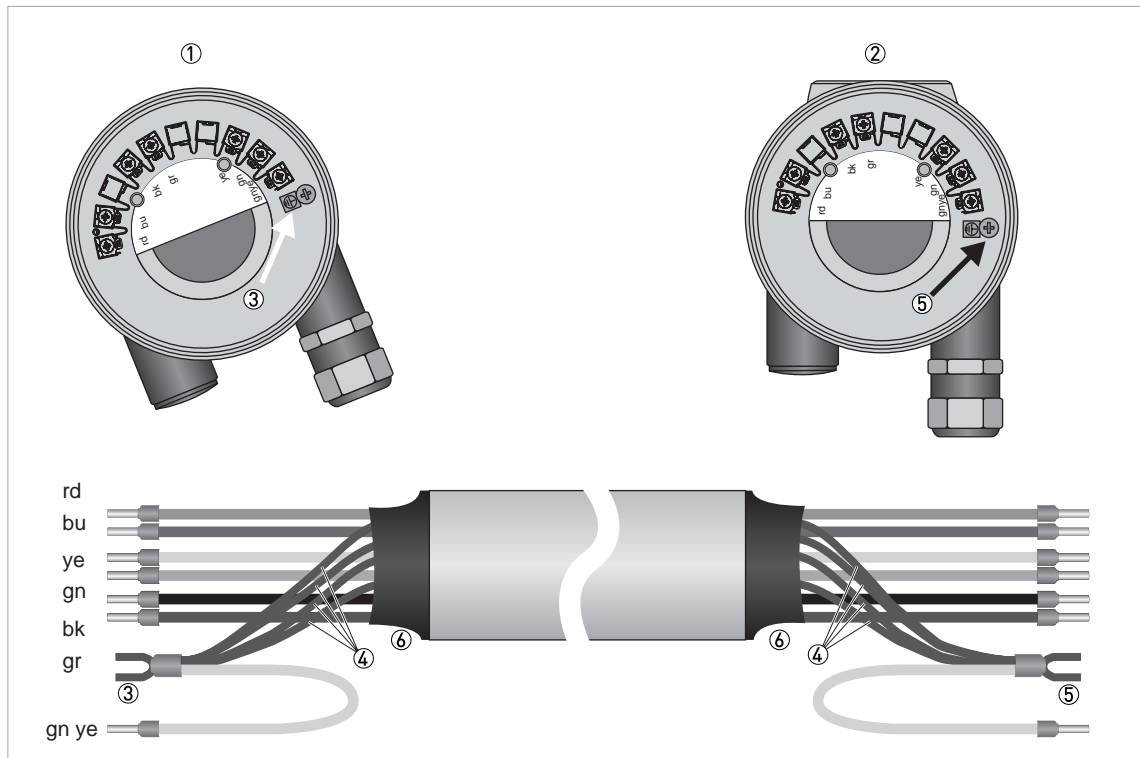


Figure 4-7: Connection of remote version

- ① Connection terminal flow sensor
- ② Connection terminal signal converter
- ③ Connection shielding flow sensor
- ④ Shielding (drain wire and overall shield)
- ⑤ Connection shielding signal converter
- ⑥ Heat shrink tubing

The maximum cable length is 50 m / 164 ft.

The cable can be shortened easily. All wires must be connected afterwards.



**CAUTION!**

Please ensure that the shielding ④ has been properly connected to both terminals ③ and ⑤. The exterior shielding of the cable must not be connected to any terminal.

## 4.5 Grounding connections

The grounding can be done either by connecting the PE (Protective Earth) terminal in the housing or the PE terminal on the connection piece between flow sensor and signal converter. Both of these electrical connections are equally effective from a technical point of view.

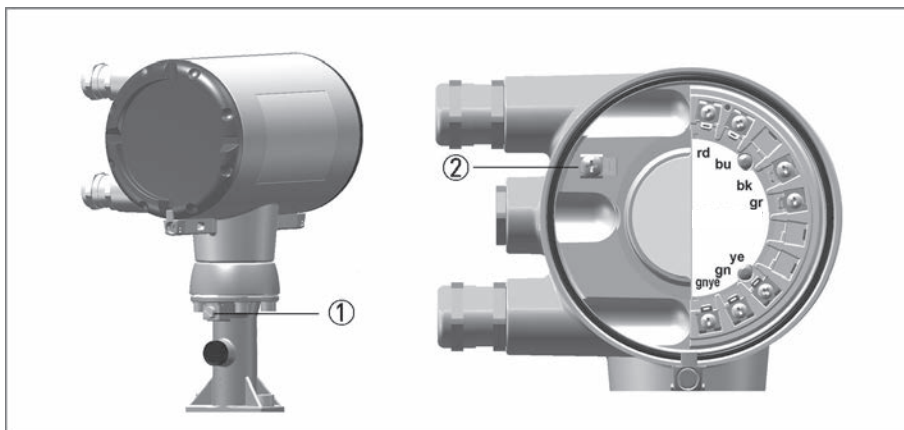


Figure 4-8: Ground connection compact version

- ① Electrical grounding connection on connection piece between flow sensor and signal converter.
- ② Electrical grounding terminal in the housing



### CAUTION!

*The measuring device has to be grounded properly to achieve accurate measurement. The grounding wire may not transfer any interference voltage. Do not use this grounding cable to ground any other electrical devices.*

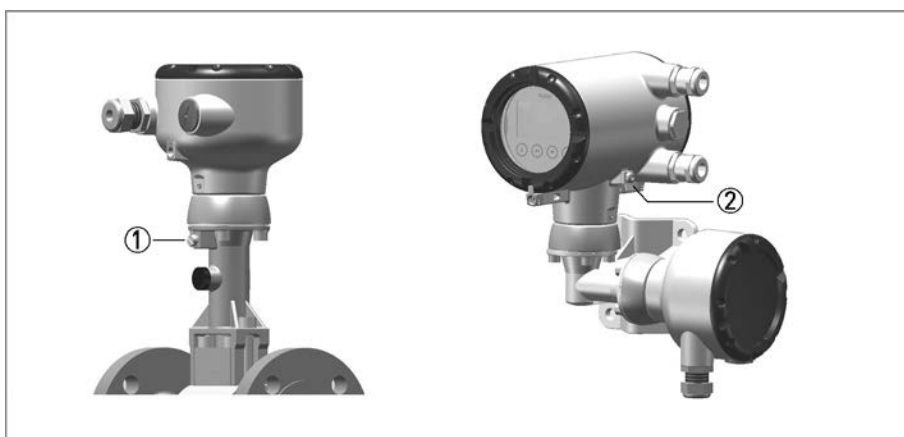


Figure 4-9: Ground connection remote version

- ① Electrical grounding connection on flow sensor
- ② Electrical grounding connection on signal converter housing



*In the remote version, the flow sensor as well as the signal converter must be grounded.*

## 4.6 Ingress protection

The signal converter electronics housing meets the requirements for IP66/67 in accordance with EN 60529 both for the compact and for the remote version.



### **CAUTION!**

*After all servicing and maintenance work on the measuring device, the specified ingress protection category must be ensured again.*

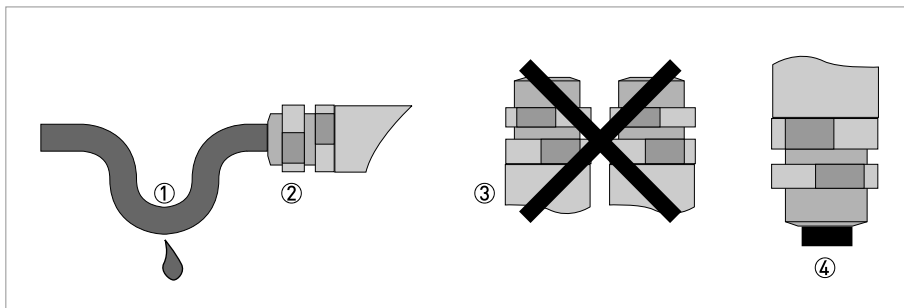


Figure 4-10: Cable feedthrough



### **Therefore it is essential to observe the following points:**

- Use only original gaskets. They must be clean and free of any damage. Defective gaskets must be replaced.
- The electrical cables used must be undamaged and must comply with regulations.
- The cables must be laid with a loop ① upstream of the measuring device to prevent water from getting into the housing.
- The cable feedthroughs ② must be tightened. Note that the clamping range of the cable feedthrough corresponds to the outer diameter of the cable.
- Align the measuring device so that the cable feedthrough is never facing up ③.
- Close any unused cable feedthroughs using blind plugs ④ suitable for the protection category.
- Do not remove the required cable bushing from the cable feedthrough.

## 5.1 Start-up screen



*After connection to power supply the device carries out a self-test. After 10 seconds the following start-up screen appears:*



Figure 5-1: Start-up screen

After finishing of the self-test the device switches to the measuring mode. Here, all of the parameters preset for the customer are analysed and checked for plausibility, and the currently measured value is displayed.

## 5.2 Operation



*The measuring device is largely maintenance-free.  
Observe the application limits in respect of temperature and medium.*



## 6.1 Display and operating elements

In case of an open front cover, the device is operated by using mechanical keys; in the case of a closed cover, a bar magnet ① is used.

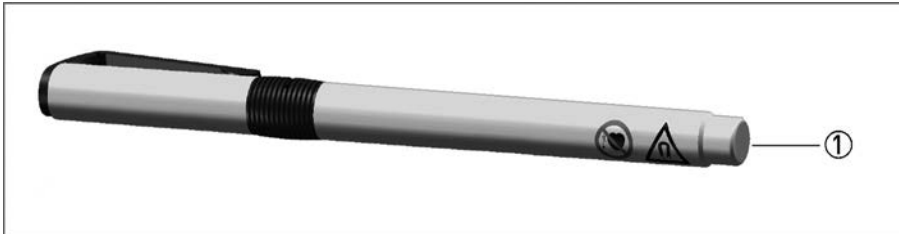


Figure 6-1: Pen with bar magnet



### CAUTION!

The switching point of the magnetic sensors is directly under the glass panel above the appropriate symbol. Touch the symbol only vertically and from the front. Touching it from the side may cause a malfunction.

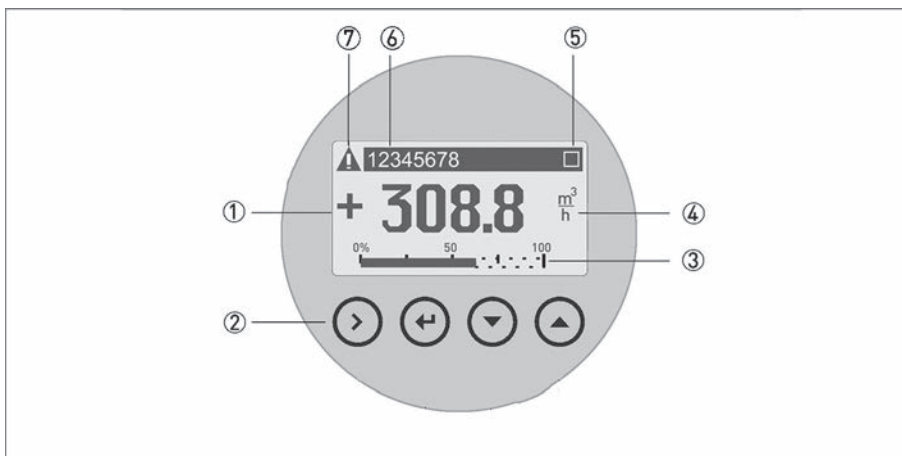


Figure 6-2: Display and operating elements

- ① Display
- ② Mechanical keys and bar magnet
- ③ Bargraph indication
- ④ 1st measured variable in large representation
- ⑤ Indicates when a key has been pressed
- ⑥ Tag number (only shown if entered previously by the operator)
- ⑦ Indicates a possible status message in the status list

The mechanical keys and keys for the bar magnet have the same functionality. In this documentation the keys are represented as symbols to describe the operating functions:





Mechanical and bar magnet	Symbol
	→
	←
	↓
	↑

Table 6-1: Description of keys

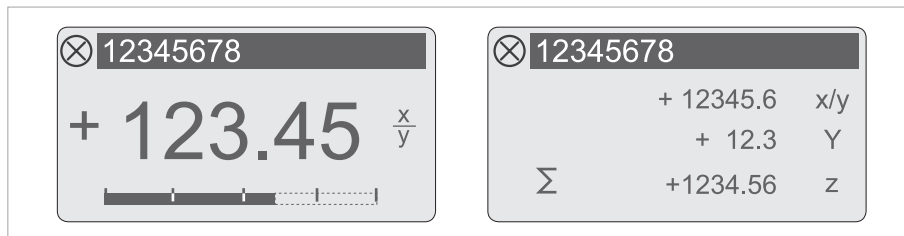


Figure 6-3: Displays in measuring mode (examples for 2 or 3 measured values)  
x, y and z denote the units of the measured values displayed

### 6.1.1 Display for selection of submenu and functions, 3 lines

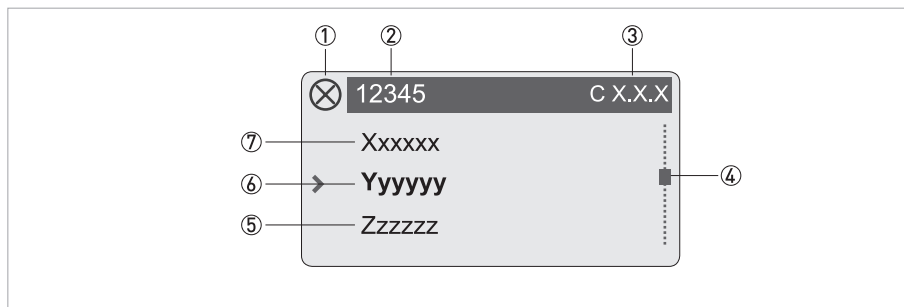


Figure 6-4: Display for selection of submenu and functions, 3 lines

- ① Indicates a possible status message in the status list
- ② Menu, submenu or function name
- ③ Number relating to ⑥
- ④ Indicates position within menu, submenu or function list
- ⑤ Next menu(s), submenu or function  
[ \_\_ \_ signals in this line the end of the list]
- ⑥ Current menu(s), submenu or function
- ⑦ Previous menu(s), submenu or function  
[ \_\_ \_ signals in this line the beginning of the list]

### 6.1.2 Display when setting parameters, 4 lines

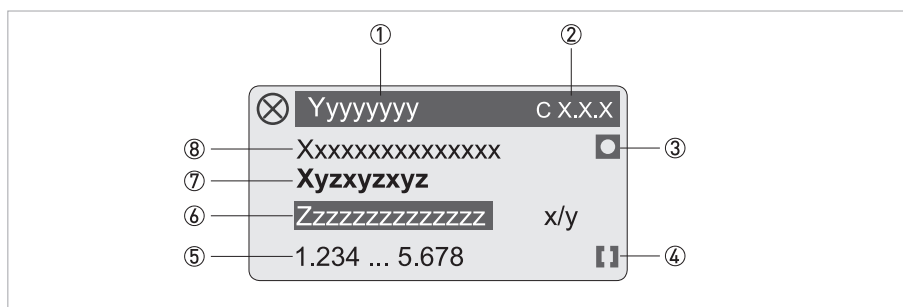


Figure 6-5: Display when setting parameters, 4 lines

- ① Current menu(s), submenu or function
- ② Number relating to ⑦
- ③ Denotes factory setting
- ④ Denotes permissible value range
- ⑤ Permissible value range for numeric values
- ⑥ Currently set value, unit or function (when selected, appears with white text, blue background)  
This is where the data is changed.
- ⑦ Current parameter
- ⑧ Factory setting of parameter

### 6.1.3 Display when previewing parameters, 4 lines

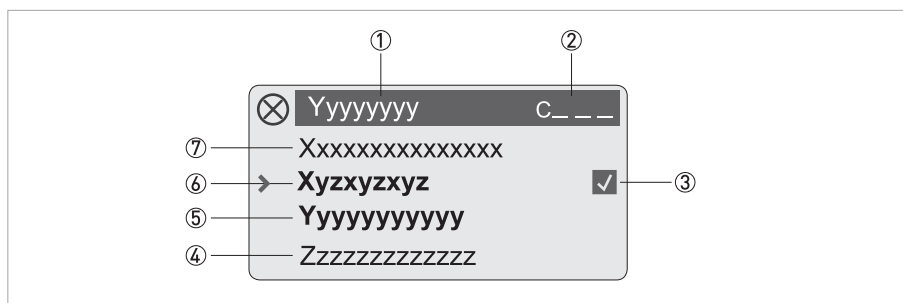


Figure 6-6: Display when previewing parameters, 4 lines

- ① Current menu(s), submenu or function
- ② Number relating to ⑥
- ③ Denotes a changed parameter (simple check of changed data when browsing through lists)
- ④ Next parameter
- ⑤ Currently set data from ⑥
- ⑥ Current parameter (for selection press key >; then see previous chapter)
- ⑦ Factory setting of parameter

## 6.2 Basic principles of operation

### 6.2.1 Functional description of the keys



- *It is recommended to activate the push buttons perpendicular to the front. Touching them from the side can cause incorrect operation.*
- *The mechanical keys and keys for the bar magnet have the same functionality.*

→	Switch from measuring mode to menu mode
	Switch to one menu level lower
	Open menu item and activate change mode
	<b>In change mode:</b> Move the input cursor one position to the right; after the last digit the input cursor jumps back to the beginning.
↑ or ↓	Change between the menu items within a menu level
	<b>In measuring mode:</b> Switch between 1. measurement page, 2. measurement page and status message.
	<b>In change mode:</b> Changing parameters and settings; running through the available characters; shifting the decimal point to the right or left.
↵	Confirm settings and changes
	Return to measuring mode

Table 6-2: Description of the operating keys

### 6.2.2 Switch from measuring mode to menu mode

Measuring mode	Operation	Menu mode
156.3 kg/h	→	> Quick Setup

Use the ↵ button to exit menu mode and return to measuring mode.

### 6.2.3 Change the settings in the menu

Press the → button to enter the menu.

Use the ↵ button to exit menu mode and return to measuring mode.



- Use the ↵ and ↑ or ↓ keys to navigate in the menu.  
The current values or settings are displayed.  
Save the new value or setting using the ↵ key.
- Some menu items contain several setting options. They are displayed in sequence by pressing the ↵ key.
- Press the ↵ button to save the settings, or to reject them.
- Before returning to measuring mode, you are prompted "Save Configuration?" which you need to accept with "Yes".  
Switch between "Yes", "Back" and "No" by pressing the ↑ or ↓ keys.

Save Configuration? Yes	←	Changes are accepted. An update is carried out and the display returns to measuring mode.
Save Configuration? No	←	Changes are discarded. The display returns to measuring mode.
Save Configuration? Back	←	Returns to menu mode

#### Example: Changing the default parameter from m<sup>3</sup>/h to l/h

Procedure	Display		Procedure	Display
	1.25 m <sup>3</sup> /h		8x ↑	Volume Flow L/h
2x →	A Quick Setup		4x ←	Save Configuration? Yes
8x ↓	A9 Units		1x ←	1250 L/h
2x →	Volume Flow m <sup>3</sup> /h			

#### 6.2.4 Character selection in change mode

Depending on the menu function, the following characters are available:

##### Numbers

0	1	2	3	4	5	6	7	8	9
---	---	---	---	---	---	---	---	---	---

##### Lower case letters

a	b	c	d	e	f	g	h	i	j
k	l	m	n	o	p	q	r	s	t
u	v	w	x	y	z				

##### Upper case letters

A	B	C	D	E	F	G	H	I	J
K	L	M	N	O	P	Q	R	S	T
U	V	W	X	Y	Z				

##### Special characters

2	3	_	-	/	.				
---	---	---	---	---	---	--	--	--	--

### 6.2.5 Units, figures and factors

Numerical values and factors are displayed in a 8 digit format. Numerical values are either displayed in floating point format (12345678) or are expressed in exponential format (12.345e06). Exponents are used in following steps: 03 / 06 / 09 or -03 / -06 / -09 etc. The conversion factor of the totalizer and the pulse output, however, is expressed in whole numbers.

#### Basic units

Flow type	Basic units	Menu
Volume flow	m <sup>3</sup> /h	A9 and/or C6.5
Norm. volume flow	Nm <sup>3</sup> /h	A9 and/or C6.5
Mass flow	kg/h	A9 and/or C6.5

User defined units can be entered in menu "A9 or C6.5 Units". The unit (text) as well as the conversion factor (number) and offset can be entered here. The conversion factor must always be entered based on the basic unit.

#### Totalizer

The basic units for the totalizer are m<sup>3</sup> for volume, Nm<sup>3</sup> for standard volume and kg for mass. Volume flow, norm. volume flow and mass flow can be selected in menu "C4.1 Flow Totalizer". If counting is to be done in another flow unit, the unit must be changed in menu "C6.5 Units".

### 6.2.6 Security and permissions

#### Access levels

The vortex flowmeter features a multi-level security concept, which helps to prevent accidental or unauthorised configuration changes.

To gain a specific access level you need to log into the device by entering a four digit hexadecimal password associated with that access level (refer to menu "C6.2 Security"). You are able to change the passwords of "Operator" and "Expert" access levels if that particular level has been reached.

The "User" access level does not have a specific password – if you enter any password not assigned to a level, e.g. "0000" (which is an invalid password), you will fall back to "User" access level.

The table below lists the access levels, their default passwords and associated permissions.

Access level	Default password	Permissions
User	0000 (any unassigned password)	<ul style="list-style-type: none"> <li>View device information</li> <li>Configure the display (C5), including changing the display language and the content of the measurement pages</li> </ul>
Operator	0009	<ul style="list-style-type: none"> <li>All rights of "User" access level</li> <li>Configure binary output (C2.2)</li> <li>Configure all HART® communication options (C3) with the exception of "C3.1.1 Current Loop Mode"</li> <li>Change "Operator" password (C6.2.2) – note that the new password must have three leading zeroes ("000")</li> <li>Activate a different meter type</li> </ul>
Expert	0058	<ul style="list-style-type: none"> <li>All configuration rights, especially process setup (C1) and current output (C2.1)</li> <li>Change "Expert" password (C6.2.2) – note that the new password must have two leading zeroes ("00")</li> </ul>



*When a particular access level has been enabled, please pay close attention to a "lock" symbol which might be present at the right side of a menu entry. This lock symbol indicates that your current access level allows you to read but not write this entry.*



*When entering the four digit password please be sure to type in all leading zeroes – i.e. enter the default "Operator" password as "0009" and not only "9" by skipping the remaining digits.*



*After a cold start of the device the user role will always be reset to "User".*

### Reset passwords

In case the user has changed particular passwords from their default settings and is not able to log in anymore, there is a "Reset Passwords" command available in the C6.2.3 submenu.

However to prevent unauthorised use this command itself is protected by a non-changeable unique password available by contacting the manufacturer.

## 6.3 Overview of the most important functions and units



A complete list of all functions and short descriptions is provided in the next section. All default parameters and settings are adapted for the customer.

### Menu structure

- "A Quick Setup": Quick check and setup of the signal converter, including application assistants
- "B Test": Simulation functions and display of the actual measurement values for all variables
- "C Setup": Complete setup possibilities

### Frequently used functions

Menu	Explanation
A1 Language or C5.1 Language	Select the menu language (for details refer to following chapter)
B1.2 Current Output	Check the current output
B1.3.1 Pulse Output	Check the pulse output
B1.3.2 Frequency Output	Check the frequency output
B1.3.3 Status/Limit Output	Check the status output
C1.8 Time Constant	Time constant, damping value
C2.1.2 0% Range	Minimum flow rate (current output) The set value represents the 4 mA value of the current output. Usually 0% of flow is set as 4 mA, but it is also possible to assign higher flow values to 4 mA.
C2.1.3 100% Range	Maximum flow rate (current output) The set value represents the 20 mA value of the current output. Usually 100% of flow is set as 20 mA, but it is also possible to assign lower flow values to 20 mA.

Table 6-3: Most important functions

## 6.4 Menu languages

### Language selection

English	German	French	Italian	Spanish
Swedish	Danish	Czech	Polish	Russian
Chinese	Turkish			
<b>In preparation:</b>				
Dutch	Portuguese	Slovak	Slovenian	Hungarian
Norwegian	Finnish	Estonian	Latvian	Lithuanian
Moldavian	Romanian	Albanian	Bulgarian	

Table 6-4: Menu languages



## 6.5 Gas options for gas measurement

Gases can be selected in menu "A8, C1.2 Medium" or "C1.3.1 Gas Mixture".

For fluid selection gas, wet gas or gas mixture the following gas selection is available:

Air	Ammonia	Argon	i-Butane	n-Butane	
CO	CO <sub>2</sub>	Ethane	Ethylene	n-Hexane	
Hydrogen	Hydrogen Sulfide	Methane	Neon	Nitrogen	
Oxygen	i-Pentane	n-Pentane	Propane	Xenon	

Gas mixtures can be defined as percentage shares of the above mentioned gases.

Default format for the shares is 0.00000 %.

To enter shares > 9.99999 % the point can be shifted rightwards by moving the cursor to the point and then press the upwards button ↑.

Change between the digits by pressing the rightwards button →.

After reaching the last digit the cursor will jump again to the first digit.

## 6.6 Units

The following units can be selected and set in menu A9 and/or C6.5. Furthermore, for each measurement customised units can be defined.

### Units for volume flow

Liquids, steam, gases			
/d	/h	/min	/s
m <sup>3</sup>	m <sup>3</sup>	m <sup>3</sup>	m <sup>3</sup>
ml	ml	ml	ml
L	L	L	L
ML	ML	-	-
hl	hl	hl	hl
ft <sup>3</sup>	ft <sup>3</sup>	ft <sup>3</sup>	ft <sup>3</sup>
gal	gal	gal	gal
kgal	kgal	kgal	kgal
Mgal	Mgal	-	-
ImpGal	ImpGal	ImpGal	ImpGal
MImpGal	MImpGal	-	-
bbbl	bbbl	bbbl	bbbl
acft	acft	acft	acft
fl.oz[Imp]	fl.oz[Imp]	fl.oz[Imp]	fl.oz[Imp]
fl.oz[US]	fl.oz[US]	fl.oz[US]	fl.oz[US]
Customised volume flow			

Table 6-5: Flow measurements and their units

### Units for norm./standard\* volume flow

Liquids, steam, gases			
/d	/h	/min	/s
Nm <sup>3</sup>	Nm <sup>3</sup>	Nm <sup>3</sup>	Nm <sup>3</sup>
NL	NL	NL	NL
Sm <sup>3</sup>	Sm <sup>3</sup>	Sm <sup>3</sup>	Sm <sup>3</sup>
SL	SL	SL	SL
Sft <sup>3</sup>	Sft <sup>3</sup>	Sft <sup>3</sup>	Sft <sup>3</sup>
Customised norm./standard volume flow			

Table 6-6: Flow measurements and their units

\* The units Nx/x and Sx/x shall be considered as equivalent. They serve as an indication for a normalised or standardised measuring variable and do not identify the underlying reference system.

**Units for mass flow**

/d	/h	/min	/s
kg	kg	kg	kg
-	g	g	g
t	t	t	-
lb	lb	lb	lb
Customised mass flow			

Table 6-7: Flow measurements and their units

**Totalizer units**

Volume	Norm./standard* volume	Mass
m <sup>3</sup>	Nm <sup>3</sup>	g
L	SL	kg
hl	SM <sup>3</sup>	oz
in <sup>3</sup>	Sft <sup>3</sup>	lb
ft <sup>3</sup>	NL	T
gal		
ImpGal		
bbl		
Customised volume		

Table 6-8: Totalizer units

\* The units Nx and Sx shall be considered as equivalent. They serve as an indication for a normalised or standardised measuring variable and do not identify the underlying reference system.

**Units additional measurements**

Temperature	Pressure	Power	Energy	Density
°C	mbar	W	J	kg/m <sup>3</sup>
°F	bar	kW	kJ	kg/L
K	atm	kJ/h	MJ	g/cm <sup>3</sup>
°Rank	kg/m <sup>2</sup>	MJ/s	kW*h	g/L
Customised temperature	kg/cm <sup>2</sup>	MJ/h	Mcal	g/ml
	g/cm <sup>2</sup>	Mcal/h	BTU	lb/gal
	torr	Btu/h	Customised energy	lb/ft <sup>3</sup>
	psi	Mbtu/s		lb/in <sup>3</sup>
	psi (abs)	Mbtu/h		Customised density
	b/ft <sup>2</sup>	Mbtu/d		
	MPa	Customised power		
	kPa			
	Pa			
	Customised pressure			

Table 6-9: Units additional measurements

The pressure unit psi (abs) refers to a reference point of 0 bara / 0 psia.  
 All other pressure units are gauge pressure units and refer to a reference pressure of 1.01325 bara / 14.7 psia (acc. to DIN 1343).

## 6.7 Menu structure

### 6.7.1 Menu overview "A Quick Setup"

Meas.	Menu A	Submenus			
> ←	↓ ↑	> ←	↓ ↑	> ←	↓ ↑
	A Quick Setup	A1 Language			
		A2 Contrast			
		A3 Login			
		A4 Tag			
		A5 Long Tag			
		A6 Message View			
		A7 Fluid			
		A8 Medium			
		A9 Units	A9.1 Volume Flow	A9.2 Cst. Vol. Flow	
			A9.3 Norm. Vol. Flow	A9.4 Cst. N.Vol.Flow	
			A9.5 Mass Flow	A9.6 Cst. Mass Flow	
			A9.7 Power	A9.8 Cst. Power	
			A9.9 Volume	A9.10 Cst. Volume	
			A9.11 Norm. Volume	A9.12 Cst. Norm. Volume	
			A9.13 Mass	A9.14 Cst. Mass	
			A9.15 Energy	A9.16 Cst. Energy	
			A9.17 Pressure	A9.18 Cst. Pressure	
			A9.19 Temperature	A9.20 Cst. Temp.	
			A9.21 Density	A9.22 Cst. Density	
		A10 Meter Type			
		A11 Application Assistant	A11.1 Liquids		
			A11.2 Saturated Steam		
			A11.3 Superheated Steam		
			A11.4 Heat Measurement		
			A11.5 Gas		
			A11.6 FAD		
		A12 Cluster Checks	Cluster 1...12		

6.7.2 Menu overview "B Test"

Meas.	Menu B		Submenus				
> ←	↓ ↑	> ←	↓ ↑	> ←	↓ ↑	> ←	↓ ↑ >
	B Test		B1 Simulation		B1.1 Set Value		B1.1.1 Volume Flow
							B1.1.2 Norm. Volume Flow
							B1.1.3 Mass Flow
							B1.1.4 Gross Power
							B1.1.5 Net Power
							B1.1.6 FAD
							B1.1.7 Volume
							B1.1.8 Norm. Volume
							B1.1.9 Mass
							B1.1.10 Gross Energy
							B1.1.11 Net Energy
							B1.1.12 Density
							B1.1.13 Temperature1
							B1.1.14 Temperature2
							B1.1.15 Pressure
							B1.1.16 Vortex Frequency
							B1.1.17 Velocity
							B1.1.18 Specific Enthalpy
							B1.1.19 Specific Heat Cap.
							B1.1.20 Reynolds Number
					B1.2 Current Output		
					B1.3 Binary Output		B1.3.1 Pulse Output
							B1.3.2 Frequency Output
							B1.3.3 Status/Limit Output
	B Test		B2 Actual Values		B2.1 Operating Time		
					B2.2 Volume Flow		
					B2.3 Norm. Volume Flow		
					B2.4 Mass Flow		
					B2.5 Gross Power		
					B2.6 Net Power		
					B2.7 FAD		
					B2.8 Volume		
					B2.9 Norm. Volume		
					B2.10 Mass		
					B2.11 Gross Energy		
					B2.12 Net Energy		
					B2.13 Density		
					B2.14 Temperature1		
					B2.15 Temperature2		

Meas.	Menu B		Submenus				
> ←	↓ ↑	> ←	↓ ↑	> ←	↓ ↑	> ←	↓ ↑ >
	B Test		B2 Actual Values		B2.16 Pressure		
					B2.17 Vortex Frequency		
					B2.18 Velocity		
					B2.19 Specific Enthalpy		
					B2.20 Specific Heat Cap.		
					B2.21 Reynolds Number		

### 6.7.3 Menu overview "C Setup"

Meas.	Menu C		Submenus				
> ←	↓ ↑	> ←	↓ ↑	> ←	↓ ↑	> ←	↓ ↑ >
	C Setup		C1 Process		C1.1 Fluid		
					C1.2 Medium		
					C1.3 Gas		C1.3.1 Gas Mixture
							C1.3.2 Relative Humidity
							C1.3.3 Inlet Temperature
							C1.3.4 Atm. Pressure
							C1.3.5 Filter Pressure Drop
							C1.3.6 Inlet Rel. Humidity
							C1.3.7 Outlet Rel. Humidity
							C1.3.8 Compressor RPM
							C1.3.9 Rated Compr. RPM
					C1.4 Saturated Steam		C1.4.1 Dry Factor
					C1.5 Current Input		C1.5.1 Function
							C1.5.2 Current Input Meas.
							C1.5.3 0% Range / 4mA
							C1.5.4 100% Range / 20mA
					C1.6 Temp. Sensor		C1.6.1 Temp. Source1
							C1.6.2 Temp. Source2
					C1.7 Pressure Sensor		C1.7.1 Pressure Source
					C1.8 Time Constant		
					C1.9 Low Flow Cutoff		
					C1.10 Operating Values		C1.10.1 Oper. Temperature
							C1.10.2 Oper. Pressure
							C1.10.3 Oper. Density
							C1.10.4 Min/Max Oper. Dens.

Meas.	Menu C	Submenus											
> ←	↓ ↑	> ←	↓ ↑	> ←	↓ ↑	> ←	↓ ↑ >						
	C Setup	C1 Process			C1.11 Normal Values		C1.11.1 Norm. Temperature						
C1.11.2 Norm. Pressure													
C1.11.3 Norm. Density													
		C2 Output	C1.12 Heater/Cooler										
C2.1 Current Output													C2.1.1 Current Out. Meas.
													C2.1.2 0% Range
			C2.1.3 100% Range										
			C2.1.4 Lower Ext. Range										
			C2.1.5 Upper Ext. Range										
			C2.1.6 Error Function										
			C2.1.7 Low Error Current										
			C2.1.8 High Error Current										
			C2.1.9 Trimming										
C2.2 Binary Output								C2.2.1 Function					
								C2.2.2 Pulse Output					
								C2.2.3 Frequency Output					
								C2.2.4 Status Output					
								C2.2.5 Limit Switch					
		C2.2.6 Invert Signal											
		C3 Communication	C3.1 HART					C3.1.1 Current Loop Mode					
C3.1.2 Identification													
C3.1.3 Device Information													
C3.1.4 HART Variables													
C3.1.5 Catch DV Temp.													
C3.1.6 Catch DV Pressure													
	C4 Totalizer	C4.1 Flow Totalizer					C4.1.1 Measurement						
C4.1.2 Preset Value													
C4.1.3 Reset Totalizer?													
C4.1.4 Set Start Value													
C4.1.5 Start Totalizer?													
C4.1.6 Stop Totalizer?													
C4.1.7 Information													
C4.2 Energy Totalizer								C4.2.1 Measurement					
								C4.2.2 Preset Value					
								C4.2.3 Reset Totalizer?					
								C4.2.4 Set Start Value					
								C4.2.5 Start Totalizer?					
								C4.2.6 Stop Totalizer?					
C4.2.7 Information													



Meas.	Menu C	Submenus				
> ←	↓ ↑	> ←	↓ ↑	> ←	↓ ↑	> ← ↓ ↑ >
	C Setup		C5 Display		C5.1 Language	
					C5.2 Contrast	
					C5.3 1. Meas. Page	C5.3.1 Function
						C5.3.2 Measurement 1. Line
						C5.3.3 0% Range
						C5.3.4 100% Range
						C5.3.5 Format 1. Line
						C5.3.6 Measurement 2. Line
						C5.3.7 Format 2. Line
						C5.3.8 Measurement 3. Line
						C5.3.9 Format 3. Line
					C5.4 2. Meas. Page	C5.4.1 Function
						C5.4.2 Measurement 1. Line
						C5.4.3 0% Range
						C5.4.4 100% Range
						C5.4.5 Format 1. Line
						C5.4.6 Measurement 2. Line
						C5.4.7 Format 2. Line
						C5.4.8 Measurement 3. Line
						C5.4.9 Format 3. Line
			C6 Device		C6.1 Information	C6.1.1 Tag
						C6.1.2 Long Tag
						C6.1.3 Meter Type
						C6.1.4 Serial Number
						C6.1.5 Manufacturer ID
						C6.1.6 Device Name
						C6.1.7 V Number
						C6.1.8 Electronic Revision
						C6.1.9 Device Revision
						C6.1.10 Software Revision
						C6.1.11 Hardware Revision
						C6.1.12 Electronic Serial No.
						C6.1.13 CG Number
						C6.1.14 Production Date
						C6.1.15 Calibration Date
					C6.2 Security	C6.2.1 Login
						C6.2.2 Change Password
						C6.2.3 Reset Passwords
						C6.2.4 Unlock SIL

Meas.	Menu C		Submenus				
> ⏪	↓ ↑	> ⏪	↓ ↑	> ⏪	↓ ↑	> ⏪	↓ ↑ >
	C Setup		C6 Device		C6.3 Extras		C6.3.1 Meter Type
							C6.3.2 Heat
							C6.3.3 Heat & Dens. by Pres.
							C6.3.4 Heat & Dens. & FAD
					C6.4 Error		C6.4.1 Message View
							C6.4.4 Error Mapping
							C6.4.4.1 Totalizer
					C6.5 Units		C6.5.1 Volume Flow ①
							C6.5.3 Norm. Vol. Flow
							C6.5.5 Mass Flow
							C6.5.7 Power
							C6.5.9 Volume
							C6.5.11 Norm. Volume
							C6.5.13 Mass
							C6.5.15 Energy
							C6.5.17 Pressure
							C6.5.19 Temperature
							C6.5.21 Density
					C6.6 Factory Default		C6.6.1 Reset to Fact. Def.?
					C6.8 Proof Test		C6.8.2 Run Proof Test?

① In all even numbered menus C6.5.2 to .22 Cst. Units (Custom Units) there is a submenu with the prompt for "Text", "Offset" and "Factor".

### 6.7.4 Menu description "A Quick Setup"

Function	Setting / Description
A1 Language	Available display languages: German, English, French, Italian, Spanish, Russian, Chinese, Swedish, Danish, Czech, Polish; 15 further languages in preparation (for details refer to <i>Menu languages</i> on page 56)
A2 Contrast	Adjust contrast of local display (-10...+10; Standard = 0)
A3 Login	Enter password: 0000 (to change password refer to menu C6.2.2)
A4 Tag	Entry and display of measuring point identifier (8 digits).
A5 Long Tag	Entry and display of long measuring point identifier (1...32 digits). Entry will be displayed in the header bar on the LC display (depending on letter size, min. 11 digits can be displayed).
A6 Message View	NAMUR messages (F, S, M, C, I) For further information refer to <i>Status messages and diagnostic information</i> on page 87.
A7 Fluid	Select: Liquid / Steam / Gas / Wet Gas / Gas Mixture Depending on selected fluid, appropriate medium can be selected in A8
A8 Medium	If fluid is "Gas" or "Wet Gas" (for details refer to <i>Gas options for gas measurement</i> on page 57)
	The following selection is available for fluid = "Steam": Saturated Steam / Superheated Steam / Custom
	The following selection is available for fluid = "Liquid": Water / Custom
	The following selection is available for fluid = "Wet Gas": Here, a gas can be selected as a wet gas from all of the above mentioned gases.
A9 Units	For further information refer to menu C6.5.
A10 Meter Type	Standard: For liquids, gases and steam; integrated temperature compensation for saturated steam.
	Heat: For liquids, gases and steam; integrated temperature compensation for saturated steam, gross/net heat measurement for saturated steam and water.
	Heat & Dens. by Pres.: Integrated density compensation for saturated steam, superheated steam and gas, gross/net heat measurement for saturated steam, superheated steam and water.
	Heat & Dens. & FAD: Integrated density compensation for saturated steam, superheated steam and gas, gross/net heat measurement for saturated steam, superheated steam and water, FAD functionality.
A11 Application Assistant	For details refer to next tables.
A12 Cluster Checks	For further information refer to <i>A12 plausibility checks</i> on page 93.

### A11 Application Assistant

The factory settings of the vortex flowmeter have been made in accordance with the order specifications. Nonetheless it can be necessary to make additional settings for the use of some functionalities. For an easy operation the device is equipped with an application assistant for each type of application. The application assistant guides the operator through the configuration of the flowmeter.

The application assistant starts with the definition of all basic units. Afterwards, the functionality-specific parameters have to be set. Settings such as configurations of the outputs or the totaliser functions, can require submenus. These can be entered by pressing the arrow "→" key. In case they are not needed, the menu items can be skipped by pressing the enter "↵" key.

To perform the settings for the application assistant, the operator must be logged on the access level "Expert". For further information refer to *Security and permissions* on page 54.

To abort an application assistant sequence, press "→" and "↑" at the same time. Be sure to select "Save Config.? No" when returning to measuring mode.

Please select a suitable application assistant from the following options:	
A11.1 Liquids	Configuration for liquid applications, incl. the correspondent output and totalizer.
A11.2 Saturated Steam	Configuration for saturated steam applications and density compensation by external or internal temperature transmitter.
A11.3 Superheated Steam	Configuration of superheated steam applications and definition of temperature and pressure value sources.
A11.4 Heat Measurement	Configuration of gross and net heat applications and definition of temperature and/or pressure value sources.
A11.5 Gas	Configuration of gas applications with optionally internal or external pressure and temperature sources for the density compensation.
A11.6 FAD	Configuration of FAD (Free Air Delivery) applications for compressors.

## A11.1 Application Assistant - Liquid

Function	Setting / Description
.1	
.2 Units	
.2.1 Volume Flow	Select unit (default: according to order specification or m <sup>3</sup> /h).
.2.2 Mass Flow	Select unit (default: according to order specification or kg/h).
.2.3 Volume	Select unit (default: according to order specification or m <sup>3</sup> ).
.2.4 Mass	Select unit (default: according to order specification or kg).
.2.5 Temperature	Select unit (default: according to order specification or °C).
.2.6 Pressure	Select unit (default: according to order specification or bar).
.2.7 Density	Select unit (default: according to order specification or kg/m <sup>3</sup> ).
.3 Process	Process configuration.
.3.1 Fluid	Select "Liquid".
.3.2 Medium	Select "Water" or "Custom".
.3.3 Time Constant	0...100 s
.3.4 Low Flow Cutoff	Enter low flow cutoff point in current volume flow unit.
.4 Operating Values	Current process conditions in case they are not measured nor calculated.
.4.1 Oper. Temperature	Input in selected unit.
.4.2 Oper. Pressure	Input in selected unit.
.4.3 Oper. Density	Input in selected unit.
.5 Current Output	Current output configuration.
.5.1 Current Out. Meas.	Select measurement variable for current output.
.5.2 0% Range	The set value represents 4 mA at the current output. Usually 0% flow = 4 mA, but it is also possible to define a higher flow value for 4 mA.
.5.3 100% Range	The set value represents 20 mA at the current output. Usually 100% flow = 20 mA, but it is also possible to define a lower flow value for 20 mA.
.5.4 Error Function	Low / Off / High / Hold
.5.5 Low Error Current	3.5...3.6 mA, available if "Error Function = Low"
.5.6 High Error Current	21...21.5 mA, available if "Error Function = High"
.6 Binary Output	Optionally configure the binary output.
.6.1 Function	Select the binary output function: Limit Switch / Status / Frequency / Pulse / Off
.6.2 Invert Signal	On, Off
.7 Pulse Output	This menu is available if "Binary Output Function = Pulse".
.8 Frequency Output	This menu is available if "Binary Output Function = Frequency".
.9 Status Output	This menu is available if "Binary Output Function = Status".
.10 Limit Switch	This menu is available if "Binary Output Function = Limit Switch".
.11 Flow Totalizer	Optionally configure the flow totalizer.
.12 Energy Totalizer	This menu is available if a non-standard meter type has been configured (refer to "C6.3 Extras").
.13 1. Meas. Page	One Value / Two Values / Three Values / One Value & Bargraph / Two values & Bargraph
.14 2. Meas. Page	One Value / Two Values / Three Values / One Value & Bargraph / Two values & Bargraph

## A11.2 Application Assistant - Saturated Steam

Function	Setting / Description
.1	
.2 Units	Same options as in A11.1.2.
.3 Process	
.3.1 Fluid	Select "Steam".
.3.2 Medium	Select "Saturated Steam".
.3.3 Time Constant	0...100 s
.3.4 Low Flow Cutoff	Enter low flow cutoff point in current volume flow unit.
.4 Current Input	
.4.1 Function	Select "On" if applicable.
.4.2 Current Input Meas.	Select "Temperature External" if "Function = On".
.5.1 Temp. Source1	Internal / External / External HART / Not Available
.5.2 Temp. Source2	Internal / External / External HART / Not Available Temperature source 1 and 2 must be different.
.6 Operating Values	Same options as in A11.1.4.
.7 Current Output	Same options as in A11.1.5.
.8 Binary Output	Same options as in A11.1.6.
.9 Pulse Output	Same options as in A11.1.7.
.10 Frequency Output	Same options as in A11.1.8.
.11 Status Output	Same options as in A11.1.9.
.12 Limit Switch	Same options as in A11.1.10.
.13 Flow Totalizer	Same options as in A11.1.11.
.14 Energy Totalizer	Same options as in A11.1.12.
.15 1. Meas. Page	Same options as in A11.1.13.
.16 2. Meas. Page	Same options as in A11.1.14.

### A11.3 Application Assistant - Superheated Steam

Function	Setting / Description
This application assistant is available if meter type is set to "Heat & Dens. by Pres." or "Heat & Dens. & FAD" (refer to "C6.3 Extras").	
.1	
.2 Units	Same options as in A11.1.2.
.3 Process	
.3.1 Fluid	Select "Steam".
.3.2 Medium	Select "Superheated Steam".
.3.3 Time Constant	0...100 s
.3.4 Low Flow Cutoff	Enter low flow cutoff point in current volume flow unit.
.4 Current Input	
.4.1 Function	Select "On", if applicable.
.4.2 Current Input Meas.	Select "Temperature External" or "Pressure External".
.5.1 Temp. Source1	Internal / External / External HART / Not Available
.5.2 Temp. Source2	Internal / External / External HART / Not Available Temperature source 1 and 2 must be different.
.6 Operating Values	Same options as in A11.1.4.
.7 Current Output	Same options as in A11.1.5.
.8 Binary Output	Same options as in A11.1.6.
.9 Pulse Output	Same options as in A11.1.7.
.10 Frequency Output	Same options as in A11.1.8.
.11 Status Output	Same options as in A11.1.9.
.12 Limit Switch	Same options as in A11.1.10.
.13 Flow Totalizer	Same options as in A11.1.11.
.14 Energy Totalizer	Same options as in A11.1.12.
.15 1. Meas. Page	Same options as in A11.1.13.
.16 2. Meas. Page	Same options as in A11.1.14.

## A11.4 Application Assistant - Heat Measurement

Function	Setting / Description
This application assistant is available if meter type is not set to "Standard" (refer to "C6.3 Extras").	
.1	
.2 Units	
.2.1 Volume Flow	Select unit (default: according to order specification or m <sup>3</sup> /h).
.2.2 Mass Flow	Select unit (default: according to order specification or kg/h).
.2.3 Power	Select unit (default: according to order specification or kJ/h).
.2.4 Volume	Select unit (default: according to order specification or m <sup>3</sup> ).
.2.5 Mass	Select unit (default: according to order specification or kg).
.2.6 Energy	Select unit (default: according to order specification or kJ).
.2.7 Temperature	Select unit (default: according to order specification or °C).
.2.8 Pressure	Select unit (default: according to order specification or bar).
.2.9 Density	Select unit (default: according to order specification or kg/m <sup>3</sup> ).
.3 Process	
.3.1 Fluid	Select "Steam" or "Liquid".
.3.2 Medium	Select "Saturated Steam", "Superheated Steam" or "Water".
.3.3 Time Constant	0...100 s
.3.4 Low Flow Cutoff	Enter low flow cutoff point in current volume flow unit.
.4 Current Input	
.4.1 Function	Select "On".
.4.2 Current Input Meas.	Select "Temperature External".
.5 Temp. Sensor	
.5.1 Temp. Source1	Internal / External / External HART / Not Available
.5.2 Temp. Source2	Internal / External / External HART / Not Available Temperature source 1 and 2 must be different.
.6 Operating Values	Same options as in A11.1.4.
.7 Current Output	
.7.1 Current Out. Meas.	Select "Gross Power" or "Net Power".
.7.2 0% Range	The set value represents 4 mA at the current output. Usually 0% flow = 4 mA, but it is also possible to define a higher flow value for 4 mA.
.7.3 100% Range	The set value represents 20 mA at the current output. Usually 100% flow = 20 mA, but it is also possible to define a lower flow value for 20 mA.
.7.4 Error Function	Same options as in A11.1.5.4.
.7.5 Low Error Current	3.5...3.6 mA
.7.6 High Error Current	21...21.5 mA
.8 Binary Output	Same options as in A11.1.6.
.9 Pulse Output	Same options as in A11.1.7.
.10 Frequency Output	Same options as in A11.1.8.
.11 Status Output	Same options as in A11.1.9.
.12 Limit Switch	Same options as in A11.1.10.
.13 Flow Totalizer	Same options as in A11.1.11.
.14 Energy Totalizer	Same options as in A11.1.12.



Function	Setting / Description
.15 1. Meas. Page	Same options as in A11.1.13.
.16 2. Meas. Page	Same options as in A11.1.14.

### A11.5 Application Assistant - Gas

Function	Setting / Description
.1	
.2 Units	Same options as in A11.1.2.
.2.1 Volume Flow	Select unit (default: according to order specification or m <sup>3</sup> /h).
.2.2 Norm. Vol. Flow	Select unit (default: according to order specification or Nm <sup>3</sup> /h).
.2.3 Mass Flow	Select unit (default: according to order specification or kg/h).
.2.4 Volume	Select unit (default: according to order specification or m <sup>3</sup> ).
.2.5 Norm. Volume	Select unit (default: according to order specification or Nm <sup>3</sup> ).
.2.6 Mass	Select unit (default: according to order specification or kg).
.2.7 Temperature	Select unit (default: according to order specification or °C).
.2.8 Pressure	Select unit (default: according to order specification or bar).
.2.9 Density	Select unit (default: according to order specification or kg/m <sup>3</sup> ).
.3 Process	
.3.1 Fluid	Select: "Gas", "Wet Gas" or "Gas Mixture".
.3.2 Medium	If fluid is "Gas" or "Wet Gas" (for details refer to <i>Gas options for gas measurement</i> on page 57).
.3.3 Time Constant	0...100 s
.3.4 Low Flow Cutoff	Enter low flow cutoff point in current volume flow unit.
.4 Current Input	Same options as in A11.3.4.
.5.1 Temp. Source1	Internal / External / External HART / Not Available
.5.2 Temp. Source2	Internal / External / External HART / Not Available Temperature source 1 and 2 must be different.
.6 Gas Mixture	If fluid = "Gas Mixture", enter gas mixture in %.
.7 Gas	
.7.1 Relative Humidity	If fluid = "Wet Gas", enter 0...100%.
.8 Operating Values	Same options as in A11.1.4.
.9 Normal Values	Default settings according to order specification or DIN.
.9.1 Norm. Temperature	Confirm default setting or define in selected temperature unit.
.9.2 Norm. Pressure	Confirm default setting or define in selected pressure unit.
.9.3 Norm. Density	Confirm default setting or define in selected density unit.
.10 Current Output	Same options as in A11.1.5.
.11 Binary Output	Same options as in A11.1.6.
.12 Pulse Output	Same options as in A11.1.7.
.13 Frequency Output	Same options as in A11.1.8.
.14 Status Output	Same options as in A11.1.9.
.15 Limit Switch	Same options as in A11.1.10.
.16 Flow Totalizer	Same options as in A11.1.11.

Function	Setting / Description
.17 1. Meas. Page	Same options as in A11.1.13.
.18 2. Meas. Page	Same options as in A11.1.14.

### A11.6 Application Assistant - FAD

Function	Setting / Description
This application assistant is available if meter type is set to "Heat & Dens. & FAD" (refer to "C6.3 Extras").	
.1	
.2 Units	
.2.1 Volume Flow	Select unit (default: according to order specification or m <sup>3</sup> /h).
.2.2 Norm. Vol. Flow	Select unit (default: according to order specification or Nm <sup>3</sup> /h).
.2.3 Volume	Select unit (default: according to order specification or m <sup>3</sup> ).
.2.4 Norm. Volume	Select unit (default: according to order specification or Nm <sup>3</sup> ).
.2.5 Temperature	Select unit (default: according to order specification or °C).
.2.6 Pressure	Select unit (default: according to order specification or bar).
.2.7 Density	Select unit (default: according to order specification or kg/m <sup>3</sup> ).
.3 Process	
.3.1 Fluid	Select "Gas".
.3.2 Medium	Select "Air".
.3.3 Time Constant	0...100 s
.3.4 Low Flow Cutoff	Enter low flow cutoff point in current volume flow unit.
.4 Current Input	Same options as in A11.3.4.
.5.1 Temp. Source1	Internal / External / External HART / Not Available
.5.2 Temp. Source2	Internal / External / External HART / Not Available Temperature source 1 and 2 must be different.
.6 Gas	
.6.1 Inlet Temperature	Enter temperature on inlet side in selected unit.
.6.2 Atm. Pressure	Enter current ambient pressure in selected unit.
.6.3 Filter Pressure Drop	Enter filter pressure drop in selected unit.
.6.4 Inlet Rel. Humidity	Enter air humidity on inlet side in 0...100%.
.6.5 Outlet Rel. Humidity	Enter air humidity on outlet side in 0...100%.
.6.6 Compressor RPM	Compressor revolutions per minute.
.6.7 Rated Compr. RPM	Rated compressor revolutions per minute.
.7 Operating Values	Same options as in A11.1.4.
.8 Current Output	Select "FAD".
.9 Binary Output	Same options as in A11.1.6.
.10 Pulse Output	Same options as in A11.1.7.
.11 Frequency Output	Same options as in A11.1.8.
.12 Status Output	Same options as in A11.1.9.
.13 Limit Switch	Same options as in A11.1.10.
.14 Flow Totalizer	Same options as in A11.1.11.
.16 1. Meas. Page	Same options as in A11.1.13.
.17 2. Meas. Page	Same options as in A11.1.14.

### 6.7.5 Menu description "B Test"

For simulation and actual values refer to *Menu overview "B Test"* on page 62.

### 6.7.6 Menu description "C Setup"

For further information refer to *Menu overview "C Setup"* on page 63.

There are four different meter types (software versions) available for the signal converter:

Meter type	Description
Standard	Uncompensated measurement for liquids, gases and steam; integrated temperature compensation included for saturated steam
Heat	Same as "Standard", plus gross/net heat measurement for saturated steam and hot water
Heat & Dens. by Pres.	Same as "Heat", plus gross/net heat measurement for superheated steam; density compensation for the measurement of gas
Heat & Dens. & FAD	Same as "Heat & Dens. by Pres.", plus FAD (Free Air Delivery) measurement

Depending on the ordered meter type those options may have been ordered and are already activated or can be activated in menu "C6.3 Extras". For this purpose an activation password is necessary. Please contact the manufacturer.

When using the standard device all menu entries concerning heat measurement, density calculation and FAD are hidden.

Function	Setting / Description
<b>C1 Process</b>	
C1.1 Fluid	Select: Liquid / Steam / Gas / Wet Gas / Gas Mixture Appropriate media can be selected in menu C1.2 dependent on selected fluid type.
C1.2 Medium	If fluid = "Liquid": Water / Custom
	If fluid = "Steam": Saturated Steam / Superheated Steam / Custom
	If fluid is "Gas" or "Wet Gas" (for details refer to <i>Gas options for gas measurement</i> on page 57)
C1.3 Gas	This menu is available if fluid = "Wet Gas" or "Gas Mixture", or if medium = "Air". Here the gas composition or gas properties can be defined.
C1.3.1 Gas Mixture	This menu is available for fluid = "Gas Mixture". Enter gas mixture as percentage share of gas options (for details refer to <i>Gas options for gas measurement</i> on page 57)
C1.3.2 Relative Humidity	This menu is available if fluid = "Wet Gas". Enter: 0...100%
C1.3.3 Inlet Temperature	The menus C1.3.3 to C1.3.9 are part of the FAD functionalities. They are available, if fluid = "Gas", medium = "Air" and FAD functionality is included in the meter type option.  Enter ambient temperature of the compressor inlet side in selected temperature unit (C6.5.19).
C1.3.4 Atm. Pressure	Enter ambient pressure of the compressor inlet side as value in selected pressure unit (C6.5.17).
C1.3.5 Filter Pressure Drop	Enter pressure drop of compressor filter in selected pressure unit (C6.5.17).
C1.3.6 Inlet Rel. Humidity	Enter relative air humidity of the compressor inlet side as 0...100%.
C1.3.7 Outlet Rel. Humidity	Enter relative air humidity of the compressor outlet side as 0...100%.

Function	Setting / Description
<b>C1 Process</b>	
C1.3.8 Compressor RPM	Enter compressor revolutions per minute.
C1.3.9 Rated Compr. RPM	Enter rated compressor revolutions per minute.
C1.4 Saturated Steam	This menu is available, if fluid = "Steam" and medium = "Saturated Steam".
C1.4.1 Dry Factor	Enter 0.85...1
C1.5 Current Input	The current input is a passive 2-wire 4...20 mA input. An external power supply is required (for details refer to <i>Current input</i> on page 40).
C1.5.1 Function	Select "On" or "Off" to enable or disable the current input.
C1.5.2 Current Input Meas.	If current input function (C1.5.1) = "On", the following selection is available: Pressure External / Temperature External
C1.5.3 0% Range / 4mA	0% value = 4 mA for pressure value or temperature value
C1.5.4 100% Range / 20mA	100% value = 20 mA for pressure value or temperature value
<b>C1.6 Temp. Sensor</b>	
C1.6.1 Temp. Source1	Select: Not available / Internal / External / External HART / Sat. Steam Temp. (Saturated steam temperature only available for meter types "Heat & Dens. by Pres." and "Heat & Dens. & FAD")  Temperature source 1 and 2 must be different. If the current input is set to "Temperature External", either "Temp. Source1" or "Temp. Source2" may be set to "External". If the current input is set "Pressure External", the "External" option is not available to both temperature source 1 and 2.
C1.6.2 Temp. Source2	
<b>C1.7 Pressure Sensor</b>	
C1.7.1 Pressure Source	Select: Not Available / Internal / External / External HART (Pressure sensor support only available for meter types "Heat & Dens. by Pres." and "Heat & Dens. & FAD")
C1.8 Time Constant	Enter: 0...100 s
C1.9 Low Flow Cutoff	Sets low flow values to "0". Enter value for low flow cutoff in volumetric flow unit.
C1.10 Operating Values	Operating values are pre-set according to the application data; value can be adjusted subsequently, if required.
C1.10.1 Oper. Temperature	Enter value in selected temperature unit.
C1.10.2 Oper. Pressure	Enter value in selected pressure unit.
C1.10.3 Oper. Density	Enter value in selected density unit.
C1.10.4 Min/Max Oper. Dens.	Minimum and maximum operating densities are defined by the nominal diameter and the operating density as standard. By activating this function, deviating values for the minimum and maximum operating densities can be defined.
C1.10.4.1 Function	Select: On / Off  If function = "On", min./max. operating density can be defined in C1.10.4.2 and C1.10.4.3
C1.10.4.2 Min. Oper. Density	Enter value for minimum operating density in selected density unit.
C1.10.4.3 Max. Oper. Density	Enter value for maximum operating density in selected density unit.
C1.11 Normal Values	Standard system values are pre-set according to the application data, if applicable. Standard system can be changed by changing values in C1.11.1 to C1.11.3.
C1.11.1 Norm. Temperature	Enter value in selected temperature unit.
C1.11.2 Norm. Pressure	Enter value in selected pressure unit.

Function	Setting / Description
<b>C1 Process</b>	
C1.11.3 Norm. Density	Enter value in selected density unit.
C1.12 Heater/Cooler	In net heat measurement applications this functionality monitors "Temp. Source 1" (C1.6.1) and "Temp. Source 2" (C1.6.2) and triggers a NE 107 status message type C in case of temperature incongruity. Select: - Heater: status message is triggered in case of "Temp. Source 1" < "Temp. Source 2" - Cooler: status message is triggered in case of "Temp. Source 1" > "Temp. Source 2" - Don't care: functionality is deactivated

Function	Setting / Description
<b>C2 Output</b>	
C2.1 Current Output	2-wire current output 4..20 mA (for details refer to <i>Technical data</i> on page 99)
C2.1.1 Current Out. Meas.	Determination of measurement variable for current output. Measurement variable for current output is pre-set according to application data.  Select: Volume Flow / Norm. Volume Flow / Mass Flow / Density / Temperature1 / Pressure / Vortex Frequency / Velocity / Gross Power / Net Power / FAD  The latter three measurement variables are just available if the respective meter type option was activated.
C2.1.2 0% Range	The set value represents the 4 mA value of the current output. Usually 0% of flow is set as 4 mA, but it is also possible to assign higher flow values than 4 mA.
C2.1.3 100% Range	The set value represents the 20 mA value of the current output. Usually 100% of flow is set as 20 mA, but it is also possible to assign lower flow values than 20 mA.
C2.1.4 Lower Ext. Range	Minimum limit of current value. Pre-set value is 4 mA. Enter: 3.8...4 mA  Condition for value < 4 mA: Measurement value at 4 mA must not be smaller or equal to 0%.
C2.1.5 Upper Ext. Range	Maximum limit of current value. Pre-set value is 20 mA. Enter: 20...20.5 mA  Condition for value > 20 mA: Measurement value at 20 mA must not be greater or equal to 100%.
C2.1.6 Error Function	This function triggers a current output signal in case of an error detection with status type F (for details refer to <i>Status messages and diagnostic information</i> on page 87).  Select: - Off: No error current signal is sent. - High: Error current signal as defined in C2.1.7 is sent. - Low: Error current signal as defined in C2.1.8 is sent. - Hold: Last current value is held.
C2.1.7 Low Error Current	Enter: 3.5...3.6 mA, available if "Error Function = Low"
C2.1.8 High Error Current	Enter: 21...21.5 mA, available if "Error Function = High"
C2.1.9 Trimming	This function enables to trim the current output. Trimming is started by entering the menu.
C2.1.9.2 4mA Trimming	Trimming of 4 mA point.  Enter measured value for 4 mA point. Reset to 4 mA restores the factory calibration.
C2.1.9.5 20mA Trimming	Trimming of 20 mA point.  Enter measured value for 20 mA point. Reset to 20 mA restores the factory calibration.
C2.2 Binary Output	For possible functions of the binary output refer to <i>Binary output</i> on page 40

Function	Setting / Description
<b>C2 Output</b>	
C2.2.1 Function	Select: Off / Pulse / Frequency / Status / Limit Switch Unless otherwise ordered the binary output is inactive.
C2.2.2 Pulse Output	Only available if "Pulse" is selected in C2.2.1.
C2.2.2.1 Measurement	Select: Volume Flow / Mass Flow / Norm. Volume Flow / Gross Power / Net Power  Gross/net power is just available for non-standard meter types measuring steam or water.  Availability of selection depending on meter type and medium configuration.
C2.2.2.2 Value p. Pulse	Define value per pulse in unit according to measurement variable selection.
C2.2.2.3 Pulse Width	Define pulse width in ms.
C2.2.2.4 100% Pulse Rate	Define 100% pulse rate in Hz.
C2.2.3 Frequency Output	Only available, if "Frequency" is selected in C2.2.1.
C2.2.3.1 Frequency Out. Meas.	Select: Volume Flow / Norm. Volume Flow / Mass Flow / Density / Temperature1 / Temperature2 / Pressure / Vortex Frequency / Velocity / Specific Enthalpy / Specific Heat Capacity / Reynolds Number / FAD / Net Power / Gross Power  Availability of selection depending on meter type and medium configuration.
C2.2.3.2 Pulse Shape	Select: Automatic (constant pulse width based on pulse/pause ratio = 1 at max. pulse rate) / Symmetric (pulse/pause ratio = 1) / Fixed (Fixed pulse length; set pulse width in C2.2.3.3)
C2.2.3.3 Pulse Width	Only available, if "Pulse Shape = Fixed" is selected in C2.2.3.2. Enter pulse width in ms.
C2.2.3.4 0% Pulse Rate	Enter value for 0% pulse rate in Hz.
C2.2.3.5 100% Pulse Rate	Enter value for 100% pulse rate in Hz.
C2.2.3.6 0% Range	Enter value for 0% range in unit according to measurement variable selection.
C2.2.3.7 100% Range	Enter value for 100% range in unit according to measurement variable selection.
C2.2.4 Status Output	Only available, if "Status" is selected in C2.2.1.
C2.2.4.1	Selection can be made, which event will trigger a signal on the status output.  Select: - Flow Totalizer Overfl.: Signal is sent, when pre-defined flow totalizer value is reached. Define value in C4.1.2. - Energy Totalizer Overf.: Signal is sent, when pre-defined energy totalizer value is reached. Define value in C4.2.2. - Failure: Status signal is sent in case of failure. - Function Check: Status signal is sent, if a test function is active. - Out of Specification: Signal is sent, if measurement is out of specification. - Type of Fluid (for steam applications): Signal is sent to signalise transition in type of fluid.
C2.2.4.2 Type of Fluid	Only available, if "Type of Fluid" is selected in C2.2.4.1.  Select (availability depending on fluid and medium configuration): - Liquid: Indicates transition of medium to liquid. - Saturated Steam: Indicates transition of medium to saturated steam. - Superheated Steam: Indicates transition of medium to superheated steam. <b>Note:</b> Correct temperature and pressure sources have to be defined in C1.6 and C1.7!
C2.2.4.3 Type of Fluid Epsilon	Only available, if "Type of Fluid" is selected in C2.2.4.1.  Value defines the sensitivity of transition detection.  Enter value between -1.0 (to decrease sensitivity) and +1.0 (to increase sensitivity).
C2.2.5 Limit Switch	Only available, if "Limit Switch" is selected in C2.2.1.

Function	Setting / Description
<b>C2 Output</b>	
C2.2.5.1 Measurement	<p>Limit output variable can be defined, which will trigger a signal on the status output.</p> <p>Select: Volume Flow / Norm. Volume Flow / Mass Flow / Volume / Density / Temperature1 / Temperature2 / Pressure / Vortex Frequency / Velocity / Specific Enthalpy / Specific Heat Capacity / Reynolds Number / Mass / Norm. Volume / FAD / Net Energy / Gross Energy / Net Power / Gross Power</p> <p>The latter five measurement variables are just available if the respective meter type option was activated and fluid/medium were properly configured.</p> <p>Availability of selection depending on meter type and medium configuration.</p>
C2.2.5.2 Lower Limit	Enter value for lower limit in unit according to selected limit output variable.
C2.2.5.3 Upper Limit	Enter value for upper limit in unit according to selected limit output variable.
C2.2.6 Invert Signal	Select: On (normally open) / Off (normally closed)

Function	Setting / Description
<b>C3 Communication</b>	
<b>C3.1 HART</b>	
C3.1.1 Current Loop Mode	Select: On (enables primary variable to be transmitted as 4...20 mA current values) / Off (disables 4...20 mA transmission, but enables HART <sup>®</sup> multi-drop mode)
C3.1.2 Identification	HART <sup>®</sup> Identification parameters
C3.1.2.1 Polling Address	<p>Set address for HART<sup>®</sup> operation. Standard setting is 000 for point-to-point operation with current output 4...20 mA. Setting of polling address ≠ 000 causes a constant 4 mA output and enables multi-drop mode.</p> <p>Enter: 000...063</p>
C3.1.2.2 Tag	Enter measuring point identifier (1...8 digits).
C3.1.2.3 Long Tag	<p>Enter long measuring point identifier (1...32 digits).</p> <p>Entry will be displayed in the header bar on the LC display (depending on letter size, min. 11 digits can be displayed).</p>
C3.1.2.4 Manufacturer ID	HART <sup>®</sup> Manufacturer ID = 006C [BOPP & REUTHER] (read-only)
C3.1.2.5 Device Type	Device Type = 6CE9 (read-only)
C3.1.2.6 Device ID	Individual device ID (read-only)
C3.1.2.7 Universal Revision	HART <sup>®</sup> revision (read-only)
C3.1.2.8 Device Revision	(read-only)
C3.1.2.9 Software Revision	(read-only)
C3.1.2.10 Hardware Revision	(read-only)
C3.1.3 Device Information	Informative text can be added to describe the device in the HART <sup>®</sup> communication loop.
C3.1.3.1 Descriptor	Commenting text to label instrument can be added; 1...16 digits.
C3.1.3.2 Message	Here additional information can be added.
C3.1.3.3 Date	Customer-defined date can be set here.
C3.1.3.4 Cfg. Change Counter	Counter for changes in settings (read-only).
C3.1.4 HART Variables	Definition of HART <sup>®</sup> variables.
C3.1.4.1 Current Out. Meas.	Primary HART <sup>®</sup> variable; identical with current output measurement variable.

Function	Setting / Description
<b>C3 Communication</b>	
C3.1.4.2 Frequency Out. Meas.	Secondary HART® variable; identical with frequency output measurement variable. If binary output is not activated or not configured as frequency output, the secondary HART® variable is selectable. The variable selection is depending on the device configuration.
C3.1.4.3 Current Input Meas.	Tertiary HART® variable; identical with current input measurement variable. If the current input is not activated, the secondary HART® variable is selectable. The variable selection is depending on the device configuration.
C3.1.4.4 Quaternary HART	Select (Availability depending on fluid and medium configuration): Volume Flow / Norm. Volume Flow / Mass Flow / Gross Power / Net Power / FAD / Volume / Norm. Volume / Gross Energy / Net Energy / Density / Temperature1 / Temperature2 / Pressure / Vortex Frequency / Velocity / Specific Enthalpy / Specific Heat Capacity / Reynolds Number
C3.1.5 Catch DV Temp.	Catch device variable allows for capturing process data from another field device in a multidrop network.
C3.1.5.1 Capture Mode	ACK - listen to responses by a specific slave device BACK - listen to bursts by a specific slave device OFF - disable capture mode
C3.1.5.2 Exp. Device Type	Define expanded device type for source slave. Enter: 000...65535
C3.1.5.3 Slave Device ID	Enter source slave address
C3.1.5.4 Capture Command	Select source command number: 1 / 2 / 3 / 9 / 33
C3.1.5.5 Slot Number	Describes slot to process in response message. Select 1...8 (depending on source command number).
C3.1.5.6 Shed Time	Shed time for mapping. Define: 0...max.
C3.1.6 Catch DV Pressure	Same options as C3.1.5.

Function	Setting / Description
<b>C4 Totalizer</b>	
C4.1 Flow Totalizer	
C4.1.1 Measurement	Select: Volume Flow / Norm. Volume Flow / Mass Flow "Norm. Vol." is only available if fluid is "Gas", "Wet Gas" or "Gas Mixture".
C4.1.2 Preset Value	Set value, which triggers signal on status output (refer to C2.2.4.1).
C4.1.3 Reset Totalizer?	Select: Yes / No
C4.1.4 Set Start Value	Set start value in selected unit. Start value has to be confirmed with "Yes" or refused with "No".
C4.1.5 Start Totalizer?	Select: Yes / No
C4.1.6 Stop Totalizer?	Select: Yes / No
C4.1.7 Information	Display of current totalizer values. The menus C4.1.7.1 to C4.1.7.3 are available depending on selected measurement variable in C4.1.1.
C4.1.7.1 Volume	Display of current totalizer value for volume flow.
C4.1.7.2 Norm. Volume	Display of current totalizer value for norm. volume flow.
C4.1.7.3 Mass	Display of current totalizer value for mass flow.



Function	Setting / Description
<b>C4 Totalizer</b>	
C4.2 Energy Totalizer	This menu is available for meter types $\neq$ "Standard" and for medium = "Steam" or "Water".
C4.2.1 Measurement	Select: Gross Energy / Net Energy "Net Energy" is only available, if fluid = "Steam" or medium = "Water".
C4.2.2 Preset Value	Set value, which triggers signal on status output.
C4.2.3 Reset Totalizer?	Select: Yes / No
C4.2.4 Set Start Value	Enter current value in selected unit. Start value has to be confirmed with "Yes" or refused with "No".
C4.2.5 Start Totalizer?	Select: Yes / No
C4.2.6 Stop Totalizer?	Select: Yes / No
C4.2.7 Information	Display of current totalizer values. The menus C4.2.7.1 and C4.2.7.2 are available depending on selected measurement variable in C4.2.1.
C4.2.7.1 Gross Energy	Display of current totalizer value for gross energy.
C4.2.7.2 Net Energy	Display of current totalizer value for net energy.

Function	Setting / Description
<b>C5 Display</b>	
C5.1 Language	Available display languages: German, English, French, Italian, Spanish, Russian, Chinese, Swedish, Danish, Czech, Polish; 15 further languages in preparation (for details refer to <i>Menu languages</i> on page 56)
C5.2 Contrast	Adjust contrast of local display [-10...+10].
C5.3 1. Meas. Page	Configuration of the first measurement display page.
C5.3.1 Function	Select: One Value / Two Values / Three Values / One Value & Bargraph / Two Values & Bargraph
C5.3.2 Measurement 1. Line	Select: Volume Flow / Norm. Volume Flow / Mass Flow / Volume / Norm. Volume / Mass / Temperature1 / Temperature2 / Pressure / Density / Vortex Frequency / Velocity / Specific Enthalpy / Specific Heat Capacity / Reynolds Number  The following options are only available for meter types "Heat" / "Heat & Dens. by Pres." / "Heat & Dens. & FAD": Gross Power / Net Power / Gross Energy / Net Energy / FAD (only available with the meter type "Heat & Dens. & FAD")
C5.3.3 0% Range	The set value represents the 0% point of the bargraph indication. Usually 0% flow = 4 mA, but it is also possible to define a higher flow value for 4 mA.  This menu is only available, if an option containing a bargraph was selected in C5.3.1.
C5.3.4 100% Range	The set value represents the 100% point of the bargraph indication. Usually 100% flow = 20 mA, but it is also possible to define a lower flow value for 20 mA.  This menu is only available, if an option containing a bargraph was selected in C5.3.1.
C5.3.5 Format 1. Line	Automatic or 1...8 digits
C5.3.6 Measurement 2. Line	Same as C5.3.2, visible if more than one value was selected in C5.3.1.
C5.3.7 Format 2. Line	Same as C5.3.5, visible if more than one value was selected in C5.3.1.
C5.3.8 Measurement 3. Line	Same as C5.3.2, visible if three values were selected in C5.3.1.
C5.3.9 Format 3. Line	Same as C5.3.5, visible if three values were selected in C5.3.1.
C5.4 2. Meas. Page	Same options as in C5.3.

Function	Setting / Description
<b>C6 Device</b>	
C6.1 Information	
C6.1.1 Tag	Entry and display of measuring point identifier (8 digits).
C6.1.2 Long Tag	Entry and display of long measuring point identifier (1...32 digits). Entry will be displayed in the header bar on the LC display (depending on letter size, min. 11 digits can be displayed).
C6.1.3 Meter Type	Display of meter type as activated in A10 or C6.3.2...C6.3.4 (read-only).
C6.1.4 Serial Number	Individual device ID (read-only).
C6.1.5 Manufacturer ID	HART <sup>®</sup> Manufacturer ID = 006C [BOPP & REUTHER] (read-only)
C6.1.6 Device Name	VTX3 (read-only)
C6.1.7 V Number	Internal order number (read-only).
C6.1.8 Electronic Revision	Electronic revision of this device as listed on device nameplate (for details refer to <i>Software history</i> on page 6).
C6.1.9 Device Revision	(read-only)
C6.1.10 Software Revision	(read-only)
C6.1.11 Hardware Revision	(read-only)
C6.1.12 Electronic Serial No.	Individual ID of electronics component (read-only).
C6.1.13 CG Number	Article code for signal converter hardware (read-only).
C6.1.14 Production Date	(read-only)
C6.1.15 Calibration Date	(read-only)
C6.2 Security	
C6.2.1 Login	Enter four digit password to gain a specific access level (for details refer to <i>Security and permissions</i> on page 54).
C6.2.2 Change Password	Change the password associated to the access level currently active.
C6.2.3 Reset Passwords	Reset all passwords to their default setting (for details refer to <i>Security and permissions</i> on page 54).
C6.2.4 Unlock SIL	Enter four digit password to unlock SIL mode (if not unlocked by order) and confirm with enter key. For details refer to "Safety Manual".
C6.3 Extras	
C6.3.1 Meter Type	Display of meter type as activated in A10 or C6.3.2...C6.3.4 (read-only).
C6.3.2 Heat	Activate a different meter type in order to enable advanced measurement options (Gross/net heat, density by pressure or FAD) using a unique authorisation code. Contact manufacturer to obtain this code.
C6.3.3 Heat & Dens. by Pres.	
C6.3.4 Heat & Dens. & FAD	
C6.4 Errors	
C6.4.1 Message View	NAMUR messages (F, S, M, C, I)  For further information refer to <i>Status messages and diagnostic information</i> on page 87.
C6.4.4 Error Mapping	For specific NE 107 events it is possible to redefine the status type.
C6.4.4.1 Totalizer	This function defines the NE 107 status type for the totalizer overflow. Select: Information / Maintenance Request / Out of Specification / Function Check / Failure / None

Function	Setting / Description
<b>C6 Device</b>	
C6.5 Units	
6.5.1 Volume Flow	C6.5.2 Cst. Volume Flow In all even numbered menus C6.5.2 to .22 Cst. Units (Custom Units) there is a submenu with the prompt for "Text", "Offset" and "Factor".
6.5.3 Norm. Vol. Flow	6.5.4 Cst. Norm. Vol. Flow
6.5.5 Mass Flow	6.5.6 Cst. Mass Flow
6.5.7 Power	6.5.8 Cst. Power
6.5.9 Volume	6.5.10 Cst. Volume
6.5.11 Norm. Volume	6.5.12 Cst. Norm. Volume
6.5.13 Mass	6.5.14 Cst. Mass
6.5.15 Energy	6.5.16 Cst. Energy
6.5.17 Pressure	6.5.18 Cst. Pressure
6.5.19 Temperature	6.5.20 Cst. Temperature
6.5.21 Density	6.5.22 Cst. Density
C6.6 Factory Default	
C6.6.1 Reset to Fact. Def.?	Query: Reset to Fact. Def.? Press "→" and confirm reset to factory default with "Yes" or refuse with "No".
C6.8 Proof Test	For details refer to the "Safety Manual".

## 6.8 Setting examples

### 6.8.1 Settings for free air delivery measurement - FAD

For the use of the FAD functionality the following parameters have to be entered into the vortex flowmeter:

- Ambient temperature (inlet)
- Atmospheric pressure (inlet)
- Air humidity (inlet and outlet)
- Motor speed (rated speed and actual speed)
- Filter pressure drop

The following configuration example describes an easy way to program all necessary parameters and settings.

Function	Parameters
C6.3 Extras	Activate meter type option "Heat & Dens. & FAD" by entering the proper four digit code (if not activated by order). This needs to be done once.

#### Enter process parameters:

C1.1 Fluid	Gas
C1.2 Medium	Air
C6.5 Units	Set units for temperature, pressure and flow.
C1.3.3 Inlet Temperature	Enter value in selected unit.
C1.3.4 Atm. Pressure	Enter value in selected unit.
C1.3.5 Filter Pressure Drop	Enter value in selected unit.
C1.3.6 Inlet Rel. Humidity	Enter value in %.
C1.3.7 Outlet Rel. Humidity	Enter value in %.
C1.3.8 Compressor RPM	Enter value in RPM.
C1.3.9 Rated Compr. RPM	Enter value in RPM.

#### Configure output:

C2.1 Current Output	
C2.1.1 Current Out. Meas.	FAD
C2.1.2 0% Range C2.1.3 100% Range	Enter value for 0% and 100% in selected unit.

#### Display one value on local display:

C5.3.1 Function	One Value & Bargraph
C5.3.2 Measurement 1. Line	FAD
C5.3.3 0% Range C5.3.4 100% Range	Enter bargraph range limits (0% / 100%) in selected unit.



*This is an example setup for basic FAD measurement. Other setup options are feasible.*

## 6.8.2 Gross heat measurement

In order to calculate gross power the mass flow (compensated by density) is multiplied by the specific enthalpy:

$$\text{Gross power } [Q_H] = \text{mass flow } [Q_m] \times \text{enthalpy } [H]$$

When measuring gross heat, internally both the flow totalizer and the energy totalizer are used.

The following configuration example describes an easy way to program all necessary settings. For this example is assumed that the internal temperature and pressure sensor are used for the gross heat calculation of superheated steam.

Function	Parameters
C6.3 Extras	Activate one of the meter type options "Heat" (for saturated steam and temperature compensation) or "Heat & Dens. by Pres." (for superheated steam and density compensation by temperature and pressure) by entering the proper four digit code (if not activated by order). This needs to be done once.

### Enter process parameters:

C1.1 Fluid	Steam
C1.2 Medium	Superheated Steam
C1.6 Temp. Sensor	
C1.6.1 Temp. Source1	Internal ("Temp. Source2" must not be selected as "Internal")
C1.7 Pressure Sensor	
C.1.7.1 Pressure Source	Internal
C6.5 Units	Set units for temperature, pressure and flow.
C1.10 Operating Values	
C1.10.3 Oper. Density	Operating density is important for sensor limits but will not be used during operation.

### Configure output and totalizers:

C2.1 Current Output	
C2.1.1 Current Out. Meas.	Gross Power
C2.1.2 0% Range C2.1.3 100% Range	Enter value for 0% and 100% in selected unit.
C4.2 Energy Totalizer	
C4.2.1 Measurement	Gross Power
C4.2.5 Start Totalizer?	Yes

### Display two values on local display: (Gross power, Gross energy)

C5.3.1 Function	Two Values
C5.3.2 Measurement 1. Line	Gross Power
C5.3.6 Measurement 2. Line	Gross Energy



*This is an example setup for basic gross heat measurement. Other setup options are feasible.*

### 6.8.3 Net heat measurement

To determine the amount of energy, which is consumed by a plant, the gross heat quantity must be reduced by the amount of energy, which is returned to the energy cycle. In the following configuration example it is assumed that the gross heat quantity is determined for superheated steam by the internal sensors and the outlet temperature value is fed into the device via the current input.

Function	Parameters
C6.3 Extras	Activate one of the meter type options "Heat" (for saturated steam and temperature compensation) or "Heat & Dens. by Pres." (for superheated steam and density compensation by temperature and pressure) by entering the proper four digit code (if not activated by order). This needs to be done once.

#### Enter process parameters:

C1.1 Fluid	Steam
C1.2 Medium	Superheated Steam
C1.5 Current Input	
C1.5.1 Function	On
C1.5.2 Current Input Meas.	Temperature External
C1.6 Temp. Sensor	
C1.6.1 Temp. Source1	Internal
C1.6.2 Temp. Source2	External
C1.7 Pressure Sensor	
C.1.7.1 Pressure Source	Internal
C6.5 Units	Select units of temperature, pressure, volume flow, power and energy.
C1.10 Operating Values	
C1.10.3 Oper. Density	Operating density is important for sensor limits but will not be used during operation.

#### Configure output and totalizers:

C2.1 Current Output	
C2.1.1 Current Out. Meas.	Net Power
C2.1.2 0% Range C2.1.3 100% Range	Enter value for 0% and 100% in selected unit.
C4.2 Energy Totalizer	
C4.2.1 Measurement	Net Power
C4.2.5 Start Totalizer?	Yes

#### Display two values on local display: (net power, net energy)

C5.3.1 Function	Two Values
C5.3.2 Measurement 1. Line	Net Power
C5.3.6 Measurement 2. Line	Net Energy



*This is an example setup for basic net heat measurement. Other setup options are feasible.*





## 6.9 Status messages and diagnostic information

The diagnostic messages are displayed in accordance with NAMUR standard NE 107. The error messages for the device are divided into status groups, each with one status signal. There are 16 status groups with fixed status signals and 8 groups with variable status signals. To facilitate identification of the problem source, the status groups are then divided into: Sensor, Electronics, Configuration and Process.



*As a status message, always the event group name and the the status signal (F/S/M/C) are displayed.*

Each status message (= status signal) has a specific symbol, determined by NAMUR, which is displayed with the message. The length of each message is limited to one line.

Symbol	Letter	Status signal	Description and consequence
	F	Failure	No measurement possible.
	S	Out of specification	Measurements are available but are no longer sufficiently accurate and should be checked.
	M	Maintenance required	Measurements are still accurate but this could soon change.
	C	Function check	A test function is active. The displayed or transferred measured value does not correspond to the actual measured value.
	I	Information	No direct influence on the measurements.



*Some of the following elimination measures require a hard reset. In case a hard reset is performed please wait for approx. 10 seconds before powering the device again.*

Status type	Event group	Single event	Description	Actions to eliminate the event
F	Sensor			
		Fatal Sensor Error	An internal error in the sensor module has occurred.	Perform a hard reset. If the message recurs, contact the manufacturer.
		No Temperature Sensor	The internal temperature sensor (PT1000) is not connected or its resistance is too high. The process temperature cannot be measured.	Check the pick-up and its connection. Contact the manufacturer, if necessary.
		Sensor Comm. Error	Error in the internal bus communication or hardware failure.	For remote version: Check the sensor connection. All versions: Perform a hard reset. If the message recurs, contact the manufacturer.
		No/Invalid Pressure Sensor	Pressure sensor not available or invalid communication	Check the connection of the pressure sensor. Perform a hard reset. If the message recurs, contact the manufacturer.
		Corrupt Sensor Parameter	Sensor parameters are inconsistent	Check sensor parameters.
		Failed Sensor Input Test	The continuous self test of the sensor electronic failed.	Perform a hard reset. If the message recurs, contact the manufacturer.
		Failed Sensor MCU Test	The continuous self test of the sensor electronic failed.	Perform a hard reset. If the message recurs, contact the manufacturer.
		Temperature Sensor Error	The resistance of the internal temperature sensor (PT1000) is too low.	Check the pick-up and its connection. Perform a hard reset. Contact the manufacturer, if necessary.
		No Measurement Value	$Q_v$ or $Q_m$ have timed out or are inconsistent.	For remote version: Check the sensor connection. All versions: Perform a hard reset. If the message recurs, contact the manufacturer.
		Temporary Piezo Error	Piezo signals partly disturbed.	Check the process conditions, proper shielding/grounding and the installation situation. Perform a hard reset. If the message recurs, contact the manufacturer.
		Fatal Piezo Error	Piezo signals disturbed.	Check the process conditions, proper shielding/grounding and the installation situation. Perform a hard reset. If the message recurs, contact the manufacturer.
		Piezo Path disrupted	Sensor electronics error.	Perform a hard reset. If the message recurs, contact the manufacturer.
		Piezo Shortcut	Shortcut on piezo or sensor electronics detected.	Perform a hard reset. If the message recurs, contact the manufacturer.



Status type	Event group	Single event	Description	Actions to eliminate the event
F	Electronics			
		Fatal DM Error	Internal error.	Perform a hard reset. If the message recurs, contact the manufacturer.
		Fatal CO Error	Internal error.	
		Fatal Converter Error	An electronics or hardware failure has occurred.	
		Emergency Off active	The current output has triggered a safety reaction and is signaling a failure current below 3.6 mA or above 21 mA.	Follow the instructions of the "Safety Manual".
		Internal Comm. Error	Error in the internal bus communication.	Perform a hard reset. If the message recurs, contact the manufacturer.
		Inconsistent Parameters	Error in the internal bus communication.	Check the parameters and make sure that the set of data is consistent. Additional information on the error can be called via HART <sup>®</sup> interface.
		Sensor Comm. Error	Error in the internal bus communication or hardware failure.	Perform a hard reset. If the message recurs, contact the manufacturer.
		Power Supply Error	Internal voltage too low to switch on sensor power supply.	Check power supply connection or replace the electronics.
		Sensor/Conv. FW Mismatch	Incompatible firmware versions in the sensor and the converter module.	Perform a hard reset. If the message recurs, contact the manufacturer.
		Max. Number of Restarts	The device could not start the measuring mode after a cold starting.	Perform a hard reset once again. If the message recurs, contact the manufacturer.
		Converter Overvoltage	An electronics or hardware failure has occurred.	Perform a hard reset. If the message recurs, contact the manufacturer.
	Intern. Comm. Error	Error in the internal bus communication.	Perform a hard reset. If the message recurs, contact the manufacturer.	
F	Configuration			
		Voting Error	Same flow calculation on redundant processors have yielded different results.	Perform a hard reset. If the message recurs, contact the manufacturer.
		Inconsistent NVRAM	Inconsistent data in the parameter memory.	
		Error Starting SIL Mode	-	-
		CO Float Error	Error in processing of the measuring value due to inconsistent set of parameter.	Load the factory settings and perform a hard reset. If the message recurs, contact the manufacturer.
		Incons. Converter Calib.	Faulty calibration data in the converter module.	Contact the manufacturer.
	Incons. Sensor Calibration	Faulty calibration data in the sensor module.		

Status type	Event group	Single event	Description	Actions to eliminate the event
F		NVRAMs Mismatch	Incompatible serial numbers of display and electronic module.	Use displays and electronic modules, which belong together. Contact the manufacturer, if necessary.
		Conv. NVRAM Layout Error	Incompatible data in parameter memory.	Perform a hard reset. If the message recurs, contact the manufacturer.
		Disp. NVRAM Layout Error	Incompatible data after firmware update.	
		SIL Verification Required	SIL mode is requested. A verification (maintenance mode 2) has to be performed by the operator.	Verify the parameters for the SIL mode according to the instructions of the safety manual and confirm the correctness with the SIL jumper.
C	Electronics			
		Firmware Update Active	A firmware update of the converter module has been started.	Wait for firmware update to finish.
C	Configuration			
		Sensor Sim. Active	A simulation of the sensor is active.	Stop the simulation of the sensor variables.
		Current Out. Sim. Active	A simulation of the current output is active.	Stop the simulation of the current output variables
		Current In. Sim. Active	A simulation of the current input is active.	Stop the simulation of the current input variables
		HART Sim. Active	Simulation of a measuring value via HART® interface.	Stop the simulation via the HART® interface.
		Flow Comp. Sim. Active	A simulation of measurement value processing is active.	Stop the simulation of the measurement value processing.
		Binary Output Sim. Active	A simulation of the binary output is active.	Stop the simulation of the binary output variables.
		Totalizer Sim. Active	A simulation of the totalizer is active.	Stop the simulation of the totalizer variables.
		SIL Prooftest	Device is in maintenance mode 3 (proof test for SIL).	Perform the test according to the instruction in the "Safety Manual".
		Parameterization Test	Device is in maintenance mode 3 (parameterization test).	

Status type	Event group	Single event	Description	Actions to eliminate the event
S	Sensor			
		Flow Meas. Out of Spec.	The vortex frequency or the volume flow is out of range. The real flow is higher or lower than the indicated value.	Check the process conditions.
		Low Flow Cutoff Undercut	Volume flow is lower than low flow cutoff (LFC)	Check the low flow cut-off or the process conditions.
		Weak Flow Meas. Signal	The vortex signal is too weak or disturbed.	Check the process conditions and the installation situation. Eliminate external disturbances. If the message recurs, contact the manufacturer.
		Pres.Sen.Temp. Out of Spec.	Temperature of the internal pressure sensor out of specification.	Make sure that the device is operated within the permissible temperature range.
	Elec. Temp. Out Of Spec.	The electronic temperature of the sensor module is out of specification.		
S	Electronics			
		Elec. Temp. Out Of Spec.	The electronic temperature of the converter is out of specification.	Make sure that the device is operated within the permissible temperature range.
S	Process			
		CO Undersaturation	The measurement value is lower than the lower range value of the current output. The current output is saturated and does not reflect the effective measuring value.	Check the process conditions and the lower current output limit.
		CO Oversaturation	The measurement value is higher than the upper range value of the current output. The current output is saturated and does not reflect the effective measuring value.	Check the process conditions and the upper current output limit.
S	Config: Totalizer			
		Flow Totalizer Overflow	The actual value of the flow counter exceeds its preset value.	Check the setting of the flow counter or reset the counter.
		Energy Totalizer Overflow	The actual value of the energy counter exceeds its preset value.	The actual value of the energy counter exceeds its preset value.
M	Sensor Information			
		Faulty Sensor Oscillator	The sensor oscillator is working out of range.	Perform a hard reset. If the message recurs, contact the manufacturer.
	Faulty sensor voltage ref.	Reference voltage in sensor module out of specification.		

Status type	Event group	Single event	Description	Actions to eliminate the event
M	Electronics Information			
		Faulty Converter Oscillator	The converter oscillator is working out of range.	Perform a hard reset. If the message recurs, contact the manufacturer.
		Faulty conv. voltage ref.	Reference voltage in converter module out of specification.	
C	Process			
		Heater / Cooler Error	During net heat metering the difference in temperature is reversed.	Check net heat metering setup. Check temperature input configuration.

## 6.10 A12 plausibility checks

When configuring the device, a number of complex "cluster" checks are run internally on the proposed configuration in order to make sure it is valid. Thus when saving a configuration the device might raise an error like this: "Failed E01", which indicates an error cluster number. In this case please consult the indicated cluster number in the following table to find out which parameters are affected.

You may also want to enter in the quick setup menu "A12 Cluster Checks" and check each setting in the affected "cluster" submenu.

No.	Name	Explanation of plausibility checks
01	Sensor Configuration / Fluid	After changing fluid, operating density or operating temperature the device checks whether the measurement variables configured at the device's outputs are still valid (HART <sup>®</sup> variables, frequency output, pulse output, status output, limit switch, local display and flow totalizer). Also their configured ranges are checked.
02	Medium	When selecting the medium the device checks whether the measurement variables configured at the device's outputs are still valid (HART <sup>®</sup> variables, frequency output, pulse output, status output, limit switch, local display and flow totalizer).  Additionally the configuration of temperature sources and pressure sources is checked.
03	Meter Type	When changing the meter type the device will check whether the measurement variables configured at the device's outputs are still valid (HART <sup>®</sup> variables, frequency output, pulse output, status output, limit switch, local display and flow totalizer).  It also checks if the currently selected medium is supported by the new meter type as well as the configuration of temperature sources and pressure sources.
04	Temperature / Pressure	Checks configuration of temperature sources and pressure sources.
05	Current output / primary HART variable	Checks if selected measurement variable is valid. Also checks limit settings for 0% and 100%.
06	Frequency output / Secondary HART variable	Checks if the frequency output/secondary HART <sup>®</sup> variable is valid. Also checks if the selected measurement variable is available in this context and if its range is valid.
07	Current input / Tertiary HART variable	If the current input is selected to provide temperature or pressure measurement data, the device checks the configuration of temperature sources and pressure sources.  It also checks if the current input range (4 mA / 20 mA) is valid.
08	Quaternary HART Variable	Checks if the measurement variable configured as quaternary HART <sup>®</sup> variable is valid.
09	Flow Totalizer	Checks if the measurement variable selected for the flow totalizer (volume flow, standard volume flow, mass flow) is valid. Also checks configuration of the HART <sup>®</sup> variables, limit switch and local display.
10	Measurement Display Pages	Checks if the measurement variables selected on both measurement display pages are valid.  If a bar graph is displayed its ranges are also checked.
11	Gas Mix Total	If a gas mixture is selected as medium, the device checks if all individual gas components add up to 100%.
12	HART Catch Variable (Temperature / Pressure)	If temperature or pressure data input is provided by HART <sup>®</sup> , the device checks if the "Slot Number" fits in with the "Capture Command".

## 7.1 Replacing signal converter / LC display

The signal converter has to be replaced by a converter of the same type. The item number ⑦ must match: 40021445xx

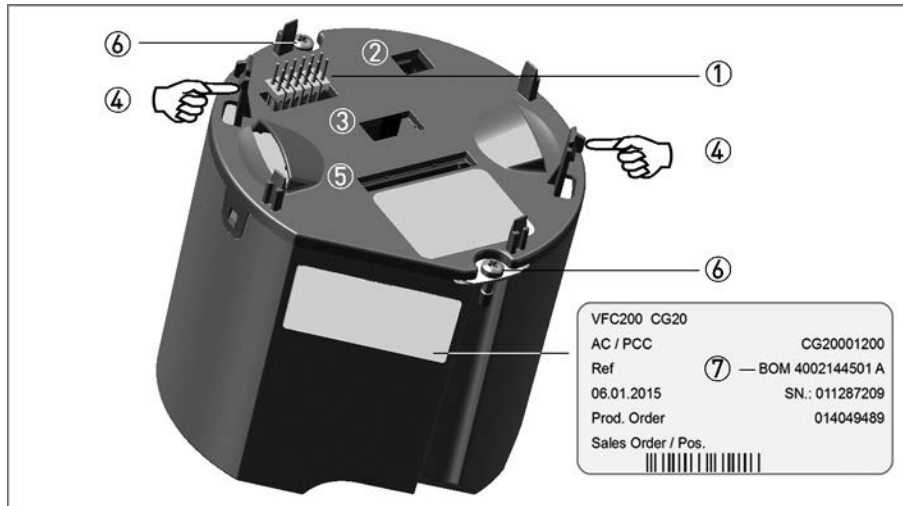


Figure 7-1: Connect transmitter module

- ① Connector for LC display
- ② Service connector
- ③ SIL connector
- ④ Display brackets
- ⑤ Connection to the flow sensor
- ⑥ Fixing screw
- ⑦ Item number



### The following steps are to be performed:

- Switch off the power supply.
- Unscrew the front cover with the key.
- Use the handle to pull out the display by plugging into the brackets ④ and gently pulling it out.
- Detach the flow sensor connection ⑤.
- Loosen the two fixing screws ⑥.
- Pull out signal converter.
- Insert new signal converter.
- Tighten the two screws ⑥.
- Attach the flow sensor cable ⑤.
- Attach display ① in desired position, apply even pressure to the entire surface.
- Screw on cover by hand.

## 7.2 Maintaining the O-rings



Figure 7-2: Maintaining the O-rings

- ① Display cover
- ② Rear cover

Whenever either the display cover ① or the rear cover ② of the housing is opened and closed again, make sure that the O-rings are well greased or being replaced if need be (O-ring 94x2,5-NBR-70K, ISO 3601-1).



**CAUTION!**

Use proper multi-purpose grease covering the full operational temperature range to treat the O-rings with the following properties:

- Operational temperature range [-30...+130°C / -22...+266°F at permanent lubrication]
- Free from silicone
- Good adhesive capability
- Lithium saponified
- Water resistant
- Compatible with material of O-ring

## 7.3 Spare parts availability

The manufacturer adheres to the basic principle that functionally adequate spare parts for each device or each important accessory part will be kept available for a period of 3 years after delivery of the last production run for the device.

This regulation only applies to spare parts which are subject to wear and tear under normal operating conditions.

## 7.4 Availability of services

The manufacturer offers a range of services to support the customer after expiration of the warranty. These include repair, maintenance, technical support and training.



*For more precise information, please contact your local sales office.*

## 7.5 Returning the device to the manufacturer

### 7.5.1 General information

This device has been carefully manufactured and tested. If installed and operated in accordance with these operating instructions, it will rarely present any problems.



**WARNING!**

*Should you nevertheless need to return a device for inspection or repair, please pay strict attention to the following points:*

- *Due to statutory regulations on environmental protection and safeguarding the health and safety of the personnel, the manufacturer may only handle, test and repair returned devices that have been in contact with products without risk to personnel and environment.*
- *This means that the manufacturer can only service this device if it is accompanied by the following certificate (see next section) confirming that the device is safe to handle.*



**WARNING!**

*If the device has been operated with toxic, caustic, radioactive, flammable or water-endangering products, you are kindly requested:*

- *to check and ensure, if necessary by rinsing or neutralising, that all cavities are free from such dangerous substances,*
- *to enclose a certificate with the device confirming that it is safe to handle and stating the product used.*



## 7.5.2 Form (for copying) to accompany a returned device



### **CAUTION!**

*To avoid any risk for our service personnel, this form has to be accessible from outside of the packaging with the returned device.*

Company:		Address:	
Department:		Name:	
Tel. no.:			
Manufacturer's order no. or serial no.:			
The device has been operated with the following medium:			
This medium is:	<input type="checkbox"/>	radioactive	
	<input type="checkbox"/>	water-hazardous	
	<input type="checkbox"/>	toxic	
	<input type="checkbox"/>	caustic	
	<input type="checkbox"/>	flammable	
	<input type="checkbox"/>	We checked that all cavities in the device are free from such substances.	
<input type="checkbox"/>	We have flushed out and neutralized all cavities in the device.		
We hereby confirm that there is no risk to persons or the environment through any residual media contained in the device when it is returned.			
Date:		Signature:	
Stamp:			

## 7.6 Disposal



### **LEGAL NOTICE!**

*Disposal must be carried out in accordance with legislation applicable in your country.*

### **Separate collection of WEEE (Waste Electrical and Electronic Equipment) in the European Union:**



According to the directive 2012/19/EU, the monitoring and control instruments marked with the WEEE symbol and reaching their end-of-life **must not be disposed of with other waste**.

The user must dispose of the WEEE to a designated collection point for the recycling of WEEE or send them back to our local organisation or authorised representative.

## 8.1 Functional principle

Vortex flowmeters are used to measure the flow of gases, vapours and liquids at completely filled pipes.

The measuring principle is based on the Karman vortex street. The measuring tube contains a bluff body at which vortex shedding occurs and which is detected by a sensor unit located behind. The frequency  $f$  of the vortex shedding is proportional to the flow velocity  $v$ . The non-dimensional Stouhal number  $S$  describes the relationship between vortex frequency  $f$ , width  $b$  of the bluff body and the average flow velocity  $v$ :

$$f = \frac{S \cdot v}{b}$$

The vortex frequency is recorded at the flow sensor and evaluated at the signal converter.

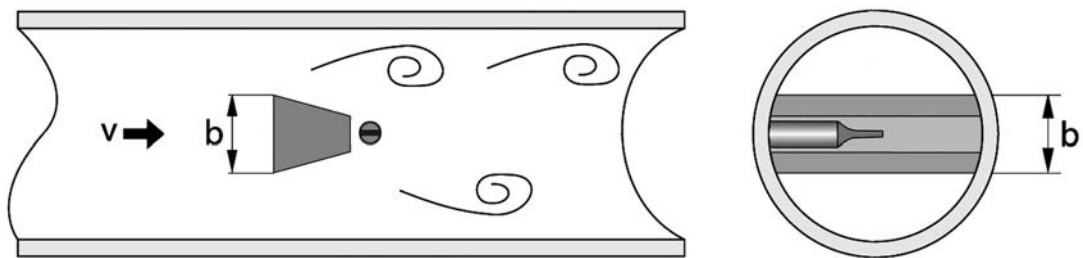


Figure 8-1: Functional principle

## 8.2 Technical data



- The following data is provided for general applications. If you require data that is more relevant to your specific application, please contact us or your local sales office.
- Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website.

### Measuring system

Application range	Flow measurement of liquids, gases and vapours
Function / Measuring principle	Karman vortex street

### Measurement

Primary measured value	Number of separated vortices
Secondary measured value	Operating and standard volume flow and mass flow

### Signal converter

Versions	Compact version
	Remote version Cable length: ≤ 50 m / 164 ft

### Flow sensor

Standard	Flange version (with integrated temperature measurement), flow sensor: F
	Sandwich version (with integrated temperature measurement), flow sensor: S
Option	Basic device with additional pressure measurement
	Basic device with additional pressure measurement and shut-off valve for pressure sensor
	Dual measuring device in both flange and sandwich version (redundant measurement)
	Dual measuring device with additional pressure measurement
	Flange version with single reduction of nominal diameter, flow sensor: F1R
	Flange version with double reduction of nominal diameter, flow sensor: F2R

### Display and user interface

Local display	Graphic display
Interface and display languages	German, English, French, Italian, Spanish, Russian, Chinese, Swedish, Danish, Czech, Polish, Turkish; 14 further languages (in preparation)

## Measuring accuracy

### Reference condition

Reference conditions	Water at +20°C / +68°F
	Air at +20°C / +68°F and 1.013 bara / 14.7 psia

### Maximum measuring error

Volume flow (liquid)	±0.75% of measured value ( $Re \geq 20000$ )
	±2.0% of measured value ( $10000 < Re < 20000$ )
Volume flow (gases and steam)	±1.0% of measured value ( $Re \geq 20000$ )
	±2.0% of measured value ( $10000 < Re < 20000$ )
Mass flow (gases and steam)	±1.5% of measured value ( $Re \geq 20000$ ) ①
	±2.5% of measured value ( $10000 < Re < 20000$ ) ①
Mass flow (liquid / water)	±1.5% of measured value ( $Re \geq 20000$ )
	±2.5% of measured value ( $10000 < Re < 20000$ )
Normalised volume flow (gas)	±1.5% of measured value ( $Re \geq 20000$ ) ①
	±2.5% of measured value ( $10000 < Re < 20000$ ) ①
Repeatability (volume flow)	±0.1% of measured value

① The maximum error of measurement refers to measurement at an operating pressure >65% of the full scale value of the applied pressure sensor.

Note: In SIL mode, deviating measuring errors have to be taken into account. For details refer to the "Safety Manual".

## Operating conditions

### Temperature

Medium temperature	-40...+240°C / -40...+465°F
Ambient temperature ②	Non-Ex: -40...+85°C / -40...+185°F
	Ex: -40...+65°C / -40...+140°F
Storage temperature	-40...+85°C / -40...+185°F

② Decreasing display contrast outside of the temperature range of 0...+60°C / +32...+140°F.

### Pressure

Medium pressure	Max. 100 bar / 1450 psi (higher pressures on request)
Ambient pressure	Atmosphere

### Media properties

Density	Taken into consideration when sizing.
Viscosity	< 10 cP
Reynold's number	> 10000

### Recommended flow velocities

Liquids ③, ④	0.3...7 m/s / 0.98...23 ft/s (optional up to 10 m/s / 32.8 ft/s taking cavitation into account)
Gases and steam ③	2.0...80 m/s / 6.6...262.5 ft/s
	DN15: 3.0...45 m/s / 9.8...148 ft/s; DN25: 2.0...70 m/s / 6.6...230 ft/s
③ These values represent the absolute limits of flow velocities. For more detailed information for your specific application refer to <i>Intended use</i> on page 7.	
④ $v_{min} = 0.7$ m/s / 2.3 ft/s in SIL mode	

### Other conditions

Ingress protection	Compact version: IP66/67
	Remote version: signal converter housing: IP66/67; flow sensor housing: IP66/67

### Installation conditions

Inlet section	≥ 15 x DN without disturbing flow, after pipe narrowing, after a single 90° bend
	≥ 30 x DN after a double bend 2x90°
	≥ 40 x DN after a double three-dimensional bend 2x90°
	≥ 50 x DN after control valves
	≥ 2 DN before flow straightener; ≥ 8 DN after flow straightener
Outlet section	≥ 5 x DN

### Materials

Flow sensor and process connections	Standard: 1.4404 / 316L
	Option: Hastelloy® C-22 on request
Electronics housing	Aluminium die-cast, two-layer coating (epoxy/polyester)
	Option: die-cast aluminium with finish for advanced requirements
Pressure sensor gasket	Standard: FPM
	Option: FFKM
Measuring tube gasket (Pick-up)	Standard: 1.4435 / 316L
	Option: Hastelloy® C-276
	Selection depends on flow sensor material / medium.

### Process connections of flange version

DIN EN 1092-1	DN15...300 - PN16...100 (higher pressures on request)
ASME B16.5	1/2...12" - 150...600 lb (higher pressures on request)
JIS B 2220	DN15...300 - JIS 10...20 K (higher pressures on request)
For detailed information on combination flange/pressure rating, refer to section "Dimensions and weights".	

### Process connections of sandwich version

DIN	DN15...100 - PN100 (higher pressures on request)
ASME	1/2...4" - 600 lb (higher pressures on request)
JIS	DN15...100 - 10...20 K (higher pressures on request)

### Electrical connections

Power supply	Non-Ex: 12...36 VDC
	Ex i: 12...30 VDC
	Ex d: 12...32 VDC

### Inputs and outputs

General	All inputs and outputs are electrically isolated from one another.
Time constant	The time constant corresponds to 63% of the elapsed time of a processor procedure. 0...100 seconds (rounded up to 0.1 seconds)

### Current output

Type	4...20 mA HART® (passive)
Output data	Volume flow, mass flow, norm. volume flow, gross/net power, free air delivery, density, temperature (internal sensor), pressure, vortex frequency, flow velocity
Resolution	5 µA
Linearity / accuracy	0.1% (of read value)
Temperature coefficient	50 ppm/K (typically), 100 ppm/K (max.)
Error signal	According to NE 43
Description of abbreviations	$U_{ext}$ = external voltage; $R_L$ = load + resistance
Load	Minimum 0 Ω; maximum $R_L = ((U_{ext} - 12 \text{ VDC}) / 22 \text{ mA})$

### HART®

	HART® protocol via passive current output
HART® revision	HART® 7 Burst mode Catch device
System requirements	Load min. 250 Ω
Multidrop operation	4 mA

### Binary output

Function	Pulse, frequency, status, limit switch
Type	Passive Proximity sensor according to DIN EN 60947-5-6 (NAMUR sensor) or pulse output signal according to VDI/VDE 2188 (category 2)
Temperature coefficient	50 ppm/K
Residual current	< 0.2 mA at 32 V ( $R_i = 180 \text{ k}\Omega$ )
Pulse width	0.5...2000 ms

**Pulse output**

Output data	Volume, mass, norm. volume, gross/net energy
Pulse rate	Max. 1000 pulses/s
Power supply	Non-Ex: 24 VDC as NAMUR or open < 1 mA, maximum 36 V, closed 120 mA, U < 2 V
	Ex: 24 VDC as NAMUR or open < 1 mA, maximum 30 V, closed 120 mA, U < 2 V

**Frequency output**

Output data	Volume flow, mass flow, norm. volume flow, gross/net power, free air delivery, density, temperature (internal sensor or via external input), pressure, vortex frequency, flow velocity, spec. enthalpy, spec. heat capacity, Reynolds number
Max. frequency	1000 Hz

**Status output**

Output data	Status according to NE 107 (F, S, C), flow totalizer overflow, energy totalizer overflow, fluid type (in steam applications)
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**Limit switch**

Output data	Volume flow, mass flow, norm. volume flow, volume, mass, norm. volume, gross/net power, gross/net energy, free air delivery, density, temperature (internal sensor or via external input), pressure, vortex frequency, flow velocity, spec. enthalpy, spec. heat capacity, Reynolds number
-------------	--

**Current input**

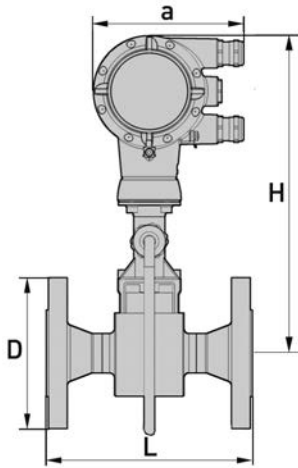
Type	4...20 mA (passive)
Resolution	6 µA
Linearity / accuracy	0.1% (of read value)
Temperature coefficient	100 ppm/K (typically), 200 ppm/K (max.)
Voltage drop	10 V

**Approvals and certificates**

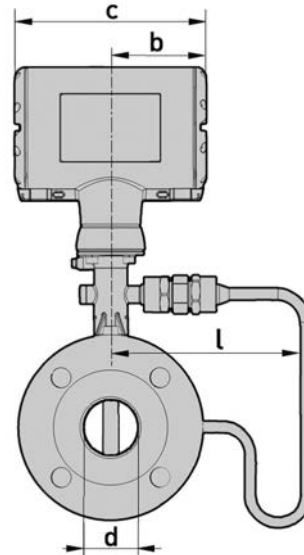
ATEX	ATEX II2 G - Ex ia IIC T6...T2 Gb (in preparation) ATEX II2 G - Ex d ia IIC T6...T2 Gb (in preparation) ATEX II3 G - Ex nA IIC T6...T2 Gc (in preparation) ATEX II2 D - Ex tb IIIC T70°C Db (in preparation)
IECEX	IECEX - Ex ia IIC T6...T2 Gb IECEX - Ex d ia IIC T6...T2 Gb (in preparation) IECEX - Ex nA IIC T6...T2 Gc (in preparation) IECEX - Ex tb IIIC T70°C Db (in preparation)
QPS (USA & Canada)	QPS Ordinary Locations (in preparation) QPS IS Class I Div 1 (in preparation) QPS XP Class I Div 1 (in preparation) QPS NI Class I Div 2 (in preparation) QPS DIP Class II, III Div 1 (in preparation)
Further approvals on request.	

### 8.3 Dimensions and weights

#### 8.3.1 Flange versions



a = 148.5 mm / 5.85"



b = 85.8 mm / 3.38"  
c = 171.5 mm / 6.76"

#### Dimensions of flange version EN 1092-1 [mm]

Nominal size DN	Pressure rating PN	d	D	L	H	H F1R ①	H F2R ②	l	l F1R ①	l F2R ②
15	40	17.3	95	200	358.8	-	-	169.3	-	-
15	100	17.3	105	200	358.8	-	-	169.3	-	-
25	40	28.5	115	200	358.3	358.8	-	169.3	169.3	-
25	100	28.5	140	200	358.3	358.8	-	169.3	169.3	-
40	40	43.0	150	200	362.3	358.3	358.8	169.5	169.3	169.3
40	100	42.5	170	200	362.3	358.3	358.8	169.5	169.3	169.3
50	16	54.5	165	200	368.3	362.3	358.3	169.5	169.5	169.3
50	40	54.5	165	200	368.3	362.3	358.3	169.5	169.5	169.3
50	63	54.5	180	200	368.3	362.3	358.3	169.5	169.5	169.3
50	100	53.9	195	200	368.3	362.3	358.3	169.5	169.5	169.5
80	16	82.5	200	200	380.3	368.3	362.3	169.3	169.5	169.5
80	40	82.5	200	200	380.3	368.3	362.3	169.3	169.5	169.5
80	63	81.7	215	200	380.3	368.3	362.3	169.3	169.5	169.5
80	100	80.9	230	200	380.3	368.3	362.3	169.3	169.5	169.5
100	16	107	220	250	396.8	380.3	368.3	171.5	169.3	169.5
100	40	107	235	250	396.8	380.3	368.3	171.5	169.3	169.5
100	63	106.3	250	250	396.8	380.3	368.3	171.5	169.3	169.5
100	100	104.3	265	250	396.8	380.3	368.3	171.5	169.3	169.5



Nominal size DN	Pressure rating PN	d	D	L	H	H F1R ①	H F2R ②	l	l F1R ①	l F2R ②
150	16	159.3	285	300	416.3	396.8	380.3	191.5	171.5	169.3
150	40	159.3	300	300	416.3	396.8	380.3	191.5	171.5	169.3
150	63	157.1	345	300	416.3	396.8	380.3	191.5	171.5	169.3
150	100	154.1	355	300	416.3	396.8	380.3	191.5	171.5	169.3
200	10	206.5	340	300	442.1	416.3	396.8	202.8	191.5	171.5
200	16	206.5	340	300	442.1	416.3	396.8	202.8	191.5	171.5
200	25	206.5	360	300	442.1	416.3	396.8	202.8	191.5	171.5
200	40	206.5	375	300	442.1	416.3	396.8	202.8	191.5	171.5
250	10	260.4	395	380	468.8	442.1	416.3	229.5	202.8	191.5
250	16	260.4	405	380	468.8	442.1	416.3	229.5	202.8	191.5
250	25	258.8	425	380	468.8	442.1	416.3	229.5	202.8	191.5
250	40	258.8	450	380	468.8	442.1	416.3	229.5	202.8	191.5
300	10	309.7	445	450	492.8	468.8	442.1	255	229.5	202.8
300	16	309.7	460	450	492.8	468.8	442.1	255	229.5	202.8
300	25	307.9	485	450	492.8	492.8	442.1	255	229.5	202.8
300	40	307.9	515	450	492.8	492.8	442.1	255	229.5	202.8

- ① F1R - single reduction  
 ② F2R - double reduction

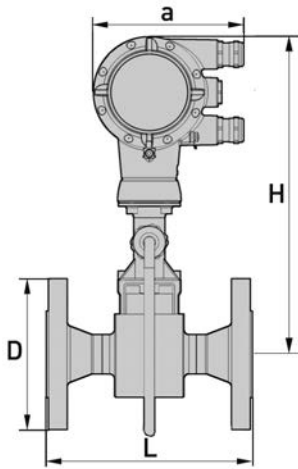
## Weight of flange version EN 1092-1 [kg]

Nominal size DN	Pressure rating PN	with	without	F1R ① with	F1R ① without	F2R ② with	F2R ② without
		Pressure sensor		Pressure sensor		Pressure sensor	
15	40	6.1	5.5	-	-	-	-
15	100	7.1	6.5	-	-	-	-
25	40	7.9	7.3	7.2	6.6	-	-
25	100	9.9	9.3	9.7	9.1	-	-
40	40	10.8	10.2	9.7	9.1	8.9	8.3
40	100	14.8	14.2	13.3	12.7	12.5	11.9
50	16	12.7	12.1	11.4	10.8	10.6	10.0
50	40	12.9	12.3	11.9	11.3	11.2	10.6
50	63	16.9	16.3	15.0	14.4	14.3	13.7
50	100	18.4	17.8	17.2	16.6	16.6	16.0
80	16	17.4	16.8	15.6	15.0	14.2	13.6
80	40	19.4	18.8	17.1	16.5	15.8	15.2
80	63	23.4	22.8	20.3	19.7	19.0	18.4
80	100	27.4	26.8	24.0	23.4	22.8	22.2
100	16	22.0	21.4	21.5	20.9	18.7	18.1
100	40	25.0	24.4	24.9	24.3	22.1	21.5
100	63	30.0	29.4	30.1	29.5	27.4	26.8
100	100	36.0	35.4	36.7	36.1	34.0	33.4
150	16	35.8	35.2	33.9	33.3	32.3	31.7
150	40	41.8	41.2	41.4	40.8	40.2	39.6
150	63	59.8	59.2	58.3	57.7	59.0	58.4
150	100	67.8	67.2	69.2	68.6	70.8	70.2
200	10	38.4	37.8	40.7	40.1	43.1	42.5
200	16	38.4	37.8	40.3	39.7	44.3	43.7
200	25	47.4	46.8	49.5	48.9	50.8	50.2
200	40	55.4	54.8	58.0	57.4	58.5	57.9
250	10	58.0	57.4	63.1	62.5	59.8	59.2
250	16	59.0	58.4	64.7	64.1	61.5	60.9
250	25	75.0	74.4	78.5	77.9	76.8	76.2
250	40	93.0	92.4	96.3	95.7	96.1	95.5
300	10	76.3	75.7	81.1	80.5	85.8	85.2
300	16	82.8	82.2	87.6	87.0	92.9	92.3
300	25	99.3	98.7	105.1	104.5	113.0	112.4
300	40	128.1	127.5	132.0	131.4	143.2	142.6

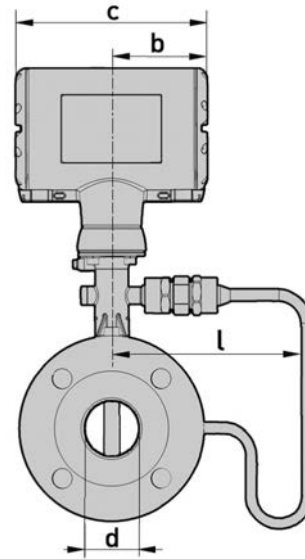
Weight specifications for version with two signal converters + 3.2 kg / 7.05 lb

- ① F1R - single reduction  
 ② F2R - double reduction

## Dimensions of flange version ASME B16.5



a = 148.5 mm / 5.85"



b = 85.8 mm / 3.38"  
c = 171.5 mm / 6.76"

## Dimensions of flange version ASME B16.5 [mm]

Nominal size DN	Pressure rating Class	d	D	L	H	H F1R ①	H F2R ②	l	l F1R ①	l F2R ②
1/2	150	16	90	200	358.8	-	-	169.3	-	-
1/2	300	16	95	200	358.8	-	-	169.3	-	-
1/2	600	16	95	200	358.8	-	-	169.3	-	-
1	150	26.6	110	200	358.3	358.8	-	169.3	169.3	-
1	300	26.6	125	200	358.3	358.8	-	169.3	169.3	-
1	600	24	125	200	358.3	358.8	-	169.3	169.3	-
1 1/2	150	41	125	200	362.3	358.3	358.8	169.5	169.3	169.3
1 1/2	300	41	155	200	362.3	358.3	358.8	169.5	169.3	169.3
1 1/2	600	41	155	200	362.3	358.3	358.8	169.5	169.3	169.3
2	150	52.5	150	200	368.3	362.3	358.3	169.5	169.5	169.3
2	300	52.5	165	200	368.3	362.3	358.3	169.5	169.5	169.3
2	600	49.2	165	200	368.3	362.3	358.3	169.5	169.5	169.3
3	150	77.9	190	200	380.3	368.3	362.3	169.3	169.5	169.5
3	300	77.9	210	200	380.3	368.3	362.3	169.3	169.5	169.5
3	600	74.0	210	200	380.3	368.3	362.3	169.3	169.5	169.5
4	150	102.3	230	250	396.8	380.3	368.3	171.5	169.3	169.5
4	300	102.3	255	250	396.8	380.3	368.3	171.5	169.3	169.5
4	600	97.0	275	250	396.8	380.3	368.3	171.5	169.3	169.5
6	150	154.1	280	300	416.3	396.8	380.3	191.5	171.5	169.3
6	300	154.1	320	300	416.3	396.8	380.3	191.5	171.5	169.3
6	600	146.0	355	300	416.3	396.8	380.3	191.5	171.5	169.3

Nominal size DN	Pressure rating Class	d	D	L	H	H F1R ①	H F2R ②	l	l F1R ①	l F2R ②
8	150	202.7	345	300	442.1	416.3	396.8	202.8	191.5	171.5
8	300	202.7	380	300	442.1	416.3	396.8	202.8	191.5	171.5
10	150	254.6	405	380	468.8	442.1	416.3	229.5	202.8	191.5
10	300	254.6	455	380	468.8	442.1	416.3	229.5	202.8	191.5
12	150	300.0	485	450	492.8	468.8	442.1	255.0	229.5	202.8
12	300	300.0	520	450	492.8	468.8	442.1	255.0	229.5	202.8

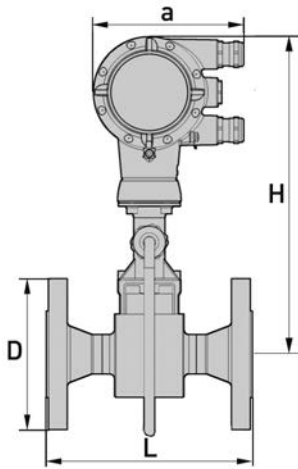
① F1R - single reduction

② F2R - double reduction

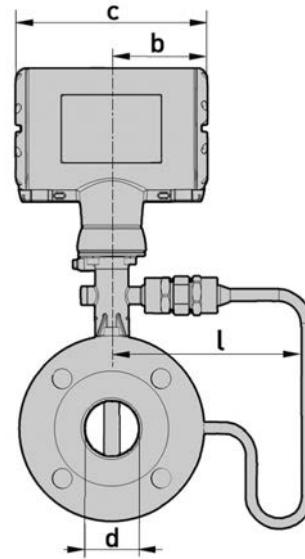
#### Weight of flange version ASME B16.5 [kg]

Nominal size DN	Pressure rating Class	with	without	F1R with	F1R without	F2R with	F2R without
		Pressure sensor		Pressure sensor		Pressure sensor	
1/2	150	5.1	4.5	-	-	-	-
1/2	300	5.5	4.9	-	-	-	-
1/2	600	5.7	5.1	-	-	-	-
1	150	6.8	6.2	6.6	6.0	-	-
1	300	7.8	7.2	7.6	7.0	-	-
1	600	8.1	7.5	7.9	7.3	-	-
1 1/2	150	8.9	8.3	8.6	8.0	7.7	7.1
1 1/2	300	11.0	10.4	10.9	10.3	10.0	9.4
1 1/2	600	12.0	11.4	11.8	11.2	11.0	10.4
2	150	11.6	11.0	11.0	10.4	10.3	9.7
2	300	13.0	12.4	12.6	12.0	11.9	11.3
2	600	14.5	13.9	14.0	13.4	13.4	12.8
3	150	20.4	19.8	16.9	16.3	15.6	15.0
3	300	23.4	22.8	20.4	19.8	19.2	18.6
3	600	24.4	23.8	22.9	22.3	21.8	21.2
4	150	24.0	23.4	25.3	24.7	22.7	22.1
4	300	32.0	31.4	33.9	33.3	31.2	30.6
4	600	41.0	40.4	44.1	43.5	41.2	40.6
6	150	36.8	36.2	37.8	37.2	36.9	36.3
6	300	51.8	51.2	56.1	55.5	55.8	55.2
6	600	76.8	76.2	79.8	79.2	82.6	82.0
8	150	50.6	50.0	48.8	48.2	52.5	51.9
8	300	75.4	74.8	72.2	71.6	78.1	77.5
10	150	75.0	74.4	75.2	74.6	73.9	73.3
10	300	107.0	106.4	112.4	111.8	113.5	112.9
12	150	107.0	106.4	109.8	109.2	120.4	119.8
12	300	152.0	151.4	165.4	155.8	171.7	171.1

## Dimensions of flange version ASME B16.5 [inch]



a = 148.5 mm / 5.85"



b = 85.8 mm / 3.38"  
c = 171.5 mm / 6.76"

## Dimensions of flange version ASME B16.5 [inch]

Nominal size DN	Pressure rating Class	d	D	L	H	H F1R ①	H F2R ②	l	l F1R ①	l F2R ②
1/2	150	0.63	3.5	7.9	14.1	-	-	6.67	-	-
1/2	300	0.63	3.7	7.9	14.1	-	-	6.67	-	-
1/2	600	0.63	3.7	7.9	14.1	-	-	6.67	-	-
1	150	1.05	4.3	7.9	14.1	14.1	-	6.67	6.67	-
1	300	1.05	4.9	7.9	14.1	14.1	-	6.67	6.67	-
1	600	1.0	4.9	7.9	14.1	14.1	-	6.67	6.67	-
1 1/2	150	1.6	4.9	7.9	14.3	14.1	14.1	6.67	6.67	6.67
1 1/2	300	1.6	6.1	7.9	14.3	14.1	14.1	6.67	6.67	6.67
1 1/2	600	1.6	6.1	7.9	14.3	14.1	14.1	6.67	6.67	6.67
2	150	2.07	5.9	7.9	14.5	14.3	14.1	6.67	6.67	6.67
2	300	2.07	6.5	7.9	14.5	14.3	14.1	6.67	6.67	6.67
2	600	1.9	6.5	7.9	14.5	14.3	14.1	6.67	6.67	6.67
3	150	3.07	7.5	7.9	15.0	14.5	14.3	6.67	6.67	6.67
3	300	3.07	8.3	7.9	15.0	14.5	14.3	6.67	6.67	6.67
3	600	2.9	8.3	7.9	15.0	14.5	14.3	6.67	6.67	6.67
4	150	4.0	9.1	9.8	15.6	15.0	14.5	6.76	6.67	6.67
4	300	4.0	10	9.8	15.6	15.0	14.5	6.76	6.67	6.67
4	600	3.8	11	9.8	15.6	15.0	14.5	6.76	6.67	6.67
6	150	6.1	11	12	16.4	15.6	15.0	7.54	6.76	6.67
6	300	6.1	13	12	16.4	15.6	15.0	7.54	6.76	6.67
6	600	5.8	14	12	16.4	15.6	15.0	7.54	6.76	6.67

Nominal size DN	Pressure rating Class	d	D	L	H	H F1R ①	H F2R ②	l	l F1R ①	l F2R ②
8	150	8.0	14	12	17.4	16.4	15.6	8.0	7.54	6.76
8	300	8.0	15	12	17.4	16.4	15.6	8.0	7.54	6.76
10	150	10	16	15	18.5	17.4	16.4	9.04	8.0	7.54
10	300	10	18	15	18.5	17.4	16.4	9.04	8.0	7.54
12	150	12	19	18	19.4	18.5	17.4	10.0	9.04	8.0
12	300	12	21	18	19.4	18.5	17.4	10.0	9.04	8.0

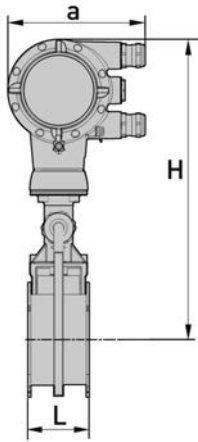
① F1R - single reduction

② F2R - double reduction

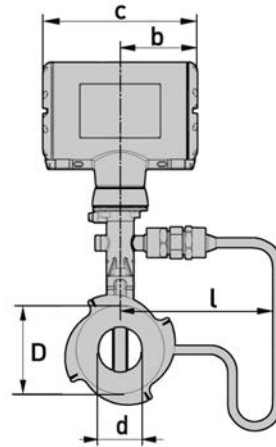
## Weight of flange version ASME B16.5 [lb]

Nominal size DN	Pressure rating Class	with	without	F1R with	F1R without	F2R with	F2R without
		Pressure sensor		Pressure sensor		Pressure sensor	
1/2	150	11	9.9	-	-	-	-
1/2	300	12	11	-	-	-	-
1/2	600	13	11	-	-	-	-
1	150	15	14	14.6	13.2	-	-
1	300	17	16	16.8	15.4	-	-
1	600	18	17	17.4	16.1	-	-
1 1/2	150	20	18	19.0	17.6	17.0	15.7
1 1/2	300	24.3	22.9	24.0	22.7	22.1	20.7
1 1/2	600	26.5	25.1	26.0	24.7	24.1	22.9
2	150	25.6	24.3	24.3	22.9	22.7	21.4
2	300	28.7	27.3	27.8	26.5	26.2	24.9
2	600	32.0	30.7	30.9	29.6	29.6	28.2
3	150	45.0	43.7	37.3	36.0	34.4	33.1
3	300	51.6	50.3	45.0	43.7	42.3	41.0
3	600	53.8	52.5	50.5	49.2	48.1	46.8
4	150	52.9	51.6	55.8	54.5	50.1	48.7
4	300	70.6	69.3	74.8	73.4	68.8	67.5
4	600	90.4	89.1	97.3	95.9	91.0	89.5
6	150	81.2	79.8	83.4	82.0	81.4	80.0
6	300	114.2	112.9	123.7	122.4	123.1	121.7
6	600	169.4	168.1	176	174.7	182.2	181.0
8	150	111.6	110.3	107.6	106.3	115.8	114.5
8	300	166.3	165.0	159.2	157.9	172.2	171.0
10	150	165.4	164.1	165.9	164.5	163.0	161.7
10	300	236.0	234.7	247.9	246.6	250.3	249.0
12	150	236.0	234.7	242.2	240.8	265.5	264.2
12	300	335.2	333.9	364.8	343.6	378.7	377.4

## 8.3.2 Sandwich version



$$a = 133 \text{ mm} / 5.24''$$

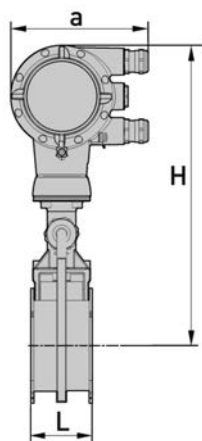


$$b = 105 \text{ mm} / 4.13''$$

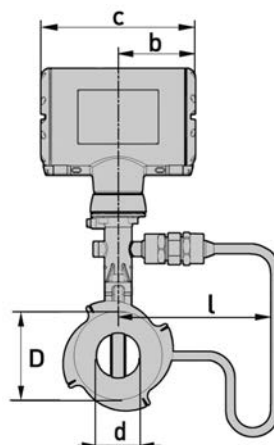
$$c = 179 \text{ mm} / 7.05''$$

## Sandwich version EN

Nominal size	Pressure rating	Dimensions [mm]					Weight [kg]			
		DN	PN	d	D	L	H	l	with	without
									Pressure sensor	
15	100	16	45	65	358.8	169.3	4.1	3.5		
25	100	24	65	65	358.3	169.3	4.9	4.3		
40	100	38	82	65	362.3	169.5	5.5	4.9		
50	100	50	102	65	368.3	169.5	6.6	6.0		
80	100	74	135	65	380.3	169.3	8.8	8.2		
100	100	97	158	65	396.8	171.5	10.1	9.5		



a = 133 mm / 5.24"



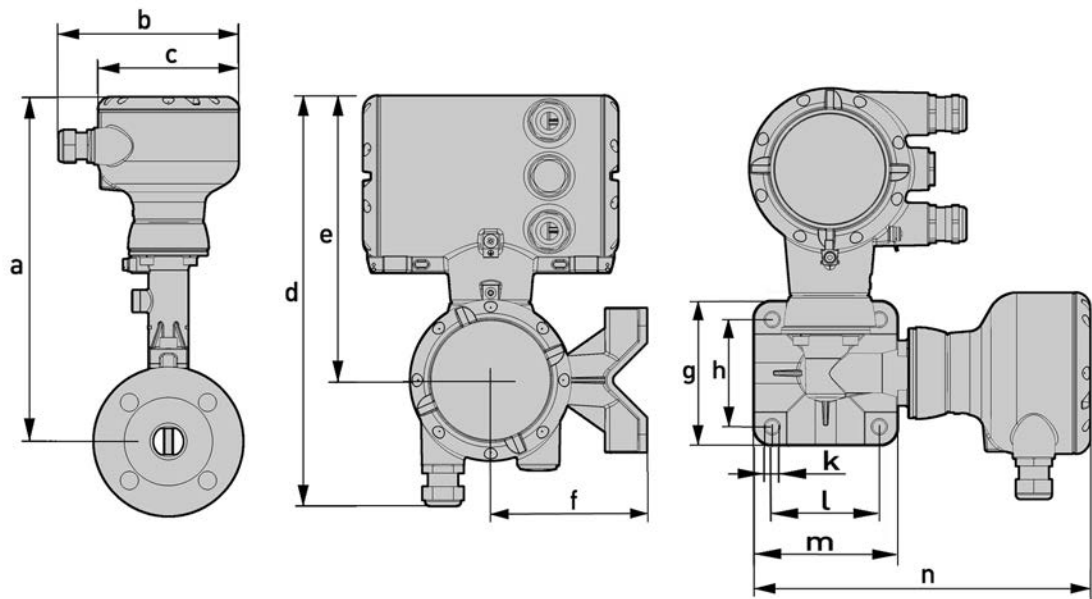
b = 105 mm / 4.13"  
c = 179 mm / 7.05"

### Sandwich version ASME

Nominal size NPS	Pressure rating Class	Dimensions [inch]					Weight [lb]	
		d	D	L	H	l	with	without
							Pressure sensor	
1/2	150	0.63	1.77	2.56	14.13	6.67	9.04	7.72
1/2	300	0.63	1.77	2.56	14.13	6.67	9.04	7.72
1/2	600	0.55	1.77	2.56	14.13	6.67	9.04	7.72
1	150	0.94	2.56	2.56	14.13	6.67	10.8	9.48
1	300	0.94	2.56	2.56	14.13	6.67	10.8	9.48
1	600	0.94	2.56	2.56	14.13	6.67	10.8	9.48
1 1/2	150	1.5	3.23	2.56	14.27	6.67	12.13	10.8
1 1/2	300	1.5	3.23	2.56	14.27	6.67	12.13	10.8
1 1/2	600	1.5	3.23	2.56	14.27	6.67	12.13	10.8
2	150	1.97	4.02	2.56	14.50	6.67	14.55	13.23
2	300	1.97	4.02	2.56	14.50	6.67	14.55	13.23
2	600	1.97	4.02	2.56	14.50	6.67	14.55	13.23
3	150	2.91	5.31	2.56	14.98	6.67	19.4	18.08
3	300	2.91	5.31	2.56	14.98	6.67	19.4	18.08
3	600	2.91	5.31	2.56	14.98	6.67	19.4	18.08
4	150	3.82	6.22	2.56	15.63	6.75	22.27	20.94
4	300	3.82	6.22	2.56	15.63	6.75	22.27	20.94
4	600	3.82	6.22	2.56	15.63	6.75	22.27	20.94



## 8.3.3 Dimensions of remote version



## Dimension a

	Flange & sandwich version						Flange version			
DN ▶	15	25	40	50	80	100	150	200	250	300
NPS ▶	1/2	1	1 1/2	2	3	4	6	8	10	12
[mm] ▶	315.7	315.2	319.2	325.2	337.2	353.7	373.2	398.9	425.7	449.7
["] ▶	12.4	12.4	12.6	12.8	13.3	13.9	14.7	15.7	16.8	17.7

## Dimension a F1/2R

	Flange version									
DN ▶	15	25	40	50	80	100	150	200	250	300
NPS ▶	1/2	1	1 1/2	2	3	4	6	8	10	12
F1R ① [mm] ▶	-	315.7	315.2	319.2	325.2	337.2	353.7	373.2	398.9	425.7
F1R ① ["] ▶	-	12.4	12.4	12.6	12.8	13.3	13.9	14.7	15.7	16.8
F2R ② [mm] ▶	-	-	315.7	315.2	319.2	325.2	337.2	353.7	373.2	398.9
F2R ② ["] ▶	-	-	12.4	12.4	12.6	12.8	13.3	13.9	14.7	15.7

① F1R - single reduction - ② F2R - double reduction

## Dimensions b...n

	b	c	d	e	f	g	h	j	k	l	m	n
[mm]	138.5	108.0	275.6	191.2	105.0	97.0	72.0	108.0	9.0	72.0	97.0	226.0
["]	5.46	4.25	10.9	7.53	4.14	3.82	2.84	4.25	0.35	2.84	3.82	8.90

## 8.4 Flow tables

### Measuring ranges

Nominal size		$Q_{min}$	$Q_{max}$	$Q_{min}$	$Q_{max}$
DN - EN 1092-1	NPS - ASME B16.5	[m <sup>3</sup> /h]		[gph]	

### Water

15	3/8	0.36	5.07	95.61	1339
25	1	0.81	11.40	215	3012
40	1 1/2	2.04	28.58	539	7550
50	2	3.53	49.48	934	13072
80	3	7.74	108.3	2045	28632
100	4	13.30	186.2	3514	49196
150	6	30.13	421.89	7961	111454
200	8	56.61	792.5	14954	209356
250	10	90.49	1267	23905	334681
300	12	131.4	1840	34720	486077

Values based on water at +20°C / +68°F

### Air

15	3/8	4.34	32.57	1147	8605
25	1	9.77	114.0	2581	30117
40	1 1/2	24.50	326.6	6472	86288
50	2	42.41	565.5	11204	149390
80	3	92.90	1239	24542	327224
100	4	159.6	2128	42168	562245
150	6	361.6	4822	95532	1273761
200	8	679.3	9057	179448	2392635
250	10	1086	14478	286870	3824929
300	12	1577	21028	416638	5555167

Values based on air at +20°C / +68°F and 1.013 bara / 14.7 psia and density 1.204 kg/m<sup>3</sup> / 0.0751 lb/ft<sup>3</sup>

## Measuring range saturated steam: 1...7 barg

Gauge pressure [barg]		1		3.5		5.2		7	
Density [kg/m <sup>3</sup> ]		1.134		2.419		3.272		4.166	
Temperature [°C]		120.4		148.0		160.2		170.5	
Flow rate		min.	max.	min.	max.	min.	max.	min.	max.
DN EN 1092-1	NPS ASME B16.5	[kg/h]		[kg/h]		[kg/h]		[kg/h]	
15	3/8	5.07	36.94	7.41	78.8	8.62	106.6	9.73	135.7
25	1	11.42	129.3	16.68	275.8	19.40	373.0	21.88	474.9
40	1 1/2	28.63	370.4	41.87	790.3	48.62	1069	54.86	1361
50	2	49.56	641.3	72.39	1368	84.18	1850	94.98	2356
80	3	108.6	1405	158.6	2997	184.4	4053	208.1	5160
100	4	186.5	2414	272.4	5149	316.8	6964	357.5	8866
150	6	422.6	5468	617.2	11666	717.8	15777	809.9	20086
200	8	793.7	10271	1159	21913	1348	29636	1521	37730
250	10	1269	16420	1853	35031	2155	47376	2432	60316
300	12	1843	23848	2692	50877	3130	68807	3532	87601

## Measuring range saturated steam: 10.5...20 barg

Gauge pressure [barg]		10.5		14		17.5		20	
Density [kg/m <sup>3</sup> ]		5.883		7.588		9.304		10.53	
Temperature [°C]		186.1		198.3		208.5		214.9	
Flow rate		min.	max.	min.	max.	min.	max.	min.	max.
DN EN 1092-1	NPS ASME B16.5	[kg/h]		[kg/h]		[kg/h]		[kg/h]	[kg/h]
15	3/8	12.77	191.6	16.48	247.2	20.20	303.1	22.87	343.1
25	1	26.01	670.6	29.54	857.0	32.71	954.8	34.80	1020
40	1 1/2	66.19	1877	74.05	2148	81.99	2394	87.24	2556
50	2	112.9	3250	128.2	3720	142.0	4144	151.0	4426
80	3	247.2	7119	280.8	8148	310.9	9077	330.8	9694
100	4	424.8	12232	482.5	13999	534.2	15597	568.5	16657
150	6	962.4	27712	1093	31715	1210	35334	1288	37737
200	8	1808	52054	2053	59574	2273	66371	2419	70884
250	10	2890	83215	3282	95237	3634	106102	3867	113318
300	12	4197	120858	4767	138318	5279	154099	5617	164578

## Measuring range saturated steam: 15...100 psig

Gauge pressure [psig]		15		50		75		100	
Density [lb/ft <sup>3</sup> ]		0.0721		0.1496		0.2033		0.2564	
Temperature [°F]		249.8		297.7		320.0		337.8	
Flow rate		min.	max.	min.	max.	min.	max.	min.	max.
DN EN 1092-1	NPS ASME B16.5	[lb/h]		[lb/h]		[lb/h]		[lb/h]	[lb/h]
15	3/8	11.09	81.44	16.42	173.7	19.05	235.0	21.59	299.2
25	1	24.95	285.0	36.95	608.1	42.86	822.4	48.58	1047
40	1 1/2	62.55	816.7	92.63	1742	107.5	2356	121.8	3000
50	2	108.3	1414	160.4	3016	186.0	4079	210.9	5194
80	3	237.2	3097	351.3	6607	407.5	8935	461.9	11376
100	4	407.6	5321	603.6	11352	700.1	15353	793.6	19547
150	6	923.3	12055	1367	25719	1586	34782	1798	44283
200	8	1734	22645	2569	48310	2979	65335	3377	83180
250	10	2773	36200	4106	77230	4763	104447	5399	132974
300	12	4027	52576	5964	112165	6918	151694	7841	193127

## Measuring range saturated steam: 150...300 psig

Gauge pressure [psig]		150		200		250		300	
Density [lb/ft <sup>3</sup> ]		0.3626		0.4682		0.5727		0.6781	
Temperature [°F]		365.9		387.9		406.0		421.7	
Flow rate		min.	max.	min.	max.	min.	max.	min.	max.
DN EN 1092-1	NPS ASME B16.5	[lb/h]		[lb/h]		[lb/h]		[lb/h]	[lb/h]
15	3/8	28.16	422.4	36.33	544.9	44.54	668.1	50.43	756.4
25	1	57.70	1479	65.50	1900	72.61	2119	75.64	2216
40	1 1/2	144.7	4164	164.2	4763	182.0	5312	189.6	5555
50	2	250.4	7209	284.3	8246	315.2	9197	328.3	96.18
80	3	548.6	15790	622.7	18062	690.3	20145	719.1	21067
100	4	942.5	27131	1070	31035	1186	34614	1236	36198
150	6	2135	61464	2424	70309	2687	78419	2799	82006
200	8	4011	115455	4553	132068	5048	147302	5258	154041
250	10	6412	184569	7279	211127	8069	235481	8406	246254
300	12	9313	268060	10571	306632	11720	342002	12209	357649







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