BOPP & REUTHER MESSTECHNIK

Vortex Meter VTX 2

with HART® Communication

EEx ia Version

Operating Manual

Read these Operating Instructions and keep them in a safe place

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1. Safety Information

1.1 Range of Application

The vortex meter is used for rate-of-flow and volume measurement of liquids, gases and steam.

Vortex meters of the VTX 2 series are available in the nominal sizes ranging from 15 mm to 300 mm. Depending on the nominal size, they can be used from PN 10 to PN 40. The maximum permissible operating temperature for the medium is 260°C (450 °C for custom units).

1.2 Hazards

The VTX 2 vortex meter has been built in accordance with the latest safety standards. It has been tested and has left our factory in a safety-wise perfect condition. In the case of improper use or when not used as intended by design, hazardous situations can occur.

For this reason note especially the warnings given in the operating instructions.

1.3 Safety

The VTX 2 vortex meter complies with the following safety criteria:

- Safety requirements in accordance with EN 61010
- EMC requirements in accordance with DIN EN 61000-6-2; DIN EN 61000-6-3
- NAMUR recommendation NE 21
- System of protection for housing IP 67 in accordance with EN 60529

In the event of a power failure, the parameter data is saved in an EEPROM.

1.4 Staff for Installation, Commissioning Work and Operation

- Only trained experts authorised by the operator of the system may run the installation work, electrical installation work, commissioning work, maintenance work and operate the system. Such staff must have read, understood and follow the information given in the operating instructions.
- In the case of aggressive media, the resistance of all parts (seals, sensors, casings etc.) in contact with the medium must be clarified first.
- As a rule, the rulings and regulations which apply in your country must be observed.

1.4.1 Factory Settings

The vortex meters are set up in the factory in accordance with the operating conditions specified in your order.

These settings are stated in the enclosed configuration data sheet.

When making any changes to the factory settings, you must take note of Chapter 5 “Configuration / Operation”.

1.5 Repairs and Hazardous Materials

The following measures must be taken before you send your vortex meter back to Bopp & Reuther Messtechnik for repair:

- In any case include with the equipment a note with a description of the failure, the application and the chemical and physical properties of the measured medium (for a form, see 14.2).
- The returned equipment has to be clean and dry; remove all residual liquid. Carefully inspect all lining grooves and slots where residual liquid might be found. This is especially important if the medium is detrimental to health (e.g. corrosive, poisonous, carcinogenic or radioactive etc.).
- We must ask you not to return any device about which you are not sure that it is absolutely safe.

Costs that are caused by the possible disposal of the device or personal injuries (e.g. burns), because the unit has not been cleaned carefully, will be borne by the plant operator.

If your vortex meter does not function properly, please contact our customer service:

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Service
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1.6 Right of Alterations

Bopp & Reuther Messtechnik GmbH reserves the right of introducing engineering changes due to improvements without having to provide separate information.

2. Description

The VTX 2 vortex meter uses a new state-of-the art electronic converter. The VTX 2 can display counter contents, flows, current output (4-20 mA) or vortex frequency. The flow rate is also indicated with an analog 4-20 mA current loop (according to NAMUR NE 21). The VTX 2 vortex meter is based on two-wire technology and supplied with power via this current loop. With the integrated HART® Interface, long-distance data transmission to a control room or a portable on-site data terminal can be carried out via the same current loop. All the relevant operating or configuration data can be read from or written into the transmitter. Thus the operational mode of the vortex meter can be optimised for the measurement task on site or through a control system.

2.1 Measuring Principle

When a liquid or gaseous with a certain minimum flow velocity meets an obstructive body, the liquid can only follow the contour of this body up to a particular point before it curls up to form a vortex. This happens alternately on either side of the body. The vortices travel downstream forming the “Kármán vortex trail”. The frequency of the forming vortices is proportional to the velocity of the flow.

The series VTX 2 vortex meter is equipped with a trapezoidal bluff body with a spring plate, which induces a precise and highly repeatable separation of the vortices for both liquid, gaseous media as well as steam.

Both the dimensions of the bluff body and its specially defined separation edge (contour) guarantee a good linearity of the error curve. The vortices separating from the bluff body generate a vortex frequency, thus causing both velocity and pressure alterations, which are detected by a piezoelectric sensor and converted to output signals (4-20 mA or pulses). The conversion is performed by an electronic converter with both auto-adaptive and microprocessor-controlled filtering of the sensor signal.

1 Measuring pipe
2 Bluff body
3 Flowing medium
4 Vortex trail

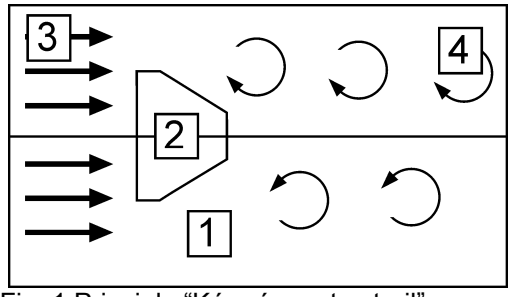


Fig. 1 Principle “Kármán vortex trail”

2.2 System Structure

The vortex meter consists of three basic components:

- The measurement pipe with the bluff body for producing the “Kármán vortex trail”.
- The sensor for detection the fluctuating pressure caused by the vortices.
- Electronic converter:
  The electronic converter pre-processes and evaluates the meter pulses. An analog 4-20 mA current loop and a digital communication module with HART® protocol are standard features of the device. In addition, a pulse output according to NAMUR (scaled or unscaled) is available. The electronic converter is installed in an industrial-type housing with a screw-down cover. This ensures a high degree of protection against electromagnetic interference and moisture. The electronics is separated from the connection compartment.

2.3 Measured Quantity

The vortex meter measures the volume resp. the volumetric flow
The mean velocity of the flow and the volumetric flow are proportional to the frequency of the vortices produced.

2.4 Measuring Range

Nominal width DN		Gases / Steam in m^3/h (volume for air)		Liquid in m^3/h		K factor	
DN	ANSI			min	max	Imp/l	Imp/m³
15	½“	2	25	0.4	8	277	
25	1“	5	130	1	20	57.7	
40	1½“	10	330	2.5	50	15.3	
50	2“	15	560	4	80	7.63	
80	3“	40	1600	6	180	2.22	
100	4“	60	2300	10	300		1010
150	6“	130	5300	20	600		311
200	8“	250	9400	40	1200		138
250	10“	400	16000	80	1800		73
300	12“	500	20000	120	2500		42
400	16“	1000	40000	240	5000		18
500	20“	1500	65000	400	8000		9.1

Table 1: Measurement ranges; the starting values for gas / steam refer to air (20°C, 1.013 bar) and those for liquids to water (20°C).

3. Installation

3.1 General Information

- Bopp & Reuther vortex meters are precision flow meters. Inlet and outlet are covered with caps for protection against foreign bodies. Remove caps shortly before putting the device into operation.
- Observe the operating data on the vortex meter, in the order confirmation and the configuration data sheet. If you want to operate the device with different operating data, you must consult Bopp & Reuther Messtechnik GmbH indicating the factory number.
- The vortex meter may be mounted in any position.
- The vortex meter can be installed in horizontal or vertical pipes.
- The permissible ambient temperature (air temperature around the meter body) must not be exceeded.
- With both high liquid temperatures and a horizontal mounting position, it is recommended installing the vortex meter such that the position of the extension pipe with the electronics housing is either beside or below the pipe.
- With steam, the electronics of the vortex meter must be assembled upright to the top (assuming the meter is installed in the horizontal pipe). Even better than the vertical installation, the installation of approximately ± 30 ° to 45 ° C at an angle to the vertical. With flange versions, this should be considered at the flange assembly into the pipeline.
- If the pipeline with the vortex meter is integrated into a heat insulation, it must be ensured that the electronics remains free and the spacer tube protrudes at least half of the insulation (see Figure 2.1).

3.2 Installation Information

Warning

- Before mounting and commissioning the device, carefully read the Operating Instructions and the Declaration of Conformity.
- Before mounting or disassembling the device, depressurize and cool down the system.
- The measuring chamber of the vortex meter must be installed in the pipe in such a way that the IP 67 degree of protection according to IEC 529 is ensured.
- Technical information of the manufacturer referring to the use of the vortex meter in connection with corrosive liquids must be observed.
- The measuring chamber of the vortex meter must be included in the equipotential bonding of the pipe.
- The housing of the vortex meter which accommodates the electronics must not be exposed to sudden temperature changes.

3.3 Fitting the Sensor

- Clean the pipe of foreign bodies before installing the vortex meter. When flushing and purging the pipe, replace the vortex meter with a fitting part.
- Do not remove the caps on the in- and outlet of the vortex meter until you install the device. Ingress of foreign objects must be avoided.
- Observe the arrow on the meter body indicating flow direction.
- Mechanical loads exerted from the pipe onto the meter are not permitted.
- Ensure that the meter body is correctly centered and the gaskets do not project into the free pipe section.
- Centering rings or pipes can be helpful (supplied on request).
- The flat gaskets (not included) must be suitable for the liquid, the maximum operating temperature and the maximum pressure (it is recommended that groove gaskets with a layer and a centering ring be used).
- The inside diameter of the flat gasket must not be smaller than the inside diameter of the meter body.
- The screw bolts (not included) must comply with the specifications according to the operating conditions (flange type, pressure class).
- Long pipes, which are prone to vibration, must be supported or fixed in the up- and downstream pipe section.

- Carefully check the system for tightness after completing the installation.

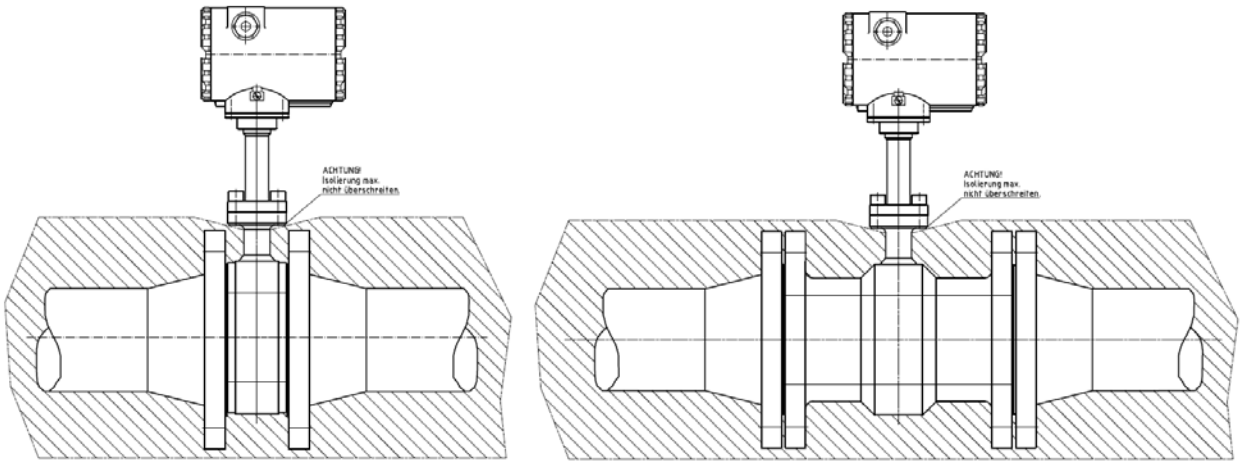


Fig 2.1: Insulation in hot media

3.3.1. Up- and Downstream Pipe Sections

A fully present, turbulent and undisturbed velocity profile in the upstream pipe section is a prerequisite for a valid measurement.

The minimum lengths are the following:

10 x nominal size for the upstream pipe section
5 x nominal size for the downstream pipe section

In view of the most commonly encountered installation mistakes, following drawings show the minimum upstream and downstream pipe sections which are required:

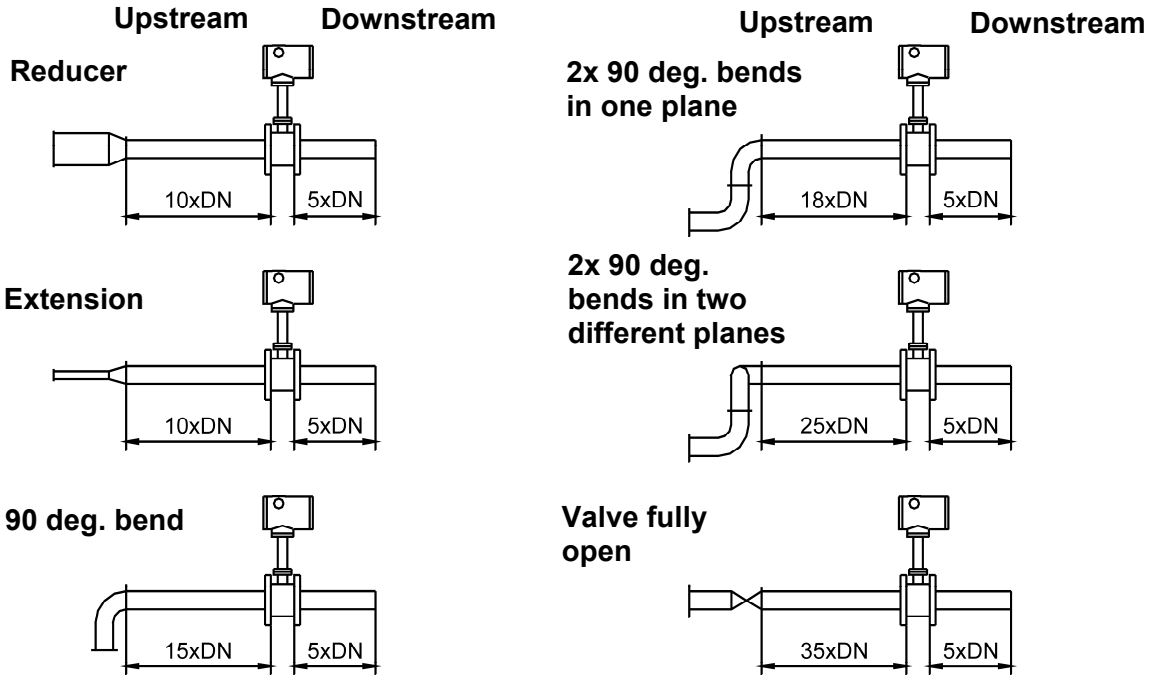


Fig. 2.2 Upstream and downstream pipe sections

3.3.1.1 Flow Straighteners

The installation of flow straighteners may reduce the influence of disturbances and the length of the required upstream pipe section. If the measurement has to be very precise, the upstream pipe section with a built-in flow straightener must be taken into account in the calibration process.

3.3.2.1 Pressure and Temperature Compensation

If pressure and/or temperature measurements are planned, the respective measurement device must be installed in the downstream pipe section. The pressure measurement device must be installed 3 x nominal size and the temperature measurement device 5 x nominal size downstream from the vortex meter.

3.4 Turning the Electronics Housing / Turning the Up-Front Display

At the transition from the sensor housing to the spacing pipe, the set screw with the 2 mm hex. socket must be loosened. Then the housing may be turned to the desired position. Finally the set screw is arrested once more.

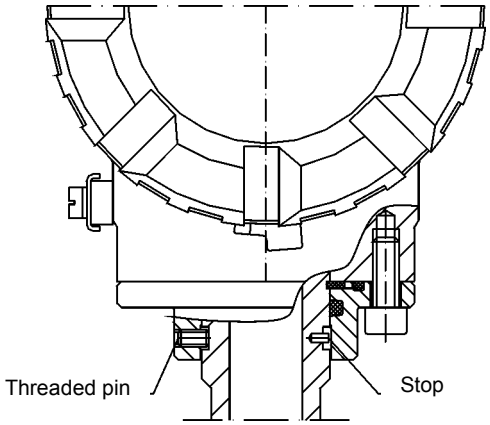


Fig. 3 Turning the electronics housing

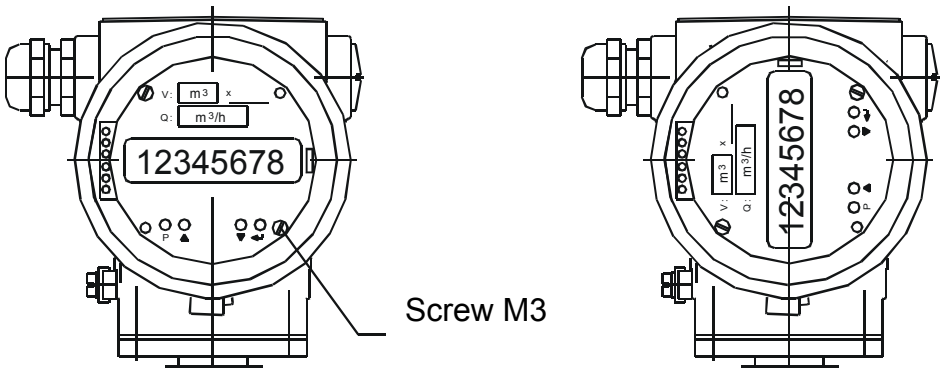


Fig. 4 Up-front display / turning the display

The up-front display may be turned in 90 degree increments.

For this:
1. Unscrew the dial plate (loosen two M3 screws)
2. Turn the two size 5 hex. studs out
3. Now the operating unit with the display may be carefully pulled out of the connector
   and inserted again in the desired 90 degree position.
4. Fit the hex. studs and the dial plate once more.

4. Electrical Connections

The electrical connections are located behind the cover on the short side of the housing.

To operate the VTX 2, a two-wire link (terminals 1+2) will do. This two-wire link has three functions:

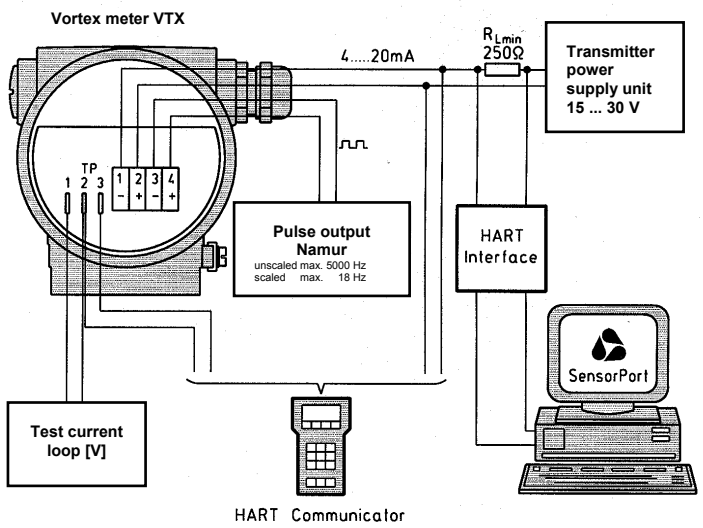
- Transmission of the 4-20 mA analog signal corresponding to the flow and the pre-set range limits.
- Provision of the auxiliary energy for the VTX 2.
- Transmission of the digital HART communication signal.

In addition two further terminals (terminals 3 and 4) are available for the pulse output in accordance with NAMUR.

Located on the connection pcb. are three tabs (TP) for servicing.

I. Connection at TP 1-2
Voltage measurement 40-200mV corresponding to 4-20mA to check the analog signal

II. Connection at TP 2-3
Communication via HART handheld terminal or HART interface (note explosion hazard regulations!)



Caution
For HART communication a minimum load of 250Ω is required!

Fig. 5 Connection options

4.1 Connecting the VTX 2

Power supply

The power supply voltage range is 14 - 30 V DC, and 30 V DC must not be exceeded.

Cable fitting	:	M20 x 1.5
Cable diameter	:	6 to 12 mm
Terminals	:	GKDS Ex
Wire cross section	:	0,2 - 2,5 mm²

The connection must be carried out as follows in accordance with EN 60079-1.1 (8.7.2 or 8.7.3). When you connect the transmitter it is essential to ensure that the individual free wires are no longer than 50mm. This can be done by cutting the casing, an insulating tube or a cable tie just before the terminal.

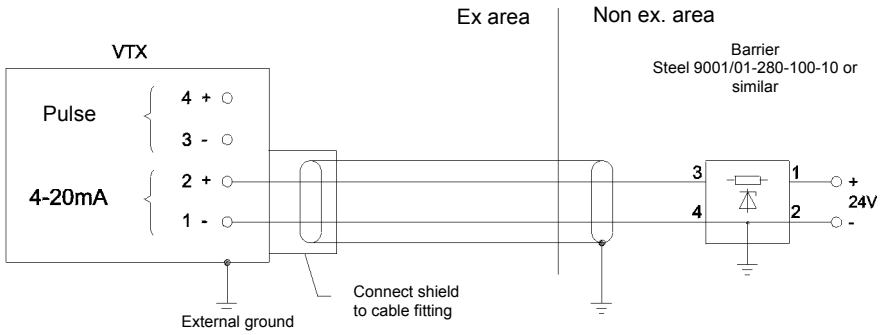
In order to comply with the stringent EMC requirements, shielded connecting cables must be used. The shield must be connected at both sides. A requirement for this is an effective and trouble-free equipotential bonding within the system.

4.2 Examples of Connections

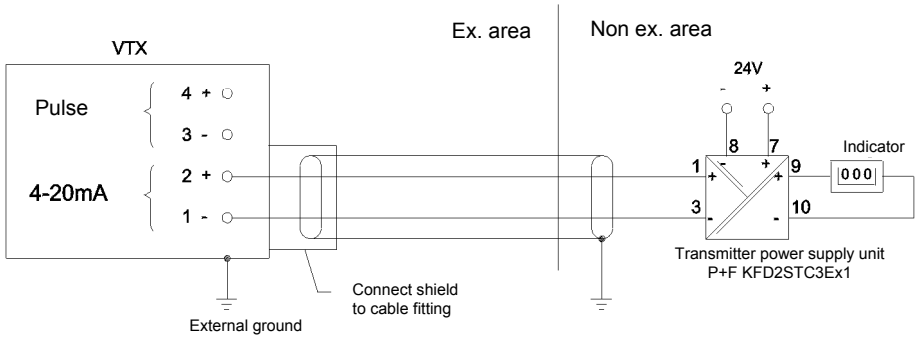
4.2.1 Applications within Explosion Hazard Areas

Two-wire current output
with/without HART

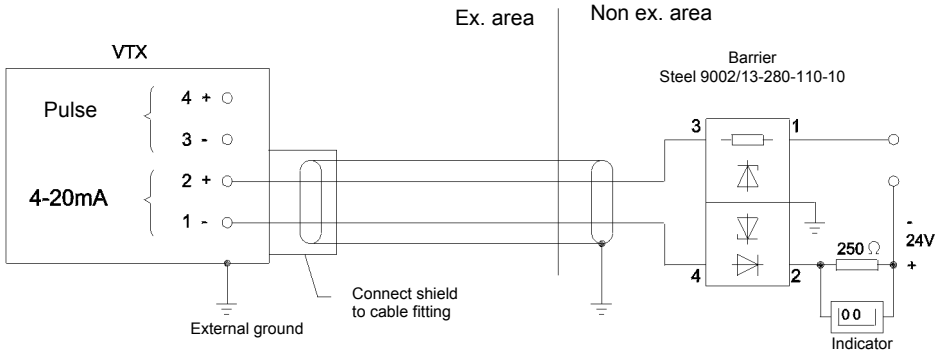
Local display without signal transmission



Analogue transmission 4 ... 20 mA, isolated,
to indicator or chart recorder

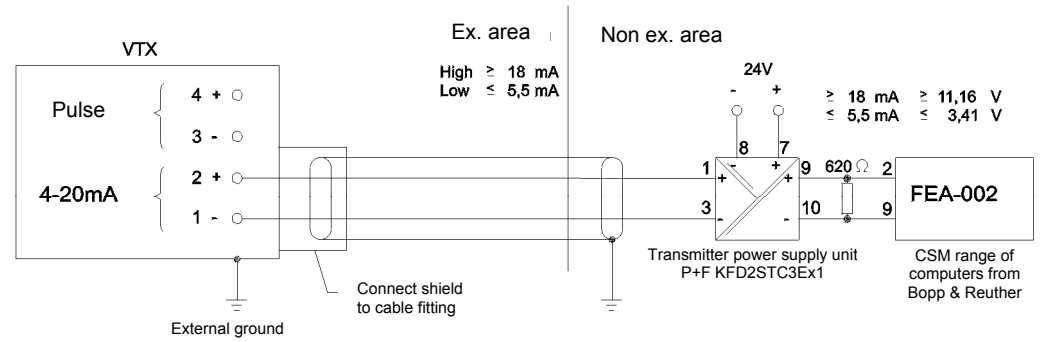


Analogue transmission 1 ... 5 V to indicator or chart recorder

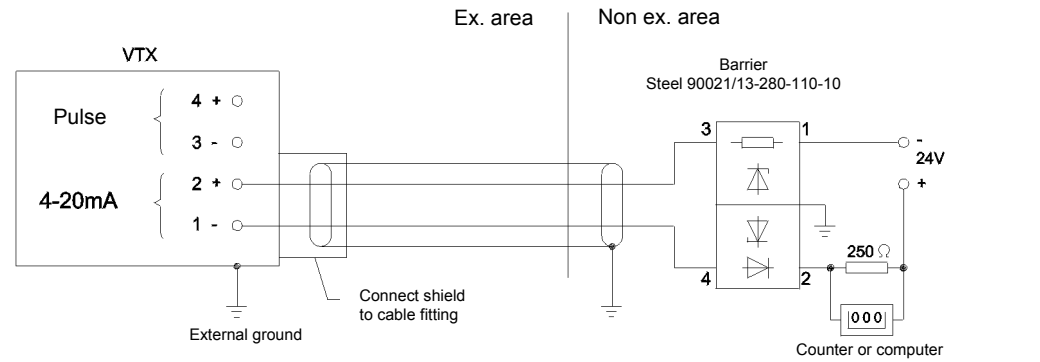


Two-wire current output (without HART)

Pulse transmission with selectable voltage to counter or computer

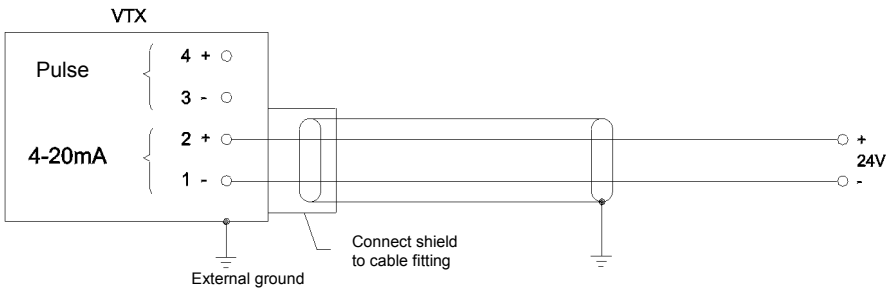


Pulse transmission 1V/5V to counter or computer

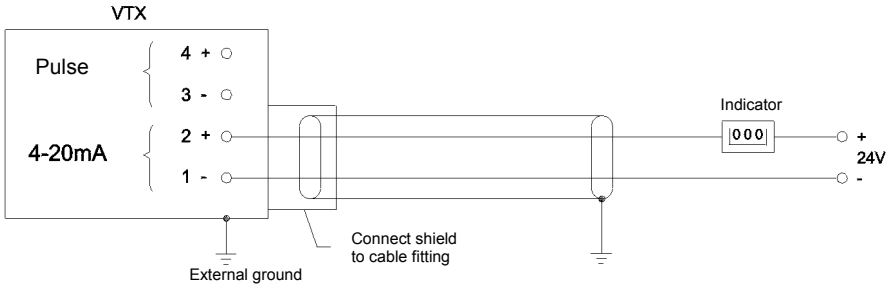


4.2.2 Application within Non-Explosion Hazard Areas

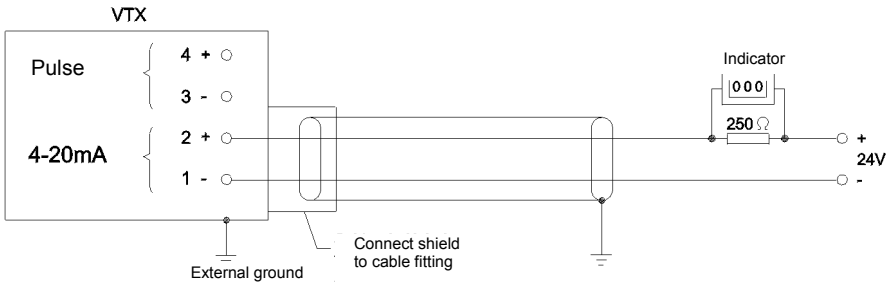
Local display without signal transmission



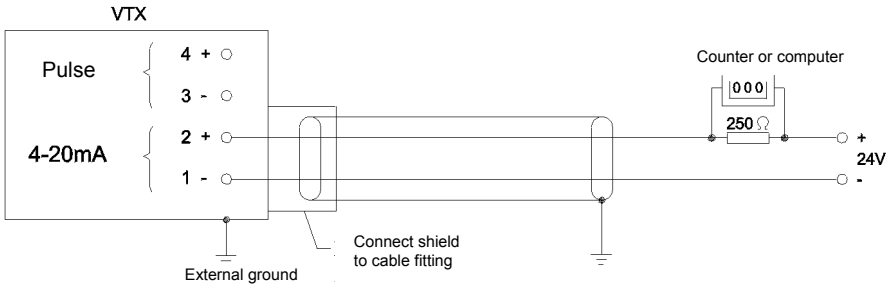
Analogue transmission 4 ... 20 mA to indicator or chart recorder



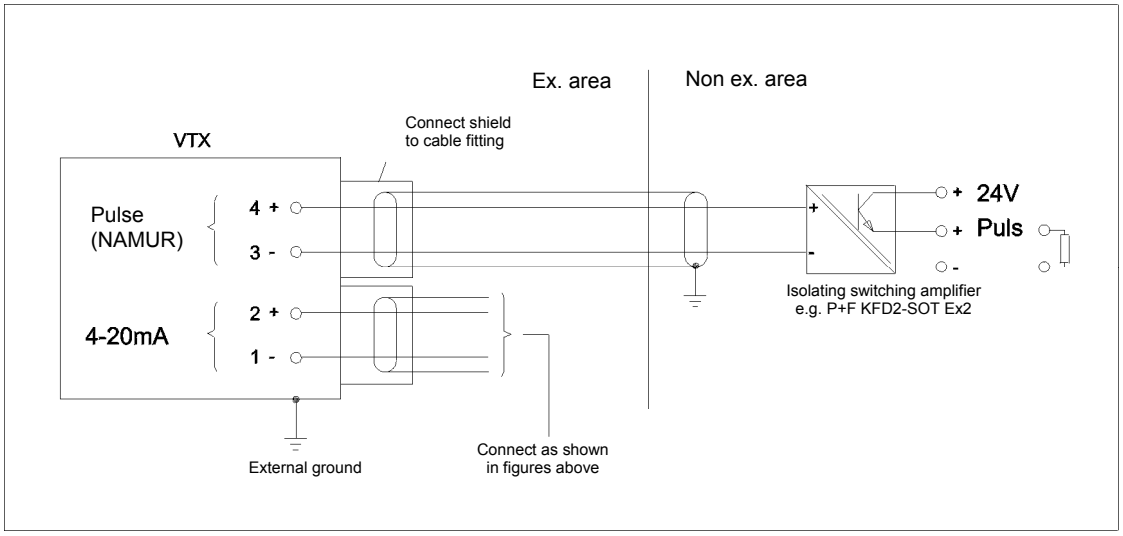
Analogue transmission 1 ... 5 V to indicator or chart recorder



Pulse transmission 1 ... 5 V to counter or computer



4.2.3 Applications within Explosion Hazard Areas with Additional NAMUR Output



4.3 Load

As to the permissible load, several parameters need to be considered.
In order to ensure reliable HART® communication, the limits for the minimum load of $R_L \geq 250\ \Omega$ must be observed.

Maximum Load:

The maximum load depends on the power supply voltage. The following relationship applies:

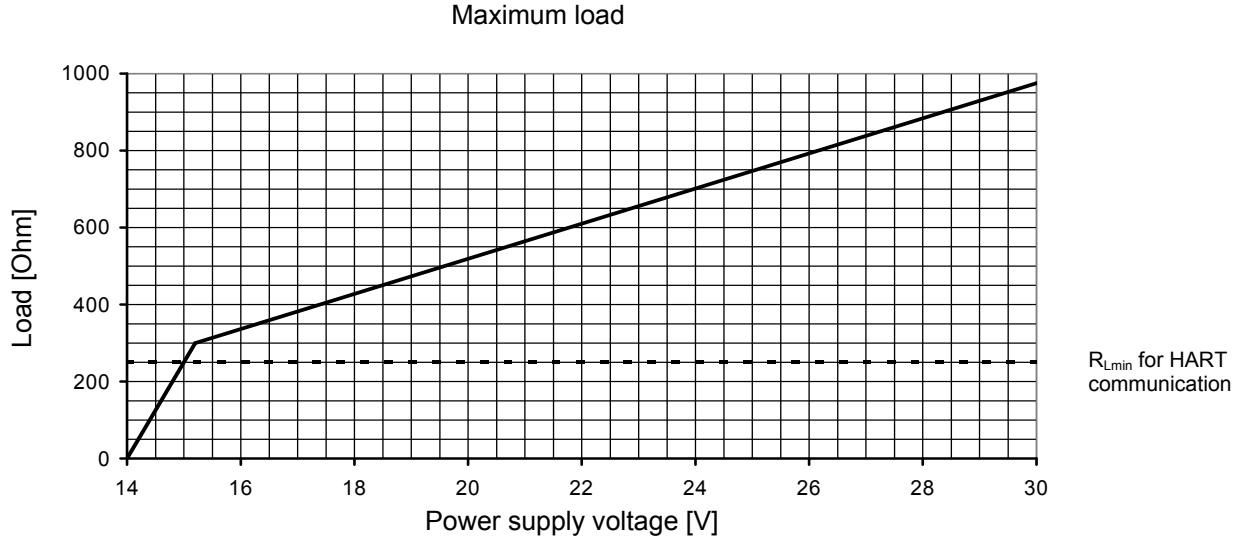


Fig. 6 Load

For $U_B < 15.2V$:

$R = (U_B – 14V) / 0.004A$

For $U_B \geq 15.2V$:

$R = (U_B –8.5V) / 0.022A$

The resistances are stated in Ω.

4.4 Max. Electrical Specifications Relevant to Safety in Accordance with the declaration of Conformity

Two-wire power supply and signal circuit (4 –20 mA current loop),
terminals 1/2

Voltage	U_i = 30 V DC
Current	I_i = 110 mA
Power	P_i = 825 mW
Effective internal capacitance	$C_i \leq 11$ nF
Effective internal inductance	$L_i \leq 4$ µH

Two-wire signal circuit (NAMUR pulses)
(frequency signal output acc. to NAMUR),
terminals 3/4

Voltage	U_i = 20 V DC
Current	I_i = 50 mA
Power	P_i = 160 mW
Effective internal capacitance	$C_i \leq 11$ nF
Effective internal inductance	$L_i \leq 4$ µH

4.5 HART® Connection

For HART® communication there are different connection options. In any case it is required that the loop resistance remains below the values given in Chapter 4.3. The HART® interface may be connected at pads TP 2 and TP3 in the compartment for the terminals with the cover removed. If the HART® interface is to be used at a different point within the current loop, then it may be connected as shown in Fig. 5.

In the example the connections of the HART® communicator may be replaced with those of the PC or Laptop.

5. Configuration / Operation

5.1 General

The following options are available for configuring the transmitter.

1. HART® communication through PACTware
2. HART® communication through a handheld terminal
3. Up front operation through the keys and display of the operating unit

5.2 PACTware

To operate the Vortex Meter PACTware software can be used.

PACTware is a configuration- and operation software that provides all Vortex functions via HART ® communication. The individual functions are listed in chapter 5.3.1 “Instrument Functions”. A PC is required for the use of PACTware with the following minimum system requirements:

- Pentium III 400
- Windows XP, VISTA or 7
- Hard drive with 100MB free space

The software is free to download: www.bopp-reuther.de

The Vortex Meter is connected to the RS232 or USB-interface of the PC using a HART® interface (see chapter 4).

Warning:
The use of a PC or a notebook computer connected to a Hart® interface within explosion hazard areas is not permitted without introducing special measures first.

5.3 Handheld Terminal

A HART® communicator (e.g. handheld HC-375 from Emerson) is another operating element which can be used. The operating functions for HC-375 are defined in a DD (Device Description). Using the HC-375 it is possible to operate or configure the VTX2 on-site. The connection is described in chapter 4.

The Device Description Language (DD) can be downloaded from the Internet (HART® Foundation www.hartcomm.org).

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5.3.1 Device Functions

- **Flow:**
  Displays the currently measured volumetric flow. The unit can be selected by the user.
- **Flow %:**
  Displays the currently measured volumetric flow as a percentage of the upper range value Qmax.
- **Current display:**
  Displays the specified value of the current output in mA.
- **Total totalizer:**
  The total totalizer adds up the volume based on the volume unit of the flow rate. This counter can only be reset for servicing. The counter content is retained when power is interrupted.
- **Daily totalizer:**
  The resettable daily totalizer adds up the volume based on the volume unit of the flow rate used in the total totalizer. This counter can be reset by the user. The counter content will be set back to zero when power is interrupted.
- **Reset daily totalizer:**
  This rese ttable daily totalizer can be reset by the user.

Diagnosis (Diag/Service) :

Communication Status (Comm status):

- **Device address: (Poll addr):**
  The user can select a value between 1 and 15 as device address in polling mode. Address = 0 means analog operation; address > 0 means polling operation. If the VTX 2 is planned to be installed in a multidrop application, an address between 1 and 15 must be specified. First, the VTX 2 must be configured with the desired address in a point-to-point connection.
- **Number of preambles (Num resp preams):**
  The read value indicates how many preambles the master is supposed to send to the slave in its request. The written value indicates how many preambles the VTX 2 is supposed to send to the master.

Device status:

- **Reset configuration changed flag (Reset changed flag):**
  The configuration changed flag indicates that configuration data have been changed in the device.

Function switches (Function switch):

- **Display switches A, B, C, and D:**
  Displays a list in hexadecimal notation of the function switches.

Measurement values:

- **Amplitude right sensor / amplitude RQ (Snsr right ASR):**
  This measured value indicates the operating condition of the sensor. The amplitudes of the sensor on the left and on the right must be identical.
- **Amplitude left sensor / amplitude RQ (Snsr left ASL):**
  This measured value indicates the operating condition of the sensor. The amplitudes of the sensor on the left and on the right must be identical.
- **Amplitude pre-filter / PZF2 (Pre filter AVF):**
  This value indicates the operational state of the filter amplifier. The amplitudes of the filters must be within the limits of the switching voltages.

- **End filter / PEF (End filter AEF):**
  This value indicates the operational state of the filter amplifier. The amplitudes of the filters must be within the limits of the switching voltages.
- **Vortex frequency (Vortexfreq):**
  Displays the number of vortices per second produced by the sensor.

Electronic data (Electr data):

- **Min PWM (Min PWM):**
  This value indicates the calibration of the PWM analog output.
- **Max PWM (Max PWM):**
  This value indicates the calibration of the PWM analog output.
- **Quartz frequency (Quarz freq):**
  The calibrated system frequency can be read.
- **Output filter fo (U outp flt)**:
  Displays the operating parameters configured for the output filter.
- **Output filter fu (L outp flt)**:
  Displays the operating parameters configured for the output filter.
- **Configure amplifier gain (Ampl gain):**
  Setting the number of amplifier stages for self-adaptation.
- **LCD Test (Perform LCD Test):**
  This command initiates the LCD test of the VTX 2.
- **Reset instrument (Master reset):**
  Through this command, the instrument may be reset to a defined state as present when powering up.
- **Firmware Version (Firmware Version):**
  Displays the firmware version indicating the week and the year of creation.

Basic settings (Basic Set-up):

Device settings (Device information):

- **Model code (Modelcode):**
  Displays the model code of the device.
- **Device identification (Dev id):**
  Displays the serial number of the electronics.
- **Device type (Model):**
  Displays the device type.
- **Sensor type (Line of products):**
  This value always defaults to zero (tandem sensor).
- **Manufacturer code (Manufacturer):**
  Displays the manufacturer.
- **Distributor code (Distributor):**
  Displays the distributor.
- **TAG (Tag):**
  Displays the tag number of the customer.
- **Date (Date):**
  Displays the date of manufacture.

- **Descriptor (Descriptor):**
  The user can enter or read a short text of up to 16 characters.
- **Message (Message):**
  The user can enter or read a short text of up to 32 characters.
- **Write protection (Write protect):**
  Activates and deactivates write protection.
- **Serial number sensor (Snsr s/n):**
  The serial number of the sensor can be read.
- **Final assembly no. of device (Final asmbly num) :**
  The final assembly number of the device can be read. It is identical with the sensor number.
- **Revisions, universal, standard, software, hardware (Revision #'s):**
  The revision numbers are read.

Transmitter data (Sensor data):

- **k factor (k factor):**
  The k factor can be read and changed. The user can select between Imp/l or Imp/m³.
- **Nominal size (Norm width):**
  The nominal size of the sensor can be read and changed. There is a picklist of all available nominal sizes.

Medium data (Medium data):

- **Medium (Medium):**
  The user can select between liquid, gas, and steam.
- **Operating density (Density):**
  The operating density can be read and changed.

Process data (Process data):

Range limits (Sensor Range)

- **Upper sensor limit (USL):**
  This sensor limit has been programmed in the VTX 2 for each meter type by the factory. The VTX 2 is configured for this range.
- **Lower sensor limit (LSL):**
  This sensor limit has been programmed in the VTX 2 for each meter type by the factory. The VTX 2 is configured for this range. Below this limit the error curve is no longer defined.
- **Minimum measuring range span (Min span):**
  The range of the measuring output can be freely defined within the measuring range. However, the set value must not be less than the minimum limit because this may lead to step changes of the output current.
- **Upper range limit (URV):**
  The upper range limit defines the characteristic value for the 20 mA point.
- **Lower range limit (LRV):**
  The lower range limit defines the characteristic value for the 4 mA point (corresponds to low flow).
- **Amplifier limiter (Ampl limiter):**
  This setting limits the sensitivity of the output amplifier.
- **Damping (Damp):**
  Damping affects the output current and the flow rate display. The user can select a value between 1 and 200 seconds. The resolution is approx. 1 second.
- **Standard unit (Unit):**
  This unit defines the value of the flow rate display and the upper range value of the current output. The unit can be selected from a predefined list. The volume unit for the counters is

derived from the volume unit of the flow rate. If the desired unit cannot be found in the list, the user can switch to "user-defined unit" (see "Special units")

- **Pulse mode factor (Puls mode factor):**
  The mode for the pulses can be selected between Imp/l and Imp/m³.

Operating modes (Operating modes):

- **Current loop 4..20 mA (Analog output mode):**
  The operating mode can be selected from two analog and two digital outputs.
  Analog output : 4 mA corresponds to flow rate Q = 0
  4 mA corresponds to flow rate Q = Qmin
  Digital output : Vortex pulses
  Scaled pulses
  The digital output will be a 4-20 mA signal. The current pulse must be switched off for HART communication (see "Special settings for digital pulse").
- **NAMUR output (Namur output):**
  The NAMUR output can be selected to output either vortex pulses or scaled pulses. This output can be deactivated separately.
- **Pulse width (Puls width):**
  The pulse width of the scaled pulses can be selected from four time constants.

Simulation (Simulation):

- **Pulse simulation (Puls simulation):**
  During pulse simulation, various fixed frequencies can be generated for line testing. Another simulation consists of the generation of a frequency that corresponds to a pulse width twice that of the set pulse width. Pulse simulation must be deactivated after the test.
- **Current simulation (Loop test)**:
  A fixed output current of 4-22 mA can be set for testing the devices connected in series. After the test, the current value 0 mA must be entered to end simulation.
- **Alarm 21.8 mA (A0 Alrm typ):**
  An alarm signal can be transmitted through the current loop. The current will then rise to 21.8 mA. This alarm will be generated due to a malfunction of the VTX 2. The alarm function can be deactivated.

Special settings (Detailed set-up):

Special units (Special units):

- **Flow rate factor (Flow scale):**
  If the desired unit is not among the standard units, a special flow rate factor can be adjusted.
- **Volume factor (Volume scale):**
  If the default volume unit for the counters is to be changed, a special volume factor can be adjusted.
- **Pulse ratio factor: (Puls scale):**
  If the pulse output is to use a different volume factor than the counters, a special pulse factor can be adjusted.

Automatic self-adaptation (Auto self adapt):

- **Calculate C, calculate filter, configure amplifier (Calculate c, calculate flt, Ampl conf):**
  These three switches will always be active for the standard configuration. A special setting may be necessary in certain cases.

Special settings (Special config):

Automatic guidance (Autom guidance):

- **Amplifier level, upper and lower filter limits (Ampl level, U flt limit, L flt limit):**
  These three switches will always be active for the standard configuration. A special setting may be necessary in certain cases.
- **Open measuring range (open meas.rnge):**
  With this switch the limits of the measuring range can be extended.
- **Open limits (Open limit):**
  With this switch the entry limits for the upper and the lower measuring range can be cancelled.
- **Open filter band (Open flt band):**
  With this switch the filter characteristic of the amplifier can be extended.
- **Amplifier character (Open char):**
  With this switch the filter characteristic of the amplifier can be changed.
- **Batch operation (Batch mode):**
  This function is not yet available.
- **Quick start (Quickstart):**
  This function is not yet available.
- **Low-flow cutoff (Lo flo cutoff):**
  With this switch flow rates below Qmin can be displayed for test purposes.
- **Analog pulse for HART (HART a-puls):**
  If the current loop is used as pulse output, reliable HART communication is no longer ensured. With this switch the bandwidth of the current pulses can be reduced in such a way that trouble-free communication is possible.
- **Digital pulse for HART (HART d-puls):**
  If the current loop is used as pulse output, reliable HART communication is no longer ensured. With this switch the output pulse can be switched off. Trouble-free communication is then possible. The output pulses that are generated during this period will be lost.

Electronic calibration (Electr calibration):

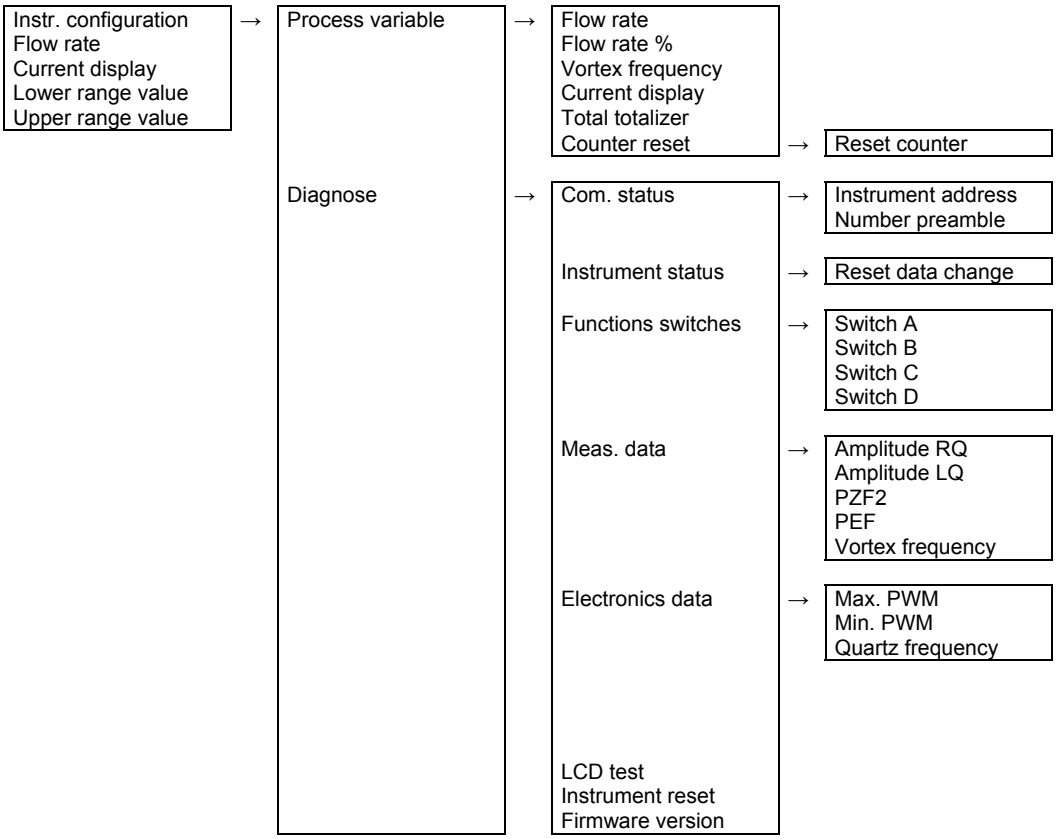
- **Calibrate current output (D/A trim):**
  The characteristic of the analog current output can be calibrated in its zero point at 4 mA and in its slope at 20 mA. It must be observed that the zero point will always have to be calibrated before the upper range value.
- **Quartz frequency (Quarz freq):**
  Displays the calibrated system frequency of the VTX 2.

Electronic parameters (Electr parameter):

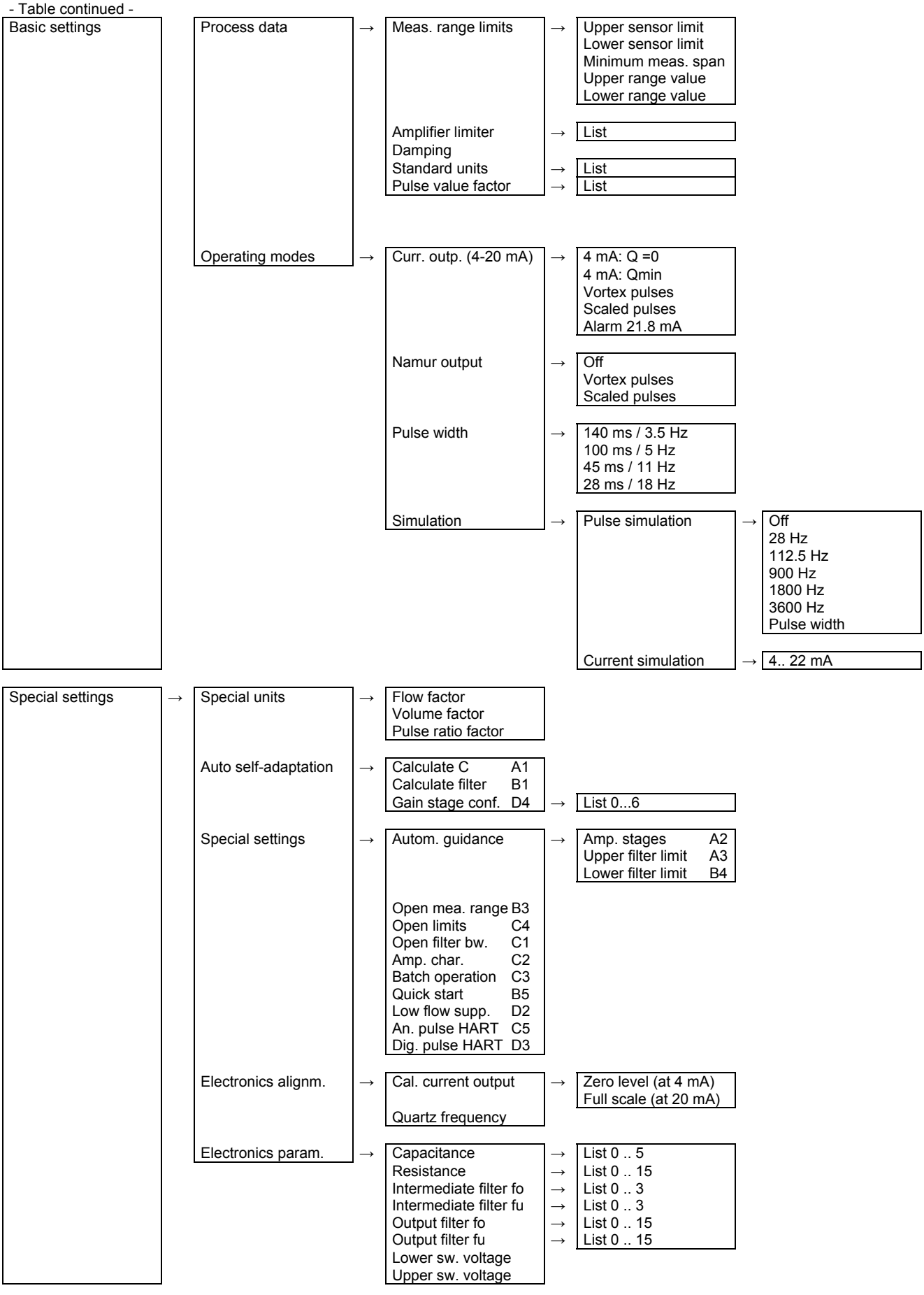
- **Capacitance (Capacity)**:
  Displays the configured operating parameters. The VTX 2 can also be configured manually with these values.
- **Resistance (Resistance):**
  Displays the configured operating parameters. The VTX 2 can also be configured manually with these values.

- **Intermediate filter fo (U mean flt)**:
  Displays the configured operating parameters. The VTX 2 can also be configured manually with these values. The frequency ranges for the intermediate filter can also be set up automatically when the self-adaptation mode is active.
- **Intermediate filter fu (L mean flt):**
  Displays the configured operating parameters. The VTX 2 can also be configured manually with these values. The frequency ranges for the intermediate filter can also be set up automatically when the self-adaptation mode is active.
- **Output filter fo (U outp flt)**:
  Displays the configured operating parameters. The VTX 2 can also be configured manually with these values. The frequency ranges for the output filter can also be set up automatically when the self-adaptation mode is active.
- **Output filter fu (L outp flt):**
  Displays the configured operating parameters. The VTX 2 can also be configured manually with these values. The frequency ranges for the output filter can also be set up automatically when the self-adaptation mode is active.
- **Lower switching voltage (L voltage)**
  Lower switching threshold for automatic switching to the next higher amplifier stage.
- **Upper switching voltage (U voltage):**
  Upper switching threshold for automatic switching to the next lower amplifier stage.

5.3.2 Menu Structure



- Table continued -



Reset instrument Overview	→	Meas. range full scale Meas. range start k factor Pulse value factor Unit selection Nominal width Medium Min. operat. density Damping Current simulation Op. mode curr. loop Function switch A Function switch B Function switch C Function switch D Amp. limiter Amp. stage Capacitance select Resistance select Intermediate filter fu Intermediate filter fo Output filter fu Output filter fo Lower switch. voltage Upper switch. voltage Flow factor Volume factor Pulse ratio factor Min. PWM Max. PWM Sensor comparator Quartz frequency ASR ASL AVF AEF

5.4 Configuring Using the Keys on the Operating Unit

5.4.1 Operation

The instrument can be operated up front through the four keys on the operating unit. For this the cover needs to be removed:

The following functions have been assigned to the keys:

„**P**“	Programming	Switches the programming mode on, sets decimal point.
„▲“	Plus	Increment
„▼“	Minus	Decrement
„↵“	Enter	Selects the next digit, carries a value over

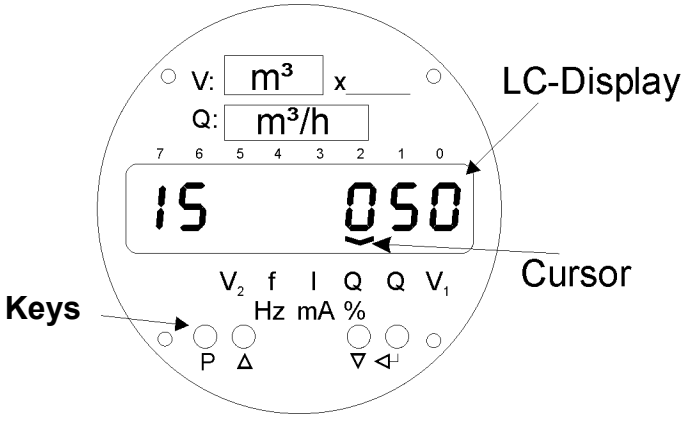


Fig. 7: Operating unit

5.4.2 Up Front Display

On the display all variables and parameter settings may be displayed. The process variables are marked by the position of the cursor, the parameters and service data by a two-digit channel number.
When in the operating mode (roll mode) the flow and count are displayed in alternating fashion. By operating the plus or the minus key, the operator may switch over the display to indicate the desired channel.
After about 5 minutes the selected channel changes back automatically to the roll mode where count and flow are displayed.
Keeping the plus key depressed for 3 seconds will invoke the roll mode immediately.

5.4.3 Access Levels

When operating the instrument via the keys, there are three access levels which must be considered.

In channel “a” the desired access level can be enabled at digit 0 (see also table “Functions switches”).

- Display level (operating mode) A/0
  All configuration and measurement data can be displayed, writing can only be done through channel a.
- User level (programming mode) A/1
  In addition the default settings for the vortex meter can be configured. On this level, operation of the function switches can be changed.
- Service level (programming mode) A/2
  All coefficients and alignment parameters can be configured.

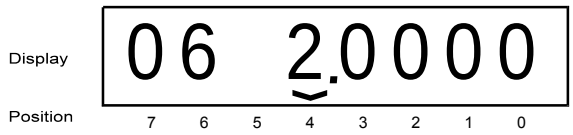
5.4.4 Examples

ⓘ **General note**: After each change to the settings the instrument should be reset (power on reset or reset through function switch B2) so as to check the newly entered resp. changed values through invoking the corresponding channel number.

Plus key (▲)

To select a channel and to change the content of the channel – in the positive direction.

Example:

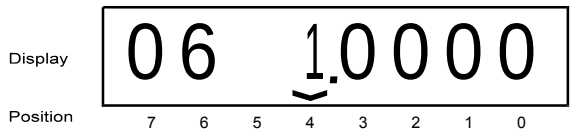


Increase for channel 6 from 1 to 2.

Minus key (▼)

To select a channel and to change the content of the channel – in the negative direction.

Example:



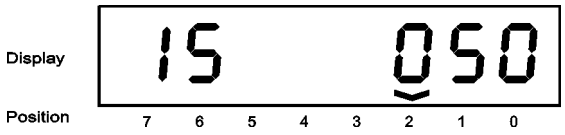
Decrease for channel 6 from 2 to 1.

Programming key (P)

This key has two functions:

- Change of channel content

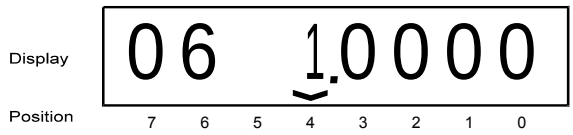
  The desired channel is selected through the plus or the minus key. Operating the programming key enables the channel so that its content may be changed. The cursor will be displayed.



Example: If channel 11 (nominal width) has been selected, then the cursor will appear at position 2.

- Setting the position for the decimal point.

  If the desired channel has been selected and if the programming key has been operated so that the cursor is visible, now a decimal point may be set at the position of the cursor. Pressing the programming key once more deletes the decimal point.



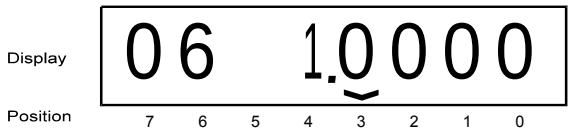
Example: Here in channel 6 a decimal point is set at position 4.

For the following channels floating point entries are provided for:

- Max. flow = Channel No. 6
- Min. flow = Channel No. 7
- k factor = Channel No. 8
- Pulse factor = Channel No. 9
- Operating density = Channel No. 13

Enter key (↵)

To move the entry position (the cursor moves from left to right) and for taking over the current value (cursor is no longer displayed)
Moreover, with the enter key it is possible to reset the status information in channel 17.



Example:

In order to activate channel 6, the enter key needs to be operated four times so that the cursor moves from position 4 to the right. Pressing the enter key once more will shift the cursor out of the display to the right and channel 6 with the current content (1.0000) is activated.

5.4.4 Channel Overview

Channel Code Table

Channel		Function	Default			Order of entries	Level
			Digits	Value	Unit	Keys	a/o
Process variables	(0)	Total totalizer	8	V1	m³		-
	(1)	Flow rate	8	Q	m³/h		-
	(2)	Percentage display	4	Q/Qmax	%		-
	(3)	Current display	4	I	mA		-
	(4)	Vortex frequency	8	f	Hz		-
	(5)	Resettable counter	8	V2	m³		-
Basic settings	6	Upper range value	5	Qmax	m³/h		1
	7	Lower range value	5	Qmin	m³/h		1
	8	k factor	5	K	Imp/ℓ o. Imp/m³		1
	9	Pulse value factor	3	1	-		1
	10	Unit selection	2	(5)	m³/h		1
	11	Nominal size	3	DN	(mm)	3	1
	12	Medium	1	Liquid/gas/steam		1	1
	13	Minimum operating density	5	ρ	kg/m³	2	1
	14	Current damping	3	3	s		1
	15	Current simulation	3	4.0	mA		1
	16	2-wire current loop	1	Analog/pulses	-		1
	17	Status information	3	000	-		-
	a	Function switch a	7	0001110	-		0
	b	Function switch b	7	0010010	-		1
	c	Function switch c	7	0000000	-		1
	d	Function switch d	7	0141100	-		1
Special settings	20	Capacitance selection	1	0-5	-		2
	21	Resistance selection	2	0-15	-		2
	22	Amplifier level	1	4	-		2
	23	Intermediate filter fu	1	0-3	-		2
	24	Intermediate filter fo	1	0-3	-		2
	25	Output filter fu	2	0-15	-		2
	26	Output filter fo	2	0-15	-		2
	27	Lower switching voltage	3	0.70	V		2
	28	Upper switching voltage	3	3.30	V		2
	29	Flow rate factor	5	1	-		2
	30	Volume factor	5	1	-		2
	31	Pulse ratio factor	5	1	-		2
	32	Current calibration 4mA	5	400	-		Y
	33	Current calibration 20mA	5	14000	-		Y
	34	Sensor comparator	3	127	-		Y
	35	Quartz frequency	5	460.00	kHz		Y
Service values	36	Amplitude RQ	3	approx. 2.5	V		-
	37	Amplitude LQ	3	approx. 2.5	V		-
	38	PZF 2	3	0-5	V		-
	39	Signal amplitude P_{EF}	3	0-5	V		-
	40	---	3	-	V		-
	41	Flow velocity	4	v	m/s		-

Function Switches

Pos-ition	Channel (switch)			
	a	**b**	**c**	**d**
0	Access levels *0: Display level ** *1: User level* *2: Service level*	Failure signal (Alarm at 21.8mA) *0: OFF** *1: ON*	Counter reset *0: OFF** *1: Reset*	0: Default*
1	Auto-adaptation (cap. selection) *0: OFF* *1: ON**	Auto-adaptation (filter selection) *0: OFF* *1: ON**	Filter bandwidth *0: 20dB (normal) ** *1: 40dB*	0: Default*
2	Amplifier guidance (in stages K22) *0: OFF* *1: ON**	Hardware reset *0: OFF** *1: ON*	Amplifier bandwidth at Qmax *0: normal** *1: wide*	Low flow suppression *0: OFF* *1: ON**
3	Filter guidance (Output filter fo) *0: OFF* *1: ON**	Open measurement range *0: OFF** *1: ON*	0: Default*	Current pulse output (general.) *0: OFF (for HART comm.)* *1: ON**
4	LCD test *0: OFF** *1: ON*	Filter guidance (Output filter fu) *0: OFF* *1: ON**	0: Default*	Auto-adaptation (Selection of the number of stages) *0 to 6 (4*)*
5	Current simulation (value of K15) *0: OFF** *1: ON*	Quick start *0: OFF** *1: ON*	Current pulse output with HART comm. (only at 150ms) *0: OFF** *1: ON*	NAMUR output *0: OFF* *1: Original frequency** *2: Scaled pulses* *3-8: Simulation values*
6	Alignment PWM / Quarz *0: OFF** *1: ON*	---	Pulse simulation (NAMUR output) *0: OFF** *1: ON*	Pulse width select *0: 150ms/3Hz** *1: 100ms/5Hz* *2: 45ms/11Hz* *3: 28ms/18Hz*

Frequency simulation	3: 28Hz 4: 112.5Hz 5: 900Hz 6: 1800Hz 7: 3600Hz
Pulse simulation	8: Pulse width

* Standard setting

5.5 Description of Functions

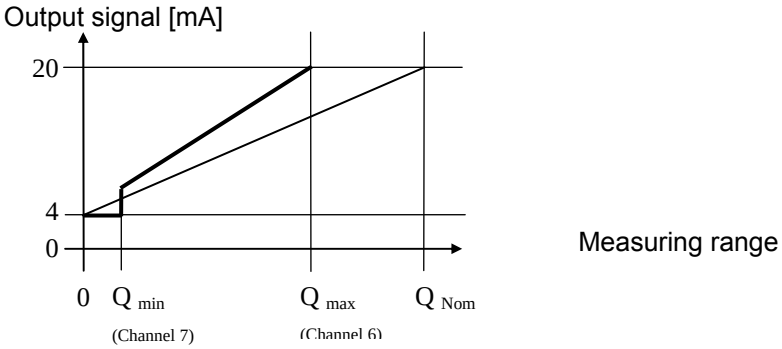
5.5.1 Analog Operation (Channel 16)

The analog output signal of 4 to 20 mA can be freely assigned to the desired measuring range within the flow rate limits of the corresponding counter quantity.

There are two analog operating modes:

5.5.1.1 Output Signal Proportional to Upper Range Value

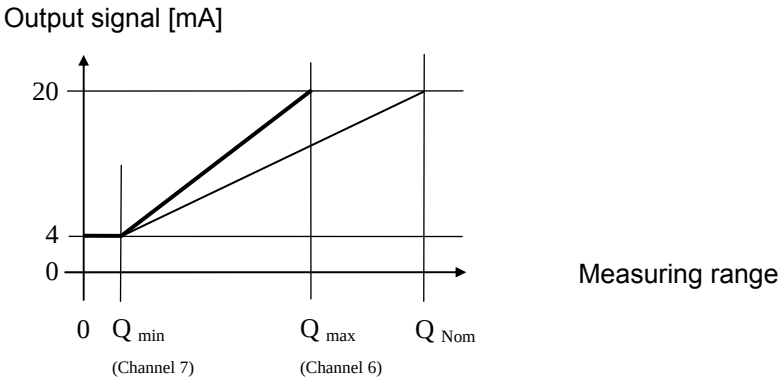
4 mA = Q = 0
(Mode 0)



Below Qmin (Channel 7) low-flow cutoff

5.5.1.2 Output Signal Proportional to Measuring Range Span

4 mA = Q min
(Mode 3)



This setting is made with Channel 16

Mode	0	3
Operating mode	4 mA = Q = 0	4 mA = Q min

5.5.1.3 Damping of Output Current (Channel 14)

With channel 14 you set the damping ratio. The setting range is between 1 (no damping) and 200 (highest degree of damping = time constant 200 s).

5.5.1.4 Current Simulation (Channel 15)

With the current simulation you can set different output currents between 4 and 22 mA.

How to proceed:

1 Switch on current simulation with function switch A 5 (enter 1).
2 Set the desired output current with Channel 15 (enter value in mA).
3 Switch off current simulation with function switch A 5 (enter 0).

5.6.1 Pulse Operation (Counter operation)

5.6.1.1 Two-Wire Current Pulse Output (Channel 16)

For volume measurements you can switch the two-wire circuit to pulse operation.

Current pulses between 4 mA = low and 20 mA = high will be supplied as the output signal.

You can select between a scalable pulse output or a pulse output of original vortex pulses.

This setting is made with Channel 16:

Mode	1	2
Operating mode	Scaled pulses	Original vortex pulses

In addition to this setting, the analog/digital jumper on the front of the electronics must be set to digital operation.

Note!
HART communication is not permitted during pulse operation. For HART configuration, the pulse output must be switched off temporarily (function switch D 3, enter 1).

5.6.1.2 Two-Wire Current Pulse Output with HART Function

In the analog operating mode (Mode 0) a pulse output with simultaneous two-wire HART communication can be utilised.

Pulse signal specs.
Current pulses: Current Low ≤ 9 mA
Current High ≥ 12 mA
Pulse width 150 ms

For this, the function switch (C5 is set to 1 [on]). The analog/digital jumper on the front of the electronics must be set to analog operation. The pulse width for the pulses which are output must be set to 150 ms.

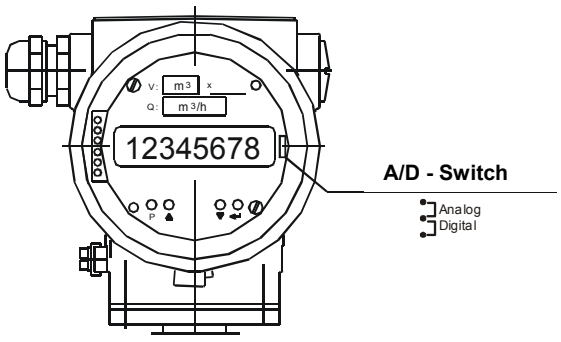


Fig. 8 Analog-Digital Switch

5.6.1.3 NAMUR – Pulses

In addition to the 2-wire connection, a separate pulse output in accordance with NAMUR is available. The additional NAMUR output can either be set to original vortex pulses (e.g. for test purposes, if a high pulse resolution is necessary) or to scaled pulses with selectable meter factor and pulse width.

This setting is made with function switch D 5:

Setting	0	1	2
Function	Pulses off	Original vortex pulses	Scaled pulses

5.6.1.4 Pulse Value Factor (Channel 9)

Through the pulse value factor you can set the meter factor of the output pulses and the counter increment.

You can set the following decadic steps for the pulse value factor (Channel 9):

0.01	0.1	1	10	100

Example:

If the pulse value factor is 10 then the following applies

a) for the pulse output:

1 pulse = 10 units (e.g. 10 m³), depending on the selected unit

b) for the meter's display (with pulse ratio factor 1, see Chapter 5.8.2.3):

1 counter increment = 10 units (e.g. 10 m³)

If the pulse output is scaled, it must be ensured that the maximum frequency of the pulse output, depending on the selected pulse width, is not exceeded (see Table 5.6.1.5).

The smallest permissible pulse value factor Z is given by

$$Z \geq \frac{Q_{max}}{f_{max}}$$

Q_{max}: max. flow rate [selected unit/seconds]
f_{max}: max. frequency of the scaled pulse output (depending on the selected pulse width, see Table 5.6.1.5)

Example 1:

Q_{max} = 400 m³ / h = 0.111 m³ / s

Pulse width 150 ms = f_{max} = 3 Hz

$Z \geq 0.111 / 3 = 0.037$ m³

thus a smallest pulse value of Z = 0.1 can be selected, i.e. 1 pulse = 0.1 m³

Example 2:

Q_{max} = 60,000 kg / h = 16.67 kg / sec

Pulse width 28 ms = f_{max} = 18 Hz

$Z \geq 16.67 / 18 = 0.926$ kg

$\Rightarrow$ smallest pulse value possible Z = 1 (or higher), i.e. 1 pulse = 1 kg

5.6.1.5 Pulse Width

(Function switch D 6)

The output pulse width can be selected according to the following table:

Setting	0	1	2	3
Pulse width	150 ms	100 ms	45 ms	28 ms
Max. frequency	3 Hz	5 Hz	11 Hz	18 Hz

5.6.1.6 Pulse Simulation

NAMUR pulse output

With pulse simulation, various output pulses can be simulated. During a simulation, the transmission of the vortex signals is stopped.

1. Switch on pulse simulation with function switch C 6.

2. Select output pulses with D 5.

Setting	3	4	5	6	7	8 (pulse width according to D 6)			
Value [Hz]	28	112,5	900	1800	3600	3	5	11	18

Two-wire current pulses

Pulse simulation has an effect only on the scaled pulse output. Pulse width must be set to 150 ms (3Hz).

5.7.1 Low-Flow Cutoff

Below the programmed lower range value (Qmin), the output variable is set to zero (0) , i.e., the current output decreases to 4 mA for analog operation, and the pulse output is switched off for pulse operation.

Low-flow cutoff can be deactivated for special applications (e.g. pulse output for test purposes).

Set function switch D 2 to 0 (OFF).

5.8 Unit Selection (Channel 10)

5.8.1 Standard Units

You can select the desired unit with Channel 10.

Setting	0	1	2	3	4	5	6	7	8	9	10
Unit	ℓ/s	ℓ/min	ℓ/h	m³/s	m³/min	m³/h	ft³/s	ft³/min	ft³/h	Impgal/s	Impgal/min

Setting	11	12	13	14	15	16	17
Unit	Impgal/h	gal/s	gal/min	gal/h	USER	kg/h	t/h

5.8.2 Special Units

In order to activate this function, you must set channel 10 to the USER unit (15). With channel 29 or 30 you can set the factors with which the process values can be converted to any unit or display value. If the default setting is active, the conversion factors in channel 29 and 30 are set to 1, i.e., the value is displayed in the previously valid units (e.g. in m³ or m³/h).
The value range of these factors is: $0.0001 \leq F \leq 99990$.

Caution: The counter must first be configured for the required operating volume measuring range with the units [m³/h].

The basic units (m³ or m³/h) are to be included for the calculation of the conversion factors to the desired display value.

Note: The maximum flow rate must not exceed a number of 99990.

5.8.2.1 Flow Rate Factor (Channel 29)

With channel 29 you set the conversion factors for the flow rate display.

Example 1: Converting standard volume flow rate for the unit [m³/h]

Flow rate factor

$$F_D = \frac{\rho_B}{\rho_N}$$

kg/m³

ρ B: Operating density, e.g. ρ_B = 7.00

ρ N: Standard density, e.g. ρ_N = 1.28 kg/m³

$$F_D = \frac{7.00}{1.28} = 5.4689$$

Example 2: Converting the standard volume flow rate for the unit [yard³ / d], for ρ_B / ρ_N = 6.0000

Flow rate factor

$$F_D = \frac{\rho_B}{\rho_N} \cdot \frac{x}{y}$$

x: Conversion factor for volume unit
e.g. 1 m³ = 1.30795 yard³, i.e.
x= 1.30795

y: Conversion factor for time unit
e.g. 1 h = 1 / 24 d, i.e.
y= 1 / 24

thus the flow rate factor is calculated

$$F_D = 6 \cdot \frac{1.30795}{1/24} = 188.34$$

5.8.2.2 Volume Factor (Channel 30)

With Channel 30 you set the conversion factors for volume measurement.

Example 1: Conversion to standard volume for the unit [m³]

Volume factor

$$F_V = \frac{\rho_B}{\rho_N}$$

$$F_V = \frac{7.00}{1.28} = 5.4689$$

Example 2: Conversion to standard volume for the unit [yard³], where $\rho_B / \rho_N = 6.000$

Volume factor:

$$F_V = \frac{\rho_B}{\rho_N} \cdot x$$

F_V = 6 x 1.30795 = 7.8477

x: Conversion factor for volume unit
e.g. 1 m³ = 1.30795 yard³, d. h.
x =1,30795

5.8.2.3 Pulse Ratio Factor (Channel 31)

With the factor (F_I) that can be set with Channel 31 the magnitude of counter increment (display) $W_{zähl}$ and pulse output (NAMUR and current pulses) W_{puls} can be set differently. For the standard setting, the factor is 1, i.e. the significance of counter increment and pulse output are identical.

$$W_{puls} = F_I \bullet W_{zäh}$$

Example:

F_I = 10 Results in a transformation of the scaled pulse output to ten times as much as the counter increment, i.e., the pulse output is ten times faster.

Caution: Observe the limit value for the maximum frequency of the pulse output (see Table 4.4).

F_I = 0.1 Results in a reduction of the scaled pulse output to one 10th of the counter increment, i.e., the pulse output is ten times slower.

The value range of this factor is: 0.0001 ≤ factor ≤ 99999

5.9.1 Device Data (Channel 8)

The k factor is a device constant that is calculated for each device through a factory calibration.

The value is entered in [pulses/ℓ] for DN 15 to DN 80

in [pulses/m³] for DN 100 to DN 250

The measuring range table lists the mean values for the individual nominal size.

5.10.1 Nominal Size (Channel 11)

When you exchange the electronics, the nominal size must be set as follows:

Entry		015	025	040	050	080	100	150	200	250
DN	DIN	15	25	40	50	80	100	150	200	250
	In.	½	1	1 ½	2	3	4	6	8	10

5.11.1 Medium (Channel 12)

The medium determines the limit values of the measuring range (see measuring range table) and the automatic gain and filter settings of the electronics.

The setting is made in three classes.

Setting	0	1	2
Medium	Gas	Liquid	Steam

5.12.1 Density (Channel 13)

Here you must enter the (minimum) operating density of the medium. With this density, apart from the effect on the automatic amplifier and filter setting, the conversion is performed with respect to the standard mass unit that may have been selected.

The operating density must be entered in the unit [kg/m³].

5.13.1 Amplifier Limiter (Channel 22)

The optimum settings for the intended operating conditions are factory-preset.

However, periodic pulsations or vibrations of the pipe may generate unwanted signals, and a flow rate is displayed in spite of the fact that the flow rate is zero.
With the setting in Channel 22 you can limit the amplifier gain in selectable levels. Thus the device can be adjusted to the corresponding operating conditions.
A lower gain stage means lower gain. In this way the sensitivity to disturbances can be reduced when the flow rate is zero.

Stage	0	1	2	3	4	5	6
Gain factor	1	2	4	8	16	32	64

Caution: If the stage number is too low, the measuring range may be restricted at low flow rates. During operation the currently active gains stage is displayed, not the limit.

5.14.1 Sensor Comparing Function (Channel 34)

This function contains a calibration value for suppressing inferences. It serves the purposes of symmetry alignment between the two sensor circuits. When changing the preamplifier stage, the sensor comparing function should also be aligned.

5.15.1 Status Information (Channel 17)

Channel 17 displays the current status of the device. If a fault is detected, it will be displayed in the status channel. You clear the fault by acknowledging it by shifting. If the same message is displayed again, it is valid.

Code no.	Meaning
001	Changing the operating data after automatic setting
002	Performing settings manually
003	Flow rate below Q_{min}
004	Flow rate is in low-flow operation (90 to 100%)
005	Incorrect filter
006	No valid data in the EEPROM
010	Incorrect data in Channel 0
011 ↓ 046	Incorrect data in Channel 1 ↓ Incorrect data in Channel 35
050	Data entry via interface does not function properly
051	Incorrect measuring range
060	Incorrect unit of measurement
100	Storage error (alarm 21.8 mA)

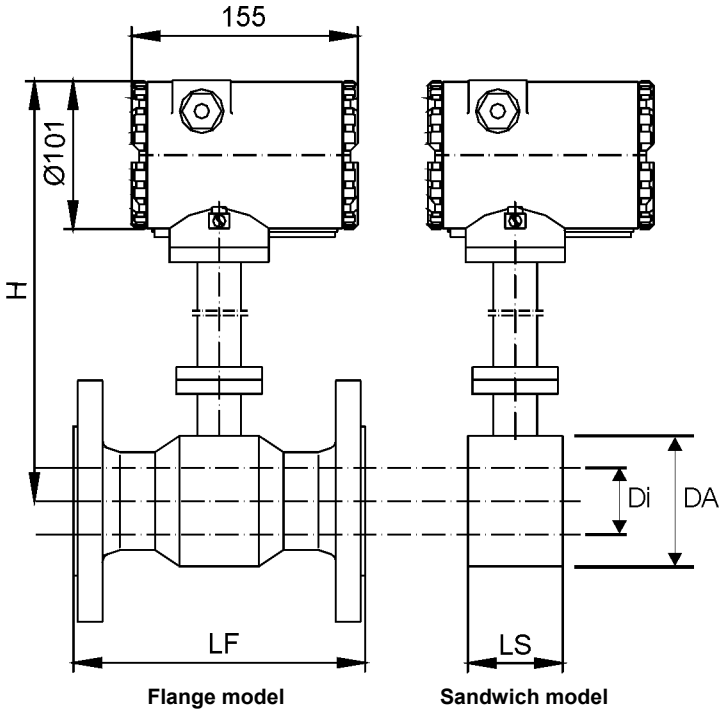
6. Dimensions and Weights

6.1 Dimensions of the Various Models

6.1.1 Types/Dimensions

Pressure rating: PN 40 / Class 300						
DN		DA [mm]	Di [mm]	H [mm]	LS [mm] Sandwich	LF [mm] Flange
DIN	Inches					
15	½“	95	16	335	65	200
25	1“	67	27	330	65	200
40	1½“	85	41,5	340	65	200
50	2“	105	53	340	65	200
80	3“	136	80	355	65	200
100	4“	164	103	370	65	250
150	6“	220	154	395	90	300
200	8“	275	202	425	120	300
250	1 0“	330	253	440	140	380
300	12“	380	303	465	160	450

Other nominal widths upon request.



Flange model **Sandwich model**

6.1.2 Weight

DN		Weight sandwich model	Weight flange model
DIN	ANSI	[kg]	[kg]
15	½"	2.0	4.5
25	1"	2.5	7
40	1 1/2"	3.0	10
50	2"	3.5	12
80	3"	9.5	26
100	4"	12.5	38
150	6"	20.5	
200	8"	30.5	
250	10"	40.5	
300	12"		

7. Specifications

7.1 Material

Sensor: stainless steel 1.4404 and 3.1B certificate
Housing with bluff body: stainless steel 1.4404 and 3.1B certificate
Seals: viton and graphite
(other materials upon request)

Electronics housing: die-cast aluminum

7.2 Process Connection

Sandwich: DN 15 to DN 300 and PN 10 to PN 40 (PN 100 upon request)
½“ – 12“ Class 150 and Class 300 (Class 600 upon request)
Flange: DN 15 to DN 300 and PN 10 to PN 40 (PN 100 upon request)
½“ – 12“ Class 150 and Class 300 (Class 600 upon request)

Larger nominal sizes and pressure stages upon request.

7.3 Environmental Conditions

Exposure of the electronics housing to sudden temperature changes must be avoided.

7.3.1 Ambient Temperature

-40° C to +60° C
Operation of the LC display is only ensured down to -10° C.

7.3.2 Storage Temperature

-40° C to +60° C

7.3.3 Climatic Category

Class DIEC 654-1

7.3.4 Degree of Protection

IP67 IEC 529 / EN 60529

7.3.5 Electromagnetic Compatibility

According to EMC guidelines 2004/108/EG, DIN EN 61000-6-2; DIN EN 61000-6-3
as well as NAMUR NE 21

Electromagnetic compatibility is only ensured when the electronics housing is closed.
When the electronics housing is open, the device may malfunction due to electromagnetic signal pickup
(see Chapter 4.2 Connecting the VTX 2).

7.4 Process Conditions

7.4.1 Media Temperature

-40°C to 260°C standard
up to 450°C for custom versions
The temperature categories for category II media are given in the following table:

Temperature category	Media temperature	Ambient temperature range (electronics housing)
T1	up to +450 °C	-40 °C < Ta < + 60 °C
T2	up to +300 °C	-40 °C < Ta < + 60 °C
T3	up to +200 °C	-40 °C < Ta < + 60 °C
T4	up to +135 °C	-40 °C < Ta < + 60 °C
T5	up to +100 °C	-40 °C < Ta < + 60 °C
T6	up to +85 °C	-40 °C < Ta < + 60 °C

The temperature categories for category I/II media are given in the following table:

Temperature category	Media temperature	Ambient temperature range (electronics housing)
T4	-20 °C to +60 °C	-40 °C < Ta < + 60 °C
T5	-20 °C to +60 °C	-40 °C < Ta < + 60 °C
T6	-20 °C to +60 °C	-40 °C < Ta < + 60 °C

The process pressure for the media must, in the case of category I media, range between 0.8 bar and 1.1 bar.

7.4.2 State of Aggregation

Liquids, gases, and steam

7.4.3 Viscosity

Viscosity limits the linear measuring range for which the error limits (measured error) are valid.

Linearity limit $Q_{Lin} = 2.826 \cdot D \cdot \mathrm{Re} \cdot \nu$

D = inside diameter [mm]
Re = Reynolds Number (limit value)
ν = dynamic viscosity [m²/s]

7.4.4 Media Pressure Limit

Depends on the design.

7.4.5 Flow Rate Limit

The max. velocity for gases and steam is about 80 m/s, and for liquids about 10 m/s. In the case of liquids the cavitation limit needs to be observed in addition.

For gases having a density < 1.2kg/m³ the lower limit for the measurements can be calculated from

$$Q_{\min} = 1.1 \frac{Q_L}{\sqrt{\rho_B}}$$

Q_L = lower flow limit for air [m³/h] (see Table 1 chapter 2.4)

The limit for linearity will depend on viscosity and is for a Reynolds number of Re=20000 (see 7.4.3). This can be checked using the following equation: $Q_{Lin} = 2.826 \cdot D \cdot \mathrm{Re} \cdot \nu$

7.4.6 Pressure Loss

Pressure loss can be calculated using the following equation:

$$\Delta p = 1400 \cdot \rho_B \cdot \frac{Q_B^2}{DN^4} \text{ [mbar]}$$

where
ρ_B = Operating density [kg/m^3]
Q_B = Operating flow rate [m^3/h]
DN = Nominal size [mm].

The results obtained will represent a rough estimate.

Example: DN 100 ; Q_B = 230 m^3/h ; ρ_B = 7.1 kg/m^3
(saturated steam at 14 bar)

$\Delta p = 1400 \times 7{,}1 \times 230^2/100^4 = 5{,}25$ mbar

Remark: see Annex
- Table for saturated steam
- Approximate calculation for determining operating density
- Gas constants (R_i table)

7.4.7 Cavitation in Liquids

When running measurements on liquids, the effect of cavitation within the vortex meter **must** be avoided. For this it must be ensured by design that the pressure downstream of the vortex meter can **not** drop below the vapour pressure for the liquid used.
At an approximate back pressure given below, cavitation can be avoided.

$$\mathbf{p_{min} \geq 2.8 \times \Delta p + 1.3 \times p_v}$$

where p_{min} = Minimum pressure in the pipe
Δp = Pressure loss
$\Delta p = 1400 \times \rho_B \times (Q_B^2 / DN^4)$
p_v = Vapour pressure of the liquid being measured under operating conditions

Example: DN 80; water of 20°C ; $\rightarrow$ Q = 108 m^3/h
$\Delta p_{VTX\,2} = 1400 \times 998.3 \times (108^2 / 80^4) \quad \rightarrow \Delta p_{VTX\,2} = 398$ mbar
$p_v = 0.02337$ bar (from VDO table for water vapour)

$\Rightarrow \quad p_{min} \geq 2.8 \times 0.40 + 1.3 \times 0.02337 = 1.15$ bar

Thus for a VTX 2 DN 80 (water, 20°C, Q_B = 108 m³/h) a pressure over 1.15 bar is required so as to avoid cavitation.

Remark: see table in the Annex: density and vapour pressure of water.

7.5 Characteristic Values

7.5.1 Reference Conditions

According to IEC 770: 20°C, 65% relative humidity, 101.3 kPa

7.5.2 Measured Error (Accuracy)

	Re ≥ 20,000	10,000 < Re ≤ 20,000
Gas/steam	± 0,9 % of measured value	± 0,9 % of upper value (for Re = 20,000)
Liquids	± 0,6 % of measured value	± 0,6 % of upper value (for Re = 20,000)

Values for measuring under reference conditions

7.5.3 Repeatability

± 0.15 % of measured value

7.6 Certificates Approvals and Standards

CE mark

DMT 99 ATEX E 078 X ⟨Ex⟩ II 1/2G EEx ia IIC T6

EMC in accordance with directive 2004/108/EG, DIN EN 61000-6-2; DIN EN 61000-6-3, as well as NAMUR NE 21

Type of protection for the housing: EN 60529

NAMUR: EN 60947-5-6

Equipment safety: EN 61010

Explosion protection: EN 60079-0, EN 60079-11

Pressurised equipment directive: 97/23/EG

8. VTX 2 Configuration Data Sheet

Channel No.	Denomination	Setting									
	Customer										
	Order no.										
	Serial no.										
	Tag no. (meas. point no.)										
	Type (model code)										
	Nominal flow rate	Liquid m³/h						Gas m³/h			
	Nominal pressure										
6	Upper range value	Q_{max}	□ m³/h					□			
7	Lower range value	Q_{min}	□ m³/h					□			
8	k factor	**up to DN 80** pulses/ℓ						**from DN 100** pulses/m³			
9	Pulse value factor Z	□ 0.01	□ 0.1	□ 1	□ 10	□ 100					
	Meter factor	1 pulse ≙				1 counter increment ≙					
10	Units	**□0**	**□1**	**□2**	**□3**	**□4**	**□5**	**□6**	**□7**	**□8**	**□9**
		ℓ/s	**ℓ/min**	**ℓ/h**	**m³/s**	**m³/min**	**m³/h**	**ft³/s**	**ft³/min**	**ft³/h**	**Impgal/s**
		□10	**□11**	**□12**	**□13**	**□14**	**□15**	**□16**	**□17**		
		Impgal/min	**Impgal/h**	**gal/s**	**gal/min**	**gal/h**	**USER**	**kg/h**	**t/h**		
11	Nominal size DN		**□ 015**	**□ 025**	**□ 040**	**□ 050**	**□ 080**	**□ 100**	**□ 150**	**□ 200**	**□ 250**	**□ 300**
		□ DIN	**15**	**25**	**40**	**50**	**80**	**100**	**150**	**200**	**250**	**300**
		□ In.	**½“**	**1“**	**1½“**	**2“**	**3“**	**4“**	**6“**	**8“**	**10"**	**12"**
12	Medium	□ 0 Gas			□ 1 Liquid				□ 2 Steam		
13	Operating density	ρ_{min} = □ kg/m³									
14	Damping	(from 1 to 200)									
16	2-wire current loop	**□ 0 4mA = 0**			**□ 3 4mA = Q_{min}**			**□ 2 Original vortex pulses**		**□ 1 Scaled pulses**	
29	Flow rate factor	F_D	□ 1					□ .			
30	Volume factor	F_V	□ 1					□ .			
31	Pulse ratio factor	F_J	□ 1					□ .			
D5	NAMUR pulse output	**□ 0 OFF**			**□ 1 Original vortex frequ.**				**□ 2 Scaled pulses**		
D5	Pulse width	**□ 0 150ms/3Hz**			**□ 1 100ms/5Hz**			**□ 2 45ms/11Hz**		**□ 3 28ms/18Hz**	
	E-series no./date										

9. Approximate Calculation for Determining the Density of Gas and Superheated Steam

$\rho = p / (R_i \times T)$ [kg/m³]

where	ρ	=	Operating density	[kg/m³]
	p	=	Operating pressure (abs.)	[N/m²] resp. [Pa]
	R_i	=	Specific gas constant	[Nm/kgK]
	T	=	Operating temperature	[K]

Example: Medium air; 5 bar; t = 20°C

$\rho = (5 \times 10^5) / (260 \times 293.15)$
$\rho = 6.56$ kg/m³

Specific gas constant R_i	
Type of gas	R_i in [Nm/(kg x K)]
Argon (Ar)	208
Acetylene (C_2H_2)	320
Ammonia (NH_3)	488
Helium (He)	2078
Carbondioxide (CO_2)	189
Carbonmonoxide (CO)	297
Air	287
Methane (CH_4)	519
Oxygen (O_2)	260
Nitrogen (N_2)	297
Water vapour (H_2O)	462
Hydrogen (H_2)	4158

Specific gas constants of some gases

10. Tables

State quantities of water and steam

Pressure (abs.)	Boiling temperature	Steam density
p [bar]	t_s [°C]	ρ_s [kg/m³]
0.30	69.12	0.1912
0.40	75.89	0.2504
0.60	85.95	0.3660
0.80	93.51	0.4792
1.0	99.63	0.5905
1.2	104.81	0.7003
1.6	131.32	0.9167
2.0	120.23	1.130
3.0	133.54	1.652
3.4	137.86	1.858
4.0	143.63	2.164
4.5	147.92	2.417
5.0	151.85	2.669
6.0	158.84	3.170
7.0	164.06	3.667
8.0	170.41	4.161
9.0	175.36	4.654
10	179.88	5.114
11	184.06	5.634
12	187.96	6.123
13	191.60	6.612
14	195.04	7.100
15	198.28	7.580
16	201.37	8.077
17	204.30	8.566
18	207.11	9.056
19	209.79	9.546
20	212.37	10.04
22	217.24	11.02
26	226.03	13.00
30	233.84	15.00
34	240.88	17.02
38	247.31	19.07
40	250.33	20.11

Density and vapour pressure of water

T °C	P_d bar	ρ kg/m³
0	0.00611	999.8
1	0.00657	999.9
2	0.00706	999.9
3	0.00758	999.9
4	0.00813	1000
5	0.00872	1000
6	0.00935	1000
7	0.01001	999.9
8	0.01072	999.9
9	0.01147	999.8
10	0.01227	999.7
11	0.01312	999.7
12	0.01401	999.6
13	0.01497	999.4
14	0.01597	999.3
15	0.01704	999.2
16	0.01817	999.0
17	0.01936	998.8
18	0.02062	998.7
19	0.02196	998.5
20	0.02337	998.3
21	0.02485	998.1
22	0.02642	997.8
23	0.02808	997.6
24	0.02982	997.4
25	0.03166	997.1
26	0.03360	996.8
27	0.03564	996.6
28	0.03778	996.3
29	0.04004	996.0
30	0.04241	995.7
31	0.04491	995.4
32	0.04753	995.1
33	0.05029	994.7
34	0.05318	994.4
35	0.05622	994.0
36	0.05940	993.7
37	0.06274	993.3
38	0.06624	993.0
39	0.06991	992.7
40	0.07375	992.3
41	0.07777	991.9
42	0.08198	991.5
43	0.08639	991.1
44	0.09100	990.7
45	0.09582	990.2
46	0.10086	989.8
47	0.10612	989.4
48	0.11162	988.9
49	0.11736	988.4
50	0.12335	988.0
51	0.12961	987.6
52	0.13613	987.1
53	0.14293	986.6
54	0.15002	986.2
55	0.15741	985.7
56	0.16511	985.2
57	0.17313	984.6
58	0.18147	984.2
59	0.19016	983.7
60	0.19920	983.2
61	0.2086	982.6
62	0.2184	982.1
63	0.2286	981.6
64	0.2391	981.1
65	0.2501	980.5
66	0.2615	979.9
67	0.2733	979.3
68	0.2856	978.8
69	0.2984	978.2
70	0.3116	977.7
71	0.3253	977.0
72	0.3396	976.5
73	0.3543	976.0
74	0.3696	975.3
75	0.3855	974.8
76	0.4019	974.1
77	0.4189	973.5
78	0.4365	972.9
79	0.4547	972.3
80	0.4736	971.6
81	0.4931	971.0
82	0.5133	970.4
83	0.5342	969.7
84	0.5557	969.1
85	0.5780	968.4
86	0.6011	967.8
87	0.6249	967.1
88	0.6495	966.5
89	0.6749	965.8
90	0.7011	965.2
91	0.7281	964.4
92	0.7561	963.8
93	0.7849	963.0
94	0.8146	962.4
95	0.8453	961.6
96	0.8769	961.0
97	0.9094	960.2
98	0.9430	959.6
99	0.9776	958.6
100	1.0133	958.1
102	1.0878	956.7
104	1.1668	955.2
106	1.2504	953.7
108	1.3390	952.2
110	1.4327	950.7
112	1.5316	949.1
114	1.6362	947.6
116	1.7465	946.0
118	1.8628	944.5
120	1.9854	942.9
122	2.1145	941.2
124	2.2504	939.6
126	2.3933	937.9
128	2.5435	936.2
130	2.7013	934.6
132	2.8670	932.8
134	3.041	931.1
136	3.223	929.4
138	3.414	927.6
140	3.614	925.8
145	4.155	921.4
150	4.760	916.8
155	5.433	912.1
160	6.181	907.3
165	7.008	902.4
170	7.920	897.3
175	8.924	892.1
180	10.027	886.9
185	11.233	881.5
190	12.551	876.0
195	13.987	870.4
200	15.55	864.7
205	17.243	858.8
210	19.077	852.8
215	21.060	846.7
220	23.198	840.3
225	25.501	833.9
230	27.976	827.3
235	30.632	820.5
240	33.478	813.6
245	36.523	806.5
250	39.776	799.2
255	43.246	791.6
260	46.943	783.9
265	50.877	775.9
270	55.058	767.8
275	59.496	759.3
280	64.202	750.5
285	69.186	741.5
290	74.461	732.1
295	80.037	722.3
300	85.927	712.2
305	92.144	701.7
310	98.700	690.6
315	105.61	679.1
320	112.89	666.9
325	120.56	654.1
330	128.63	640.4
340	146.05	610.2
350	165.35	574.3
360	186.75	527.5
370	210.54	451.8
374.15	221.2	315.4

11. Certificate of Non-Objection for Contractor

Unbedenklichkeitsbescheinigung für Auftragnehmer
Certificate of non-objection for contractor
Fiche de Renseignements

Kunde / Client / Client :

.....

Auftragsnr. / Lieferschein : Order No. : / Delivery note : No. d' ordre / Bordereau de livraison :	Datum : Date : Date :	
.....	.....	....

Auftragstext / Order text / Caractéristiques:		
.....	.....	.....
.....	.....	.....

ATTENTION – GEFAHREN – HINWEISE – ATTENTION

Letzter Stoff / Last medium / Dernier liquide mesuré:	Eigenschaften angeben! z.B. ätzend, brennbar, giftig State characteristics! i.e. corrosive, flammable, toxic Identification des dangers! p.e. corrosif, inflammable, toxique
Gerät entleert / Unit drained / Vidangé complètement ? ja / yes / oui □ □ nein / no / non	.....
Spülung mit / drained with / liquide de rinçage :	.....
Restverschmutzung / rest of medium / impuretés restantes? ja / yes / oui □ □ nein / no / non	.....

SCHUTZMASSNAHMEN – PROTECTION MEASURES- MESURES DE PROTECTION

Schutzmaßnahmen/protection measures/mesures de protection	ja / yes / oui □	□ nein / no / non
Handschuhe / gloves / gants	□	□
Schutzanzug / protection suit/ tenue de sécurité	□	□
Gestellbrille / eye glasses/ lunettes	□	□
Korbbrille und Gesichtsschutz / Glasses with face protection/ Lunettes avec protection du visage	□	□
Atemschutz / respirator / appareil respiratoire	□	□
Mit Absaugung arbeiten / extractor cowl / travailler sous hotte aspirante	□	□
Besondere Schutzmaßnahmen / special protection / mesures de protection Particulières	□	□
Bite angeben / please state / à préciser :	.....	

Beauftragter / Mandatory / Mandataire: Name in Druckbuchstaben/name in printed letters/nom en lettres capitales	
Ort und Datum / place and date / lieu et date:	Unterschrift / signature / signature: .....

12. Certificates

12.1 EC-Model Design Certificate DMT 99 ATEX E 078 X (Dec. 1999)

12.2 EC- Model Design Certificate Modul B Guideline 97/23/EG (July 2005)

12.3 EC-Conformity declaration (Aug. 2013)

Translation

DMT

(1) # EC-Type Examination Certificate

(2) **- Directive 94/9/EC -**
Equipment and protective systems intended for use in potentially explosive atmospheres

(3) ## DMT 99 ATEX E 078 X

(4) **Equipment:** **Vortex flowmeter type VTX1... / VTX2...**

(5) **Manufacturer:** **Bopp & Reuther Messtechnik GmbH**

(6) **Address:** **68261 Mannheim**

(7) The design and construction of this equipment and of any approved variations are specified in the schedule to this type test certificate.

(8) The certification body of Deutsche Montan Technologie GmbH, notified body no. 0158 in accordance with Article 9 of the Directive 94/9/EC of the European Parliament and the Council of 23 March 1994, certifies that the equipment has been found to comply with the essential health and safety requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.
The examination and test results are recorded in confidential test and assessment report BVS PP 99.2076 EG.

(9) The Essential Health and Safety Requirements are assured by compliance with

EN 50014:1997	General requirements
EN 50020:1994 (VDE 0170/0171 Part 7/4.96)	Intrinsic safety 'i'
EN 50284:1999	Electrical apparatus in Group II Category 1G

(10) If an "X" is placed after the certificate number it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC type test certificate relates only to the design and construction of the described equipment. Further requirements of Directive 94/9/EC apply to the manufacture and placing on the market of this equipment.

(12) The marking of the equipment shall include the following:

Ex II 1/2G EEx ia IIC T6

Deutsche Montan Technologie GmbH
Essen, 16.12.99

Signed: Dr. Jockers
DMT-Certification Body

Signed: Dr. Dill
Head of Special Services Unit

Am Technologiepark 1, 45307 Essen, Telephone (0201)172-1416, Telefax (0201)172-1716

(13) Schedule to

(14) # EC-Type Examination Certificate

DMT 99 ATEX E 078 X

(15) 15.1 Type explanation for vortex flowmeter type VTX1... / VTX2...

15.1.1 Type VTX1... : vortex flowmeter with paddle sensor
15.1.2 Type VTX2... : vortex flowmeter with tandem sensor

(In the complete name, the dots are replaced by letters and/or digits for marking details of the design that are not relevant to explosion-protection.)

15.2 Description

The vortex flowmeter type VTX1... or type VTX2... is a flow meter supplied by an intrinsically safe power supply and is used for continuous measurements of gaseous media or liquids in pipelines in potentially explosive atmospheres that require the use of apparatus in categories 1/2G.

The vortex flowmeter consists of a cylindrical light-metal enclosure (electronic enclosure) sealed with threaded covers which contains insulating boards with electronic components embedded in casting compound.

There is an LCD display below one cover, which may be fitted optionally with an inspection glass, and below the other cover are the terminals for the intrinsically safe supply and signal circuits.

The flow sensor is incorporated in a stainless steel measuring chamber designed as a meter enclosure. For the purposes of thermal decoupling the measuring chamber is placed away from the electronic enclosure by means of a spacing tube.

The electronic enclosure is installed in potentially explosive atmospheres that require Category 2 apparatus. The process connection elements of the measuring chamber are integrated in a pipe which separates atmospheres that require apparatus in Categories 1 or 2 respectively.

15.3 Electrical, mechanical and thermal parameters

15.3.1 2-conductor supply and signal circuit (4 -20 mA current loop)
Terminals 1 /2

Voltage	U_i	=	DC	30 V
Current	I_i	=		110 mA
Power	P_i	=		825 mW
Effective internal capacitance	C_i	≤		11 nF
Effective internal inductance	L_i	≤		4 µH

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15.3.2 2-conductor signal circuit (NAMUR impulses)
(Frequency signal output in accordance with NAMUR protocol; galvanically separated from 2-conductor supply and signal circuit)

Terminals 3 /4

Voltage	U_i	=	DC	20 V
Current	I_i	=		50 mA
Power	P_i	=		160 mW
Effective internal capacitance	C_i	≤		11 nF
Effective internal inductance	L_i	≤		4 µH

15.3.3 Permitted ambient temperature range for the electronics enclosure - 40°C ≤ Ta ≤ + 70°C
Permitted medium temperature range for the measuring chamber - 40°C ≤ Ta ≤ +450°C

15.3.3.1 The allocation between temperature class, medium and ambient temperature when the vortex flowmeter is used in potentially explosive atmospheres that require Category 2 apparatus may be seen in the following table:

Temperature class	Medium temperature	Ambient temperature range (electronics enclosure)
T1	up to + 450°C	-40°C < Ta < + 70°C
T2	up to + 300°C	-40°C < Ta < + 70°C
T3	up to + 200°C	-40°C < Ta < + 70°C
T4	up to + 135°C	-40°C < Ta < + 70°C
T5	up to + 100°C	-40°C < Ta < + 70°C
T6	up to + 85°C	-40°C < Ta < + 70°C

15.3.3.2 The allocation between temperature class, medium and ambient temperature when the vortex flowmeter is used in potentially explosive atmospheres that require Category 1/2 apparatus may be seen in the following table:

Temperature class	Medium temperature	Ambient temperature range (electronics enclosure)
T4	-20°C up to + 60°C	-40°C < Ta < + 70°C
T5	-20°C up to + 60°C	-40°C < Ta < + 70°C
T6	-20°C up to + 60°C	-40°C < Ta < + 70°C

With apparatus in Category 1 the process pressure must be between 0.8 bar ...1.1 bar

The conditions for use in operations without potentially explosive mixtures can be seen in the technical information.

(16) Test report
No. BVS PP 99.2076 EG
33 pages

Am Technologiepark 1, 45307 Essen, Telephone (0201)172-1416, Telefax (0201)172-1716

(17) Special provisions for safe use

17.1 The measuring chamber of the vortex flowmeter must be installed in the pipe in such a way that degree of protection IP 67 in accordance with IEC Publication 529 is guaranteed.

17.2 The manufacturer's technical information on using the vortex flowmeter in connection with aggressive or corrosive media must be observed.

17.3 The measuring chamber of the vortex flowmeter must be included in the equipotential bonding of the pipeline.

17.4 Sudden temperature changes of the electronics enclosure of the vortex flowmeter must be avoided.

We confirm the correctness of the translation from the German original.
In the case of arbitration only the German wording shall be valid and binding.

45307 Essen, 15.03.2000
BVS-Scha/Loh A 9900439

Deutsche Montan Technologie GmbH

Head of certification body

Head of special services unit

Am Technologiepark 1, 45307 Essen, Telephone (0201)172-1416, Telefax (0201)172-1716

ZERTIFIKAT ◆ CERTIFICATE ◆ 認証証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

TÜV SÜD
Industrie Service

TÜV CERT

ZERTIFIKAT
Certificate

EG-Baumusterprüfung (Modul B) nach Richtlinie 97/23/EG
EC Type-examination (Module B) according to Directive 97/23/EC

Zertifikat-Nr.: IS-DDB-MAN-05-01-13461050-004
Certificate No.:

Name und Anschrift des Herstellers:
Name and postal address of manufacturer:

Bopp & Reuther Messtechnik GmbH
Am Neuen Rheinhafen 4
D-67346 Speyer

Hiermit wird bescheinigt, daß das unten genannte EG-Baumuster die Anforderungen der Richtlinie 97/23/EG erfüllt.
We herewith certify that the type mentioned below meets the requirements of the Directive 97/23/EC.

Prüfbericht Nr.:
Test report No.:

BB-DDB-MAN-P-02-05-13461050-486

Geltungsbereich:
Scope of examination:

Wirbeldurchflussmesser der Baureihe / Vortex flowmeter VTX2

Fertigungsstätte:
Manufacturing plant:

Bopp & Reuther Messtechnik GmbH
Am Neuen Rheinhafen 4
D-67346 Speyer

TÜV Industrie Service GmbH
TÜV SÜD Gruppe
TÜV-CERT-Zertifizierungsstelle für Druckgeräte

Mannheim, 25. Juli 2005
(Ort, Datum)
(Place, date)

(Dr.-Ing. M. Arras)
Benannte Stelle, Kennnummer 0036
Notified Body, No. 0036

Bitte beachten Sie die Hinweise auf der zweiten Seite.
Please note the remarks on the second page..

TÜV Industrie Service GmbH
TÜV SÜD Gruppe
Abteilung Druckbehälter
Dudenstraße 28
D-68167 Mannheim

Tel.: (06 21) 395-257
Fax: (06 21) 395-495
www.tuev-sued.de

Mitglied der
CONFÉDERATION EUROPÉEN
CEOC
D'ORGANISMES DE CONTROLE

BOPP & REUTHER
MESSTECHNIK

EG-Konformitätserklärung
EC-Conformity declaration
Déclaration de conformité CE

- Hiermit erklären wir, Bopp & Reuther Messtechnik GmbH, Am Neuen Rheinhafen 4, 67346 SPEYER dass die nachfolgend bezeichnete Baueinheit aufgrund ihrer Konzipierung und Bauart sowie in der von uns in Verkehr gebrachten Ausführung den einschlägigen grundlegenden Sicherheits- und Gesundheitsanforderungen der zutreffenden EG-Richtlinien entspricht.
Bei einer nicht mit uns abgestimmten Änderung der Baueinheit verliert diese Erklärung ihre Gültigkeit.
- We Bopp & Reuther Messtechnik GmbH, Am Neuen Rheinhafen 4, 67346 SPEYER, herewith confirm that the unit mentioned below complies with the basic safety and health requirements of the relevant EC directives concerning design, construction and putting the model into circulation. This declaration is no longer valid if the unit is modified without our agreement.
- Par la présente, nous, Bopp & Reuther Messtechnik GmbH, Am Neuen Rheinhafen 4, 67346 SPEYER, déclarons que les appareils décrits ci-dessous, en raison de leur conception et de leur construction ainsi que sous la forme sous laquelle nous les commercialisons, correspondent aux exigences de sécurité et de santé publique conformément à la réglementation CE qui les concerne. Toute modification des appareils sans notre accord entraine la perte de validité de cette déclaration de conformité.

- Bezeichnung der Baueinheit /
Description of the unit /
Description de l'équipement

Wirbelzähler VTX2
Vortex Meter VTX2
Débitmètre Vortex VTX2

Mögliche Anbaugeräte/ possible add. units/ equip. complém. possib.	Ex - (ATEX 95 - 94/9/EG)							EMV (EMC) 2004/108/EG	
	EN 60079			EN 1127	Nr.			EN 61000	
Transmitter	-0	-1	-11	-1	Notif. Body	Certificate Nr.	Marking	-6-2	-6-3
VTX-I	x		x	x	158	DMT 99 ATEX E 078 X	II 1/2G EEx ia IIC T6	x	x
VTX-X	x	x	x	x	158	BVS 04 ATEX E 021 X	II 2G EEx d [ib] IIC T4	x	x

DMT = BVS (see Nr. Notif. Body) = DEKRA EXAM GmbH, Dinnendahlstraße 9, 44809 Bochum - www.dekra-exam.eu

Angaben bezüglich Druckgeräte Richtlinie 97/23/EG / Parameters concerning PED 97/23/EC / Paramètres concernant la DESP 97/23/EC:

- Klassifizierung / Classification / Classification — **Rohrleitungsteil** / Pipe/ Tuyauterie

- Fluid Kategorie / Fluid category / Dangerosité du fluide — **Gruppe** / Group / Groupe **1**

- Diagramm / Diagramm / Tableau — **II / 6**

- Angewandte Kategorie / Category beeing used / Catégorie de risque appliquée — **III** (DN > 25) **§3, Abs. 3 (DN ≤ 25)**

- **Benannte Stelle** / notified Body / Organisme Notifié — 0036

- Folgende Richtlinien sind bei der vorliegende Baueinheiten nicht Anwendbar / the following directives do not apply to the above equipment / les directives suivantes ne s'appliquent pas à ces équipements:
2006/42/CE (MD), 2006/95/CE (LVD)

- Angewandten Normen oder technische Spezifikationen / Applied standards or technical rules / Normes ou spécifications techniques employées: EN 10213-1, AD-Merkblätter

Dr. J.Ph. Herzog
Geschäftsführung / Managing Director

i.A. D. Fiebig
CE-Ex-Beauftragter / CE-Ex-Authorized-Person