VORTEX-VT

Vortex Flowmeter
VORTEX-VT
10VT1000 / 10VR1000
EEx 10VT1000, EEx 10VR1000

Valid for Software Levels 50VT1000
D699B151U01 B.10 and higher

Instruction Bulletin

D184B087U02 Rev. 00 / 12.2000

CE

ABB

You have purchased a high quality, modern instrument from Bailey-Fischer & Porter. We thank you for your purchase and the confidence you have shown in us..

The information contained herein includes instructions for the assembly and installation and the specifications for the instrument. Bailey-Fischer & Porter reserves the right to make hardware and software refinements which may not be reflected in this manual without prior notice. Any questions which may arise that are not specifically answered by these instructions should be directed to Bailey-Fischer & Porter at out main plant in Göttingen, Germany or to one of our Technical Sales Bureaus for further detailed information and technical instructions

Introductory Safety Notes

Specified Usage

The Vortex Flowmeters are to be installed only in the specified applications.

Every usage which exceeds the specifications is considered to be non-specified. Any damages resulting therefrom are not the responsibility of the manufacturer.
The risk is borne by the user alone.

The application specifications include the installation, start-up and service requirements specified by the manufacturer.

Installation, Start-Up and Operating Personnel

Please read this Instruction Manual and the safety notes before attempting installation, start-up or operation.

Only qualified personnel should have access to the instrument.
The personnel should be familiar with the warnings and operating requirements contained in this Instruction Manual.

Assure that the connections are in accordance with the Interconnection Diagrams. Ground the flowmeter system.

Observe the warning notes in this document indicated by the symbol:

Hazardous Material Information

In view of the requirements of the Disposal Ordinance of 27.08.86 (AbfG. §11 Special Wastes) which states that the possessor of the special waste is responsible for its care and the employer, according to the Hazardous Waste Ordinance of 01.10.86 (GefStoffV, §17 General Protection Responsibility) also has the responsibility to protect his employees, we must make note that

a) all flowmeter primaries and/or flowmeter converters which are returned to Bailey-Fischer & Porter for repair are to be free of any hazardous materials (acids, base, solutions, etc.).

b) the flowmeter primaries must be flushed so that the hazardous materials are neutralized together with any other areas which may be contaminated by the hazardous materials (see Hazardous Material Ordinance - GefStoffV).

c) for service and repair **written conformation** is required that the measures listed in a) and b) above have been carried out.

d) costs which may arise for the decontamination of hazardous materials during repair will be invoiced to the owner of the equipment.

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1. Principle of Operation

The operation of the VORTEX flowmeter is based on the Karman Vortex Street. As the flow passes the shedder vortices are formed alternately on both sides of the shedder. The flow causes these vortices to shed forming a vortex street (Karman Vortex Street) (Fig. 1).

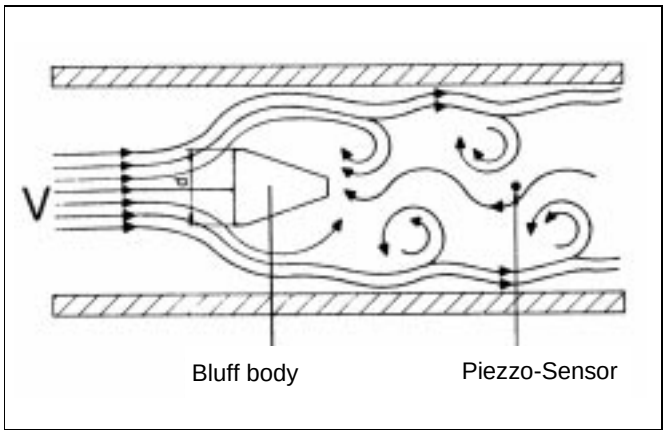


Fig.1 Karman Vortex Street

The Frequency **f** of vortex shedding is proportional to the flow velocity **v** and indirectly proportional to the width of the shedder **d**:

$$f = St \times \frac{v}{d}$$

St, the Strouhal-Number, is a dimensionless number which defines the quality of the vortex flowrate measurements.

The **St** value is constant over wide Reynolds Number **Re** ranges for properly designed shedders. (Fig. 2).

$$Re = \frac{v \times D}{\vartheta}$$

ϑ = Kinematic viscosity

D = Meter size

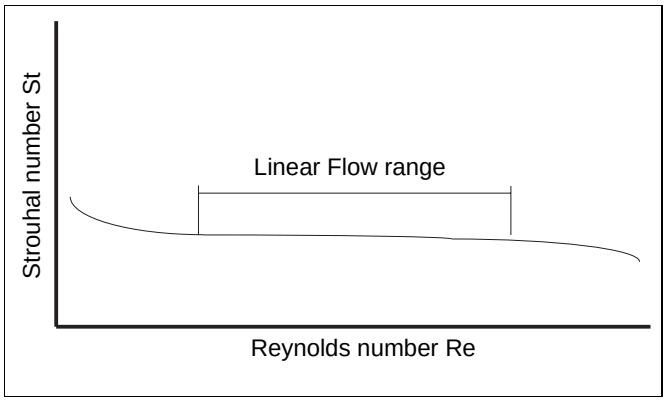


Fig.2 Relationship Strouhal-No. vs. Reynolds-No.

The vortex shedding frequency which is measured is a function of the flow velocity alone and is independent of the fluid density and viscosity.

The local pressure variations resulting from the vortex formation are measured by a Piezo-Sensor and converted into electrical impulses corresponding to the vortex shedding frequency.The flowrate calculated from these values is available as a current output signal (4 - 20 mA).

2. Assembly and Installation Flowmeter Primary

2.1 Checking

Before installing the VORTEX flowmeter check for mechanical damage due to improper handling during shipment. All claims for damages are to made promptly to the shipper prior to installation.

2.2 Installing the Flowmeter Primary in the Pipeline

2.2.1 Installation Requirements

The VORTEX flowmeter can be installed at any location in the pipeline. Care should be taken to assure that

- the ambient requirements are maintained (see Specification Sheet D184S027U02).
- the recommended in- and outlet sections are utilized (Fig. 3).
- **the flow direction corresponds to the arrow on the flowmeter primary.**
- the required minimum space for removal of the preamplifier and for exchanging sensors is available (see Specification Sheet D184S027U02, Fig. 18/19).
- mechanical vibrations are eliminated by appropriate supports if necessary.
- **the inside diameter of the flowmeter primary and the pipeline are the same** (see Spec. Sht. Fig. 19/20).
- Pressure fluctuations in long pipelines at zero flow resulting from intermediate valve operations are to be avoided.
- pulsating flow from piston pumps or compressors must be reduced by appropriate means.
- the flowmeter primary must always be full when metering liquids.
- the flowmeter primary must be installed with the electronic components located on the side or towards the bottom of the pipeline the fluid temperatures are high (Fig. 4).

2.2.2 Recommended In- and Outlet Sections

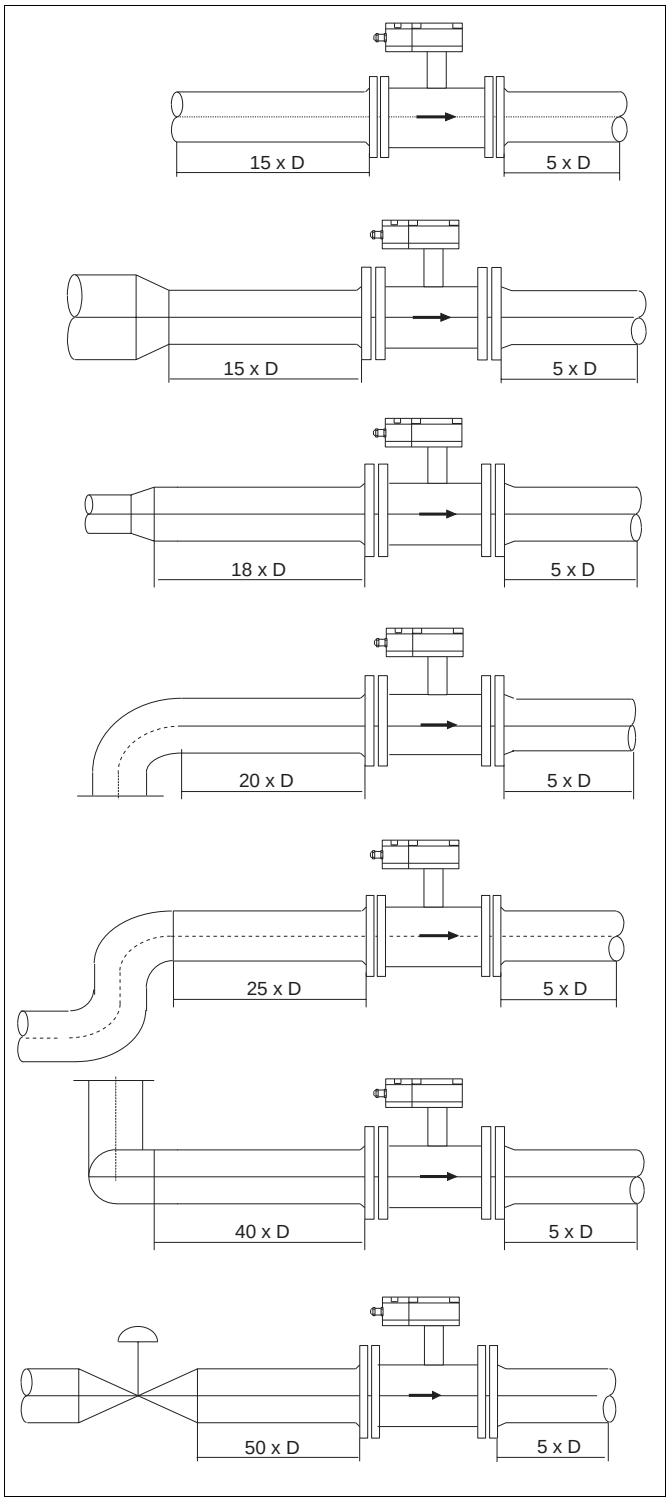


Fig.3 Recommended In- and Outlet Sections

2.2.3 Installation for High Fluid Temperatures >150 °C

Warning:

The relationship between the fluid and ambient temperatures must be considered as indicated in Fig. 4.

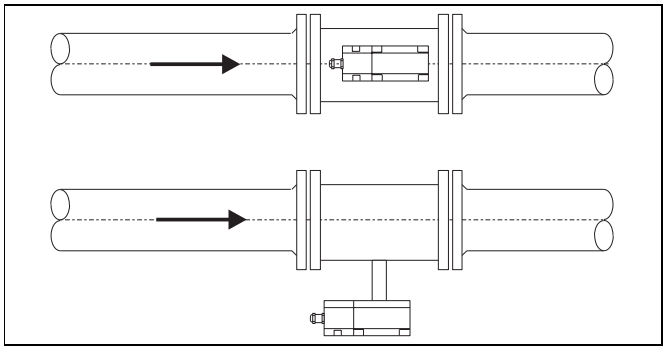


Fig.4 Installation for High Fluid Temperatures >150 °C

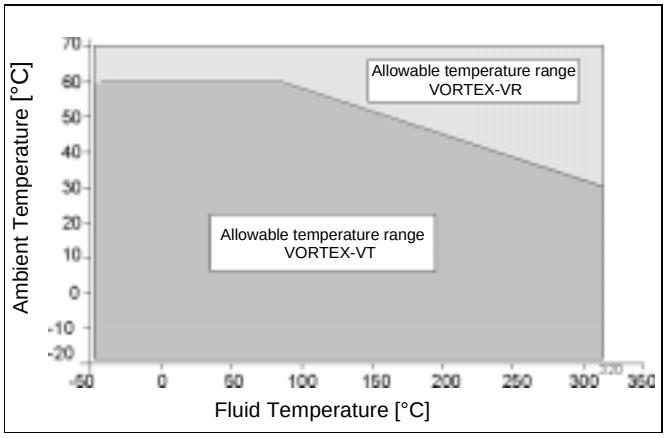


Fig.5 Relationship Ambient Temperature-
Fluid Temperature-

2.2.4 Installation of control valve locations

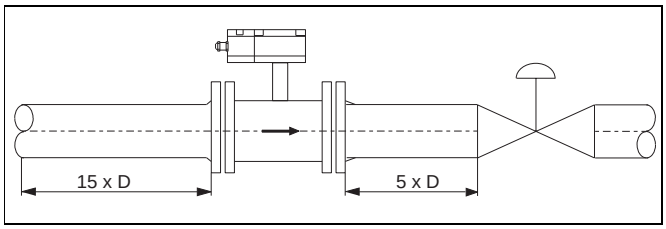


Fig.6 Installation of control valve location

2.2.5 Centering the Wafer Design

The centering of Wafer Design is accomplished by utilizing the outside diameter of the body of the flowmeter primary and the mounting bolts. Centering sleeves or segments are included as accessories with the shipment whose dimensions are a function of the pressure rating of the flowmeter (up to DN 80 [3"]).

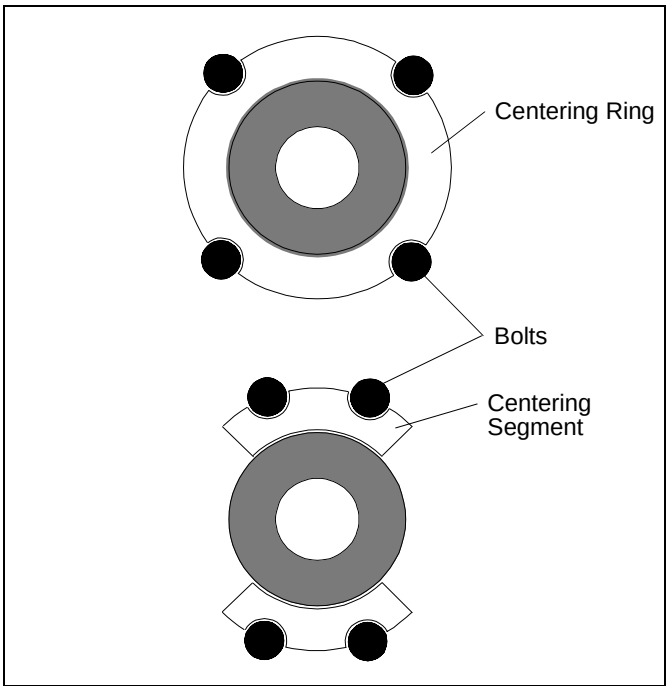


Fig.7 Wafer Design Centering with Rings or Segments.

3. Converter Start-Up

3.1 Sensor Connections

The Piezo sensor is connected to terminals 19, 1B and 2B on the analog board. The connections are made as follows:

19 = red (signal)
1B = blue (common)
2B = yellow (compensation)

3.2 Preamplifier Settings

The matching of the input circuit (preamplifier) to the fluid being metered and to the meter size is made using the switches on the analog board.
The switch settings are usually set at the factory according to the ordering information. If all the necessary information was not available or if changes have occurred, the switches are to be set in accordance with the specifications in the Settings Tables (lower portion of Fig. 8). Please note that the settings are different for DIN and ANSI dimensions.

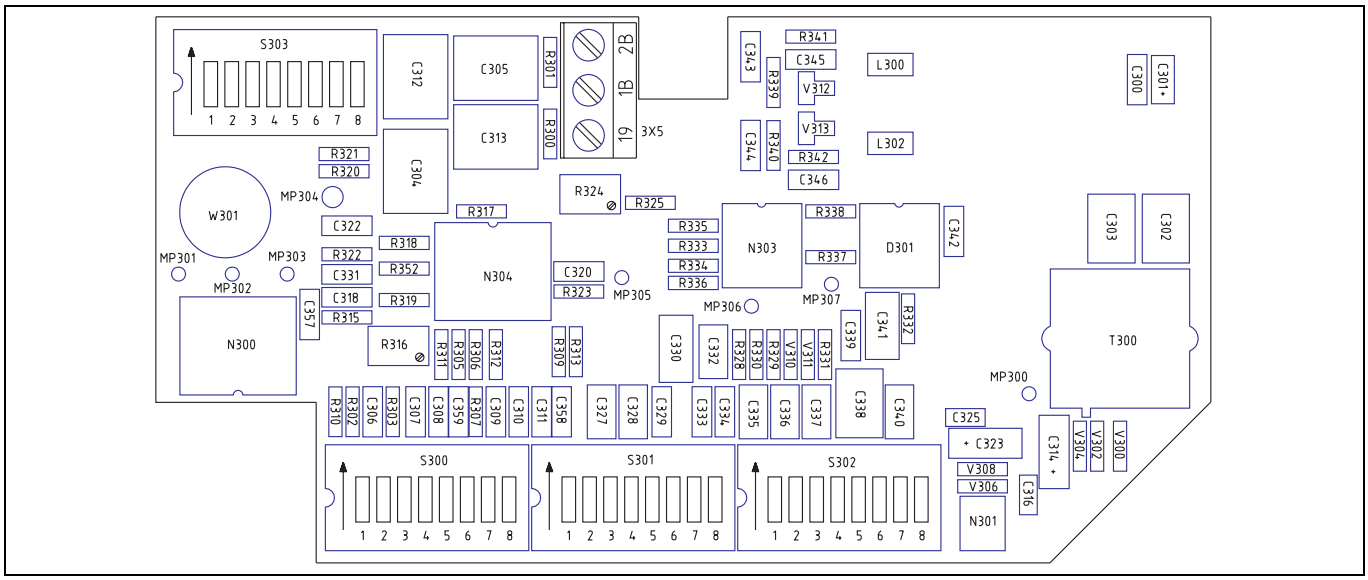


Fig.8 Analog Board 10VT1000

Size **DIN**	Gas				Liquid			
	S300	S301	S302	S303	S300	S301	S302	S303
15	1,2,6,7	4,8		5,6	5	2,4-7	2,8	2,5,6
25	1-4, 6-8	1,4	1	5,6	5	2,3,7	2,8	1,2,5,6
40	1,3,6,8	4	1	5,6	5	2,3,7	4,8	1,2,5,6
50	1,3,6,8	5	1	5,6	5	2,3,7	5,8	1,2,5,6
80	1,3,6,8	5	2	5,6	4,5	1,2,3,7	6,8	1,2,5,6
100	1,3,6,8	5	2	5,6	4,5	1,2,3,7	6,8	1,2,5,6
150	3,8	6	3	5,6	4,5	1,2,3,7	4-6,8	1,2,5,6
200	1-8	1,2,6	3	3,4,7,8	3-5,8	1-8	1-6,8	1-4,7,8
250	1-8	1,2,6	3	3,4,7,8	3-5,8	1-8	1-8	1-4,7,8
300	1-8	1,2,6	3	3,4,7,8	3-5,8	1-8	1-8	1-4,7,8

Size **ANSI**	Gas				Liquid			
	S300	S301	S302	S303	S300	S301	S302	S303
1/2”	1,2,6,7	4,8		5,6	5	2,4-7	2,8	2,5,6
1”	1-4, 6-8	1,4	1	5,6	5	2,3,7	2,8	1,2,5,6
1-1/2”	1,3,6,8	4	1	5,6	5	2,3,7	2,3,8	1,2,5,6
2”	1,3,6,8	5	1	5,6	5	2,3,7	1,3,4,8	1,2,5,6
3”	1,3,6,8	5	2	5,6	4,5	1,2,3,7	3,5,8	1,2,5,6
4”	1,3,6,8	5	2	5,6	4,5	1,2,3,7	2,3,5,8	1,2,5,6
6”	3,8	6	3	5,6	4,5	1,2,3,7	5,6,8	1,2,5,6
8”	1-8	1,2,6	3	3,4,7,8	3-5,8	1-8	1-6,8	1-4,7,8
10”	1-8	1,2,6	3	3,4,7,8	3-5,8	1-8	1-6,8	1-4,7,8
12”	1-8	1,2,6	3	3,4,7,8	3-5,8	1-8	1-8	1-4,7,8

Settings Table 10VT1000

4. Electrical Connections VORTEX-VT

The converter of the VORTEX-VT is designed for 2-wire operation, i.e., the supply voltage and the output signal (4-20 mA) utilize the same leads.

4.1 Interconnection Examples

a) Supply Voltage from a Central Power Supply

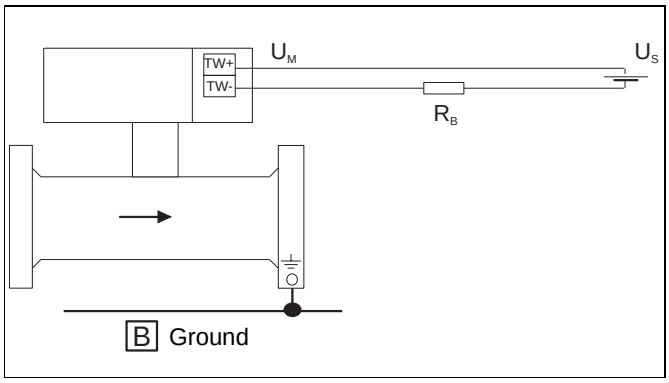


Fig.9 Central Power Supply

b) Supply Voltage from a Power Supply

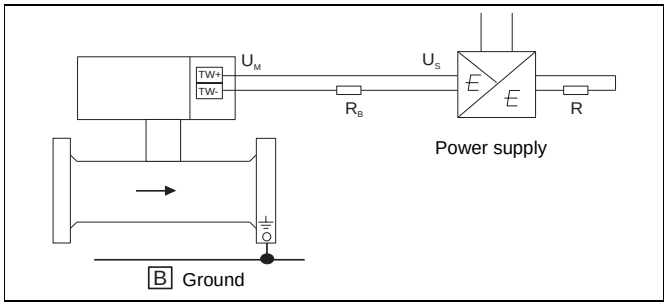


Fig.10 Supply Voltage from a Power Supply

$U_M \geq$ Supply voltage, 14 V DC

U_S = Power supply voltage, 14 V to 46 V DC

R_B = Max. allowable load for the power supply (e.g. Indicator, Recorder, cable resistance etc.)

R = Max. allowable load for the output circuit - determined by the power supply (e.g. Indicator, Recorder etc.)

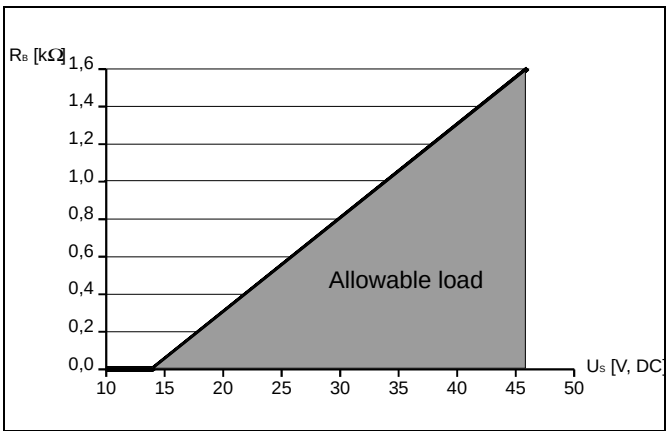
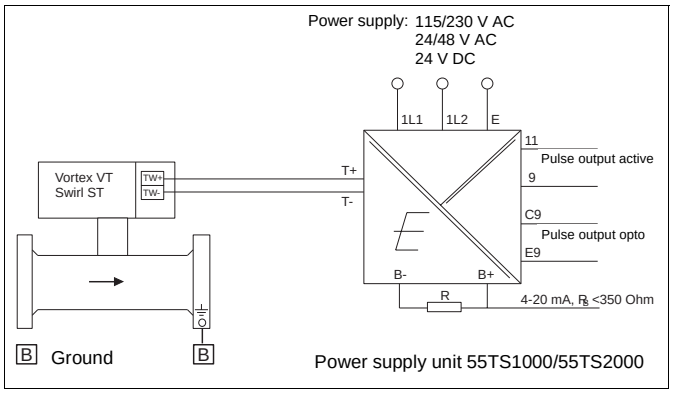


Fig.11 Load Diagram

4.2 Pulse Transmission

With the intelligent converter of the VORTEX-VT it is possible to transmit pulses together with the 4-20 mA output signal in 2-wire technology. The converter superimposes the scaled pulse output on the current output in accordance with the Bell 202 Standard. This signal is demodulated in the Bailey-Fischer & Porter Power Supply 55TS1000/TS2000 and converted into a separate galvanically isolated pulse output signal. This does not affect any other connected instruments.

Supply Voltage from Power Supply 55TS1000/TS2000



4.3 Communication, HART®-Protocol

The HART-Protocol provides for digital communication between a process control system/PC, handheld terminal and the VORTEX-VT. The parameter settings for all instruments can be transmitted from the converter to the process control system/PC. In the reverse direction it is possible to reconfigure the converter.

The digital communication is accomplished by superimposing an AC signal on the current output (4-20 mA) which does not affect any other connected instruments.

Transmission Mode

FSK-Modulation on the current output 4-20 mA per Bell 202 Standard. Max. signal amplitude 1.2 mA_{SS}.
Logic 1: 1200 Hz
Logic 0: 2200 Hz
The SMART VISION ® WINDOWS-Software can be utilized for the HART-Communication. Detailed information will sent upon request.

Current Output Load

Min. > 250 Ω, max. 750 Ω
Max. cable length
1500 m AWG 24 twisted and shielded

Baudrate

1200 Baud

Current Output at Alarm

High = 22.4 mA
Low = 3.85 mA
For operation with HART-Protocol see the separate Instruction Manual “VORTEX 4-HART-Communication” (D184B008U13)

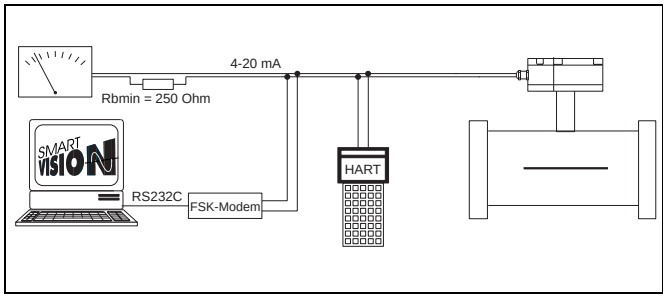


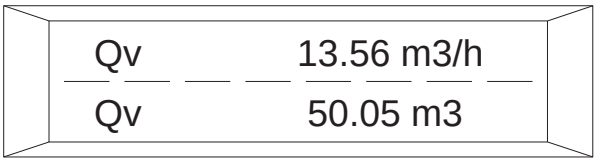
Fig.12 HART-Communication

5. Data Entry/Operation and Configuration

5.1 LC-Display

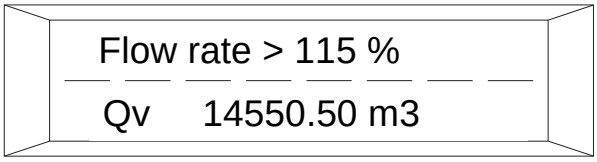
After the instrument is turned on a number of automatic self check routines are executed After they have been completed the standard process display appears (process information). The values displayed can be user configured.

1st Line Volume flowrate, bargraph display
2nd Line Totalized volume flow



1st Line Volume flowrate in eng'g units
2nd Line Totalized volume flow

A message is displayed in the first line if an error is detected



This message is alternately displayed as a clear text message or as the corresponding error number. Only the error with the highest priority is displayed in clear text, while in the alternate display, the error numbers for all the errors detected are displayed.

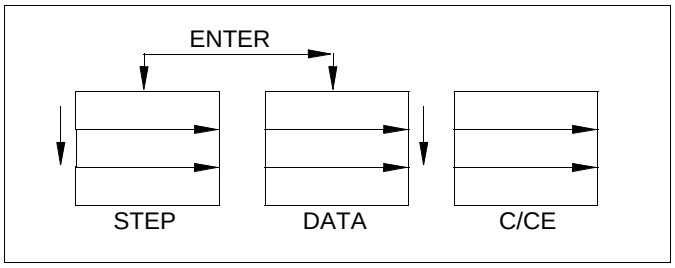
No.	Error	Priority
3	Flowrate >115 %	2
5	EEPROM	0
6	Totalizer defective	1
9	Q_V > 115 % Range	2

In the event of an error the current output can be set to 3.85 mA or 22.4 mA (set in parameter I_{OUT} at Alarm).

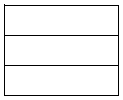
Warning:
For errors 3 and 9 the current output is always set to 22.4 mA. Error 9 must be reset by pressing a button or by interrupting the supply voltage.

5.2 Data Entry

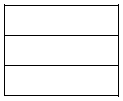
Data is entered utilizing the 3 buttons STEP, DATA and C/CE in the connection box.
The electronic circuit compartment need not be opened.
During operating/programming the instrument always remains on-line; the current output continues to indicate the instantaneous operating conditions.



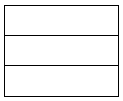
Keypad in Connection Box



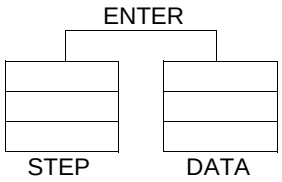
C/CE — Switch from the process display to the programming mode by pressing the C/CE button once.



STEP — Page up through the menu.

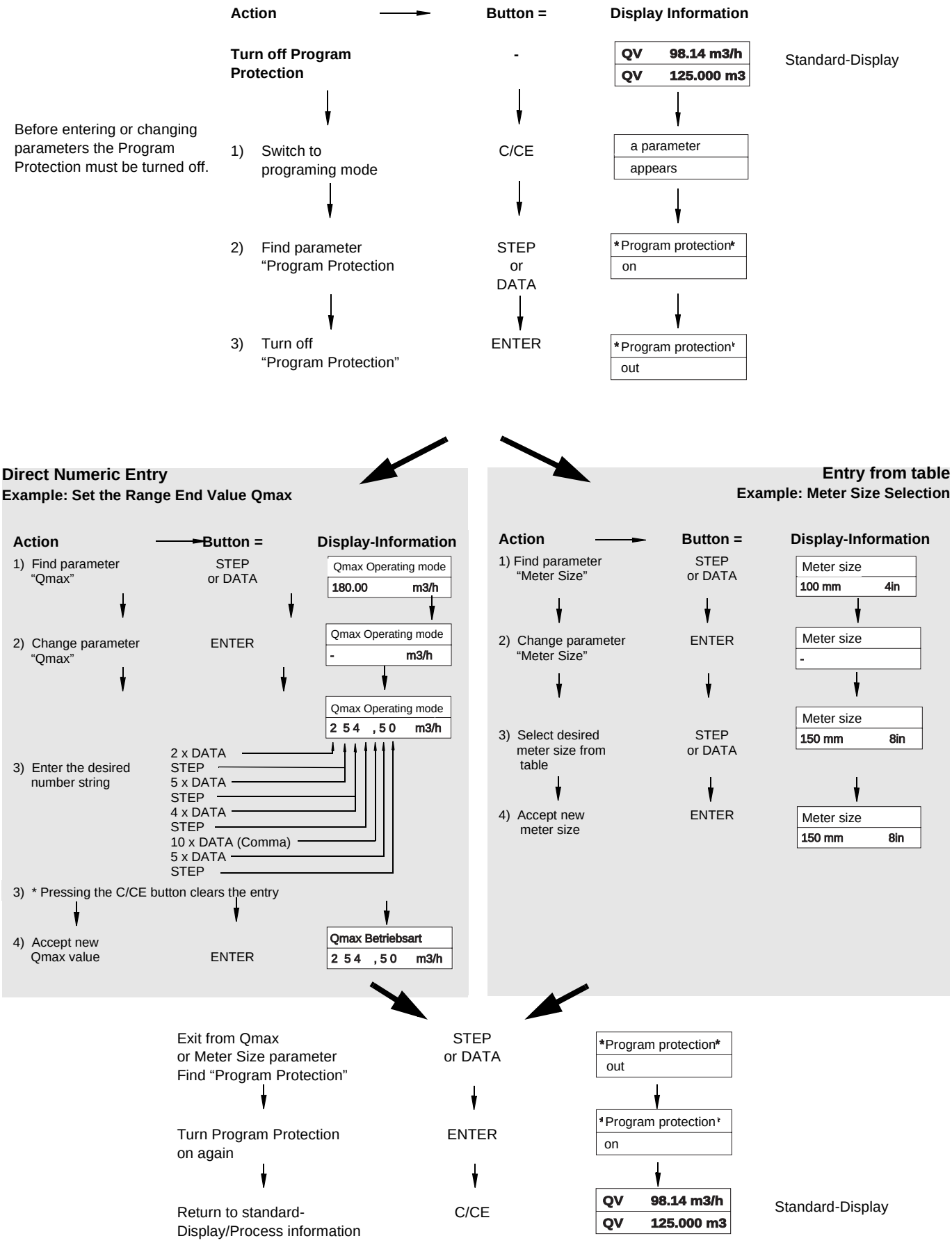


DATA — Page down through the menu

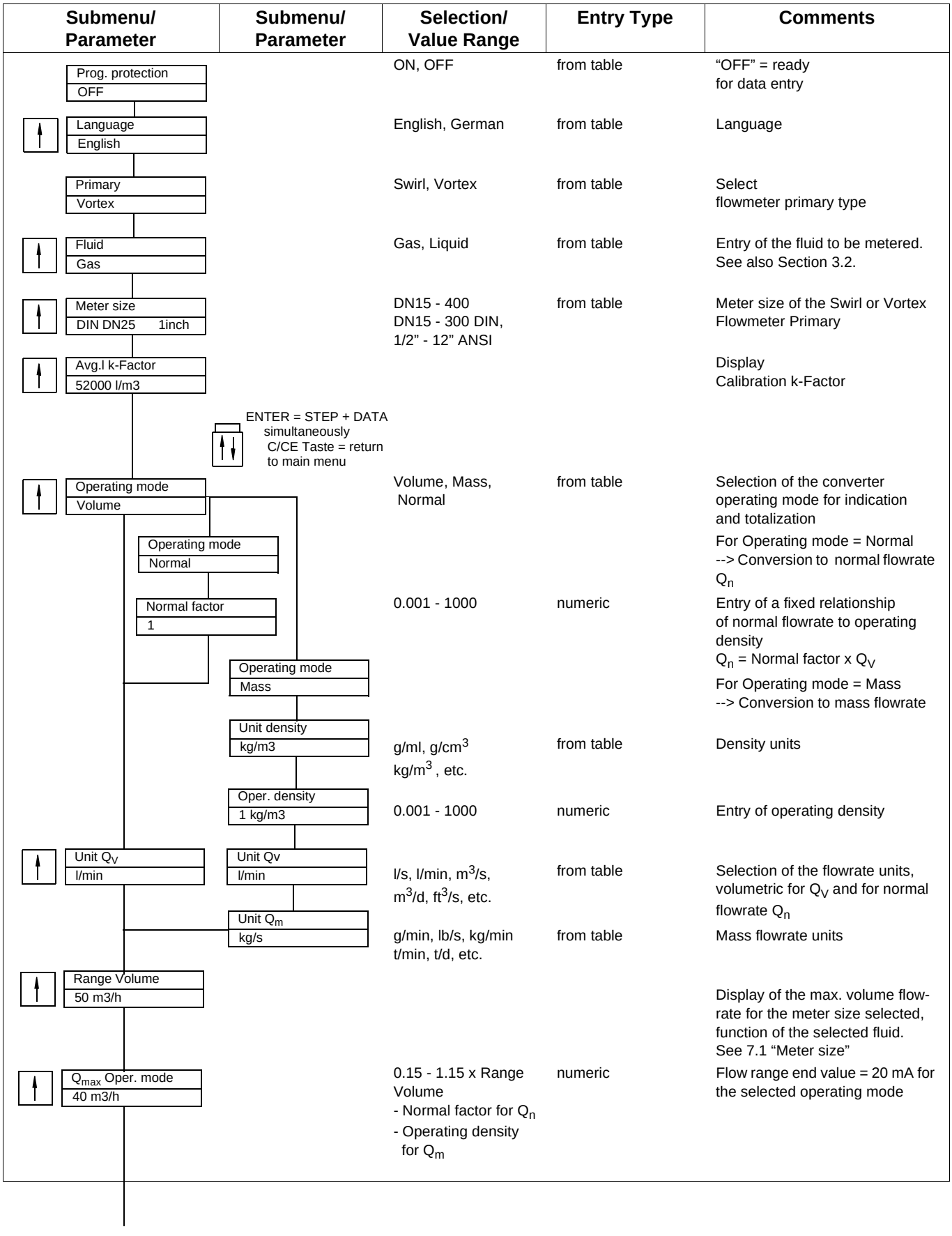


ENTER-Function

Press STEP & DATA simultaneously to select the parameter, or accept and store the newly entered parameter value or selection.

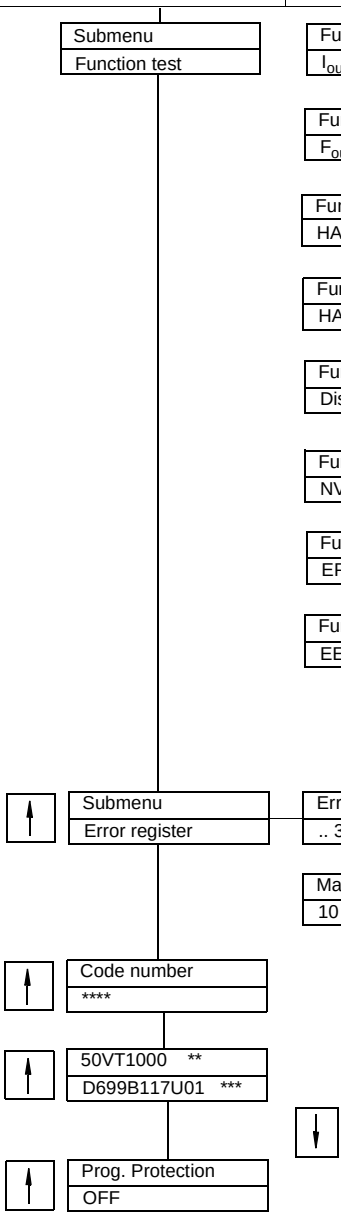

Action
Button =
Display Information
Turn off Program Protection
-
QV 98.14 m3/h
QV 125.000 m3
Standard-Display
Before entering or changing parameters the Program Protection must be turned off.
1) Switch to programing mode
C/CE
a parameter
appears
2) Find parameter "Program Protection
STEP or DATA
Program protection
on
3) Turn off "Program Protection"
ENTER
Program protection
out
Direct Numeric Entry
Example: Set the Range End Value Qmax
Action
Button =
Display-Information
1) Find parameter "Qmax"
STEP or DATA
Qmax Operating mode
180.00 m3/h
2) Change parameter "Qmax"
ENTER
Qmax Operating mode
- m3/h
Qmax Operating mode
2 5 4 , 5 0 m3/h
3) Enter the desired number string
2 x DATA
STEP
5 x DATA
STEP
4 x DATA
STEP
10 x DATA (Comma)
5 x DATA
STEP
3) * Pressing the C/CE button clears the entry
4) Accept new Qmax value
ENTER
Qmax Betriebsart
2 5 4 , 5 0 m3/h
Entry from table
Example: Meter Size Selection
Action
Button =
Display-Information
1) Find parameter "Meter Size"
STEP or DATA
Meter size
100 mm 4in
2) Change parameter "Meter Size"
ENTER
Meter size
-
3) Select desired meter size from table
STEP or DATA
Meter size
150 mm 8in
4) Accept new meter size
ENTER
Meter size
150 mm 8in
Exit from Qmax or Meter Size parameter Find "Program Protection"
STEP or DATA
Program protection
out
Turn Program Protection on again
ENTER
Program protection
on
Return to standard-Display/Process information
C/CE
QV 98.14 m3/h
QV 125.000 m3
Standard-Display

5.3 Parameter Overview and Data Entry



Submenu/ Parameter	Submenu/ Parameter	Selection/ Value Range	Entry Type	Comments
Prog. protection OFF		ON, OFF	from table	"OFF" = ready for data entry
Language English		English, German	from table	Language
Primary Vortex		Swirl, Vortex	from table	Select flowmeter primary type
Fluid Gas		Gas, Liquid	from table	Entry of the fluid to be metered. See also Section 3.2.
Meter size DIN DN25 1inch		DN15 - 400 DN15 - 300 DIN, 1/2" - 12" ANSI	from table	Meter size of the Swirl or Vortex Flowmeter Primary
Avg.l k-Factor 52000 l/m3				Display Calibration k-Factor
	ENTER = STEP + DATA simultaneously C/CE Taste = return to main menu			
Operating mode Volume		Volume, Mass, Normal	from table	Selection of the converter operating mode for indication and totalization
	Operating mode Normal			For Operating mode = Normal --> Conversion to normal flowrate Q_n
	Normal factor 1	0.001 - 1000	numeric	Entry of a fixed relationship of normal flowrate to operating density Q_n = Normal factor x Q_V
	Operating mode Mass			For Operating mode = Mass --> Conversion to mass flowrate
	Unit density kg/m3	g/ml, g/cm^3 kg/m^3 , etc.	from table	Density units
	Oper. density 1 kg/m3	0.001 - 1000	numeric	Entry of operating density
Unit Q_V l/min	Unit Qv l/min	l/s, l/min, m^3/s, m^3/d, ft^3/s, etc.	from table	Selection of the flowrate units, volumetric for Q_V and for normal flowrate Q_n
	Unit Q_m kg/s	g/min, lb/s, kg/min t/min, t/d, etc.	from table	Mass flowrate units
Range Volume 50 m3/h				Display of the max. volume flow-rate for the meter size selected, function of the selected fluid. See 7.1 "Meter size"
Q_{max} Oper. mode 40 m3/h		0.15 - 1.15 x Range Volume - Normal factor for Q_n - Operating density for Q_m	numeric	Flow range end value = 20 mA for the selected operating mode

Submenu/ Parameter	Submenu/ Parameter	Selection/ Value Range	Entry Type	Comments
Qmin (Volume) 1 m3/h		0 - 0.1* Range Volume or: 0 - 10%	numeric	Range beginning value or low flow cutoff value setting. When flowrate is less than Qmin the flowrate is set to 0 and the totalizer stopped.
Submenu Total-				
	Unit totalizer m3	m3, ft3, ugl, igl, bbl or. g, kg, t, lb	from table	Selection of the totalizer units as a function of the selected Operating mode of Volume or. Mass flow
	Totalizer Q_V 123456.78 m3			Display totalizer value Q_V, Q_m or Q_n
	Tot. overflow 0		from table	Display totalizer overflows max. 65.535 overflows 1 Overflow = 10,000,000 units
	Function Totalizer reset		from table	Reset flow totalizer and overflow counter. Warning displayed before the totalizers are reset
Submenu Pulse output				
	Pulse factor 1000 1/m3	0.001 - 100	numeric	For int. and ext. flow totalization. Display pulses per selected flow unit
	Pulse width 50 ms	1 - 800 ms	numeric	Max. 50 % on/off cycle. When exceeded a warning is displayed. Detailed information see 7.4
Damping 10.00 s		1 - 100 s	numeric	Damping setting for the current output, response time 1 τ (= 63 %) for a flowrate step change
Submenu Current output				
	Current output Current + pulse	Current and pulse Current and HART	from table	Selection of the output type
	I_{out} at Alarm 22.4 mA	3.85 mA or 22.4 mA	from table	Current output value setting for an alarm condition. For flowrate > 115 %, I_{out} is always set to 22.4 mA
Submenu Display				
	Display 1st Line Percent	Q_V Volume, Q_m Mass, Q_n Normal, Percent, Percent bar, Totalizer, Frequency	from table	Selection for 1st line of the display
	Display 2nd Line Q_V Volume	Q_V Volume, Q_m Mass, Q_n Normal, Percent, Percent bar, Totalizer, Frequency	from table	Selection for 2nd line of the display



Submenu/ Parameter	Submenu/ Parameter	Selection/ Value Range	Entry Type	Comments
Submenu Function test	Function I_{out}	- 1 to 115 %	numeric	Test current output, manual process control (100 % = 20 mA)
	Function F_{out}	0 to 115 %	numeric	Test pulse output
	Function HART-Transmitter		0 = Pulse 1 = No pulse	Test HART-Transmitter
	Function HART-Command		--	Test HART-Receiver
	Function Display	Automatic test	from table	Test Display indication
	Function NVRAM	Automatic test	from table	Test NVRAM (used to store the totalizer and overflow values)
	Function EPROM	Automatic test	from table	Test EPROM (used to store the program)
	Function EEPROM	Automatic test	from table	Test EEPROM (used to store the meter location specific parameters)
Submenu Error register	Error register .. 3 ..		from table	Display of the detected errors
	Mains interrupt 10			Display of the number of power shut downs since start-up
Code number ****				Only for Bailey-Fischer & Porter
50VT1000 ** D699B117U01 ***				Display software version ** = Display version date *** = Display software revision number
Prog. Protection OFF				

6. Configuring the Converter at Start-Up

The metering system has been configured prior to shipment by BFP in accordance with the Ordering Information and all parameters and required values set. Because the meters can be universally installed, i.e. for liquids or gases we recommend that the following parameters be checked before start-up:

Software:

Parameter	Action
1. Fluid	Select gas or liquid
2. Meter size	Check against size listed on the instrument tag
3. k-Factor	Select k-Factor.The value entered must agree with the value listed on the instrument tag.

4. Which flowrate units should be used for the display indication and for the flow totalization ?

Mass Units		Volume Units	
Parameter	Action	Parameter	Action
Operating mode Mass	select	Operating mode Volume or Normal	select
Density units kg/m^3	select from table	Units Qv/Qn l/min	select from table
Operating density	enter	Normal factor (only for Normal flowrate)	enter
Units Qm kg/s	select from table		

5. Set the desired flow range in the units selected above in the parameter **Qmax Operating mode** and enter flow range 0.15 to 1.15 x Range Volume.
6. Check the low flow cutoff value in parameter **Qmin Volume**
   Setting range: 0 to 0.1 x Range.
7. Select the flow units for the internal flow totalizer in parameter **Unit totalizer.**
8. The response time of the electronic circuitry to flowrate changes can be set in the parameter **Damping**.
   Default setting 3 sec.
9. Select Submenu Display and select desired mode, e.g.
   1st Line display select Percent bar
   2nd Line display select Totalizer
   The meter is ready for operation.

7. Additional Configuration Information

7.1 Meter Size

The electronic circuitry, which are identical for all sizes, are adjusted for the meter size of the flowmeter primary. The meter sizes are specified in **DIN and ANSI Dimensions**. The switches in the preamplifier must be set based on the meter size selection.

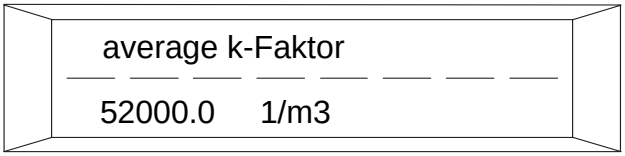
Volume Flow Range for the Meter Sizes (DIN) VORTEX-VT

Meter Size [mm]	Liquid [m^3/h]			Gas [m^3/h]		
15	0.5	-	6.0	4.0	-	24.0
25	0.8	-	18.0	15.0	-	150.0
40	2.4	-	48.0	30.0	-	390.0
50	3.0	-	70.0	40.0	-	500.0
80	8.0	-	170.0	100.0	-	1200.0
100	10.0	-	270.0	150.0	-	1900.0
150	30.0	-	630.0	300.0	-	4500.0
200	70.0	-	1100.0	250.0	-	8000.0
250	70.0	-	1700.0	800.0	-	14000.0
300	135.0	-	2400.0	1400.0	-	20000.0

Volume Flow Range for Meter Sizes (ANSI) VORTEX-VT

Meter Size [in]	Liquid [m^3/h]			Gas [m^3/h]		
1/2	0.5	-	6.0	5.0	-	24.0
1	0.8	-	18.0	9.7	-	82.0
1-1/2	2.4	-	48.0	21.0	-	320.0
520	3.0	-	70.0	43.0	-	450.0
3	8.0	-	170.0	75.0	-	1000.0
4	10.0	-	270.0	120.0	-	1900.0
6	30.0	-	630.0	250.0	-	4050.0
8	70.0	-	1100.0	250.0	-	8000.0
10	70.0	-	1700.0	800.0	-	14000.0
12	135.0	-	2400.0	1400.0	-	20000.0

7.2 Calibration k-Factor



The calibration k-Factor displayed must agree with the value listed on the instrument tag.

Each flowmeter is calibrated on a test stand at 5 flowrates. The calibration k-Factor is entered in the converter and recorded on the calibration report. The average calibration k-Factor value is also recorded on the instrument tag.

Typical k-Factor values for the various meter sizes and the frequencies generated in the VORTEX flowmeters for liquids and gases are listed in the following table These are approximate values and are presented as guidelines only:

Vortex

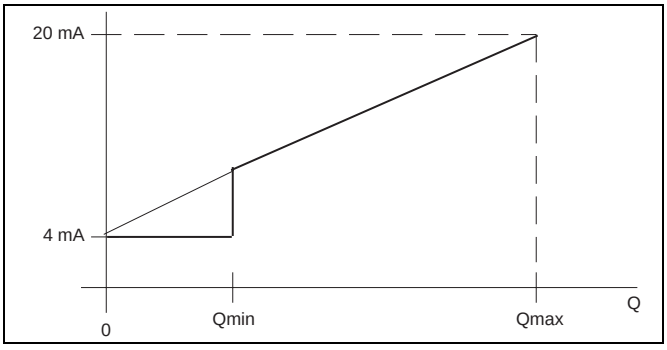
Meter Size [mm]	Typ. k-Factor max [1/m^3]	Liquid f_{max}	Gas f_{max}
15	22500	4.0	24.0
25	48000	15.0	150.0
40	14500	30.0	390.0
50	7500	40.0	500.0
80	2100	100.0	1200.0
100	960	150.0	1900.0
150	290	300.0	4500.0
200	132	250.0	8000.0
250	55	800.0	14000.0
300	39	1400.0	20000.0

The flowrate is calculated in the converter using the following equation:

$$Q = \frac{f}{k}$$

Q = Volume flowrate [m^3/s]
f = Frequency [1/s]
k = Calibration k-Factor [1/m^3]

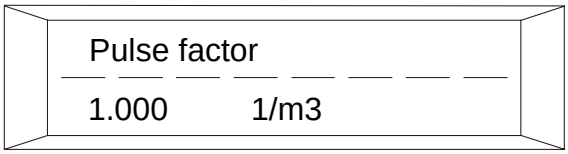
7.3 Current Output



The curve shows the behavior of the measurement value at the current output: Above Qmin, for the operating mode selection, the current follows a straight line, whose end values at 4 mA are Q = 0 and at 20 mA are Q_{max}. As a result of the low flow cutoff circuit the flowrate is set to Q_{min}= 0, i.e. 4 mA current, when the flowrate drops below Q_{min} .

7.4 Submenu Pulse Output

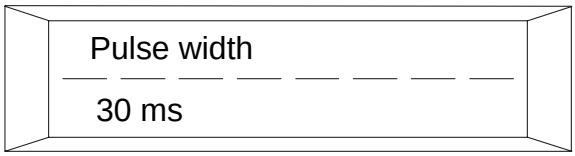
Within this menu the pulse output can be user scaled.



0.001 - 100

The pulse factor is the number of pulses per selected flowrate unit.

The pulse signal is superimposed on the current output in accordance with the Bell 202 Standard. This signal is demodulated in the Bailey-Fischer & Porter Power Supply 55TS1000/ TS2000 and converted into a separate galvanically isolated pulse output signal.



1 - 800 ms

The pulse width (duration of the pulses) for the scaled pulse output can be set between 1 and 800 ms.

The program monitors the relationship of the pulse width to the length of the period at the max. totalizer frequency (115 % flowrate). For a relationship ≥ 50 % a warning is displayed and the old value retained.

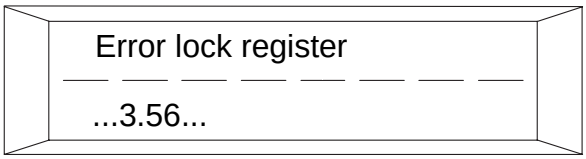
! Note:

For the pulse output to be operational it is necessary that "Current + pulse" be selected in the submenu "Current Output".

7.5 Submenu Error Register

This submenu includes the Error Register and the Mains Interrupt counter.

7.5.1 Error lock Register



Submenu Error Register
Display the Error Register

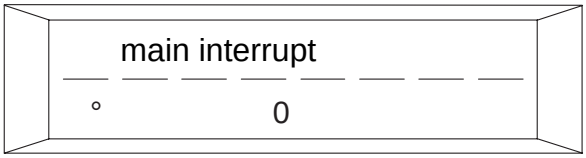
No.	Error	Priority
0	-	
1	-	
2	-	
3	Flowrate > 115 %	2
4	-	
5	EEPROM	0
6	Totalizer defective	1
7	-	
8	-	
9	Q_V > 115 % Range	2

All errors detected are stored permanently in the Error Register until it is reset, regardless whether they existed for a short or long time period.

The number in the Error Register display corresponds to a specific error:
Error: OK: .... or Error.. 3.56..

The Error Register can be cleared by pressing the “ENTER-Button).

7.5.2 Main Interruptions



Submenu Error Register
Mains interrupt counter

The converter counts the number of power interruptions. They can be displayed here. The Mains Interrupt counter can be cleared with the command “Reset Error”. This command is located in the Code section.

7.6 Normal Factor (See also Sect. 5.3)

$$\frac{Q_N}{Q_V} = \frac{(1{,}013 + p)}{1{,}013} \times \frac{273}{(273 + T)}$$

Since the mass flowrate is constant the following equation applies:

$$\frac{Q_N}{Q_V} = \frac{\rho_V}{\rho_N}$$

Q_N = Normal flowrate
Q_V = Volume flowrate
p = Operating pressure
T = Operating temperature [°C]
ρV = Operating density
ρN = Normal density

8. VORTEX-VR

The Vortex Flowmeter line was augmented by the addition of the VORTEX-VR, a design with a remote mounted converter. The VORTEX-VR is based on the VT-Instrument technology and includes all the options of the VORTEX-VT. The ability to remotely mount the converter is now possible when the flowmeter primary is installed in difficult to access locations. This design is advantageous when extreme ambient conditions exist at the meter site. The converter can be installed up to 10 m distant from the flowmeter primary. The converter and the flowmeter primary are interconnected using a special cable (included with the shipment).
After the mechanical and electrical installations have been completed, the cable can be cut to length and connected (see Fig. 14).
The signals transmitted between the flowmeter primary and the converter are unamplified signals, therefore the terminal connections should be made carefully and the cable routed through vibration free areas.
In addition to the supply voltage terminals (TW-/TW+), the terminals (19, 2B, 3) for the signal cable which interconnects the flowmeter primary and the converter are located in the separate connection box, (see Fig. 15).

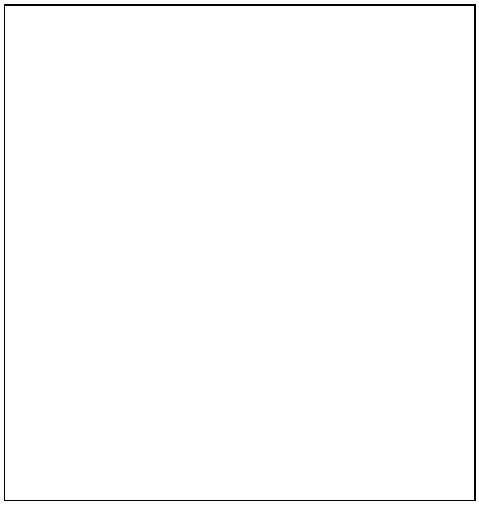


Fig.13 VORTEX-VR

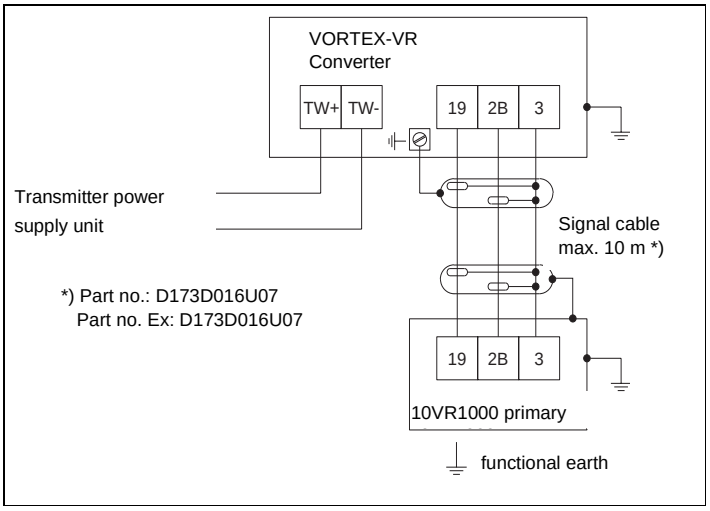


Fig.14 Interconnection Diagram VORTEX 10VR1000

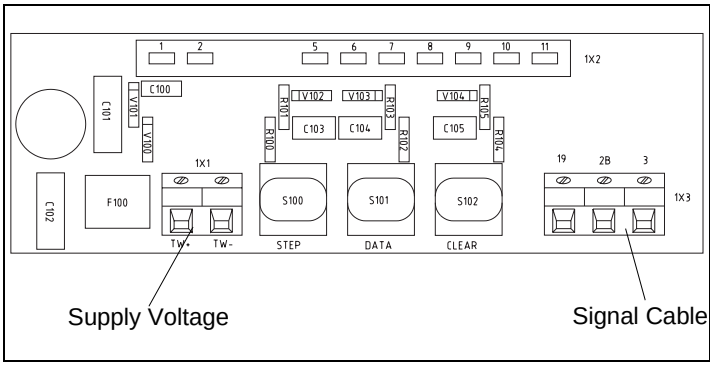
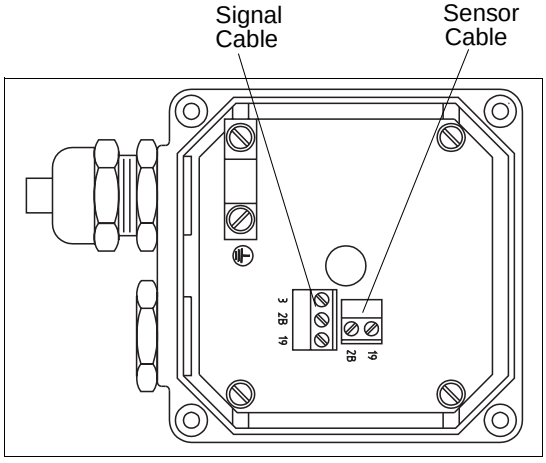


Fig.15 Connection Box, Converter VORTEX-VR



Connection Box, Flowmeter Primary 10VR1000

9. Specifications 10VT1000/ 10VR1000

EC-Design Test Certificate TÜV 97 ATEX 1160

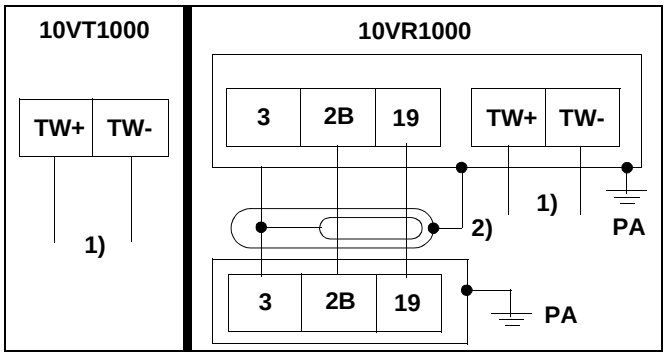
Symbol ⟨Ex⟩ II 2G EEx ib IIC T4

Ambient temperature, standard:
-20 °C to +60 °C

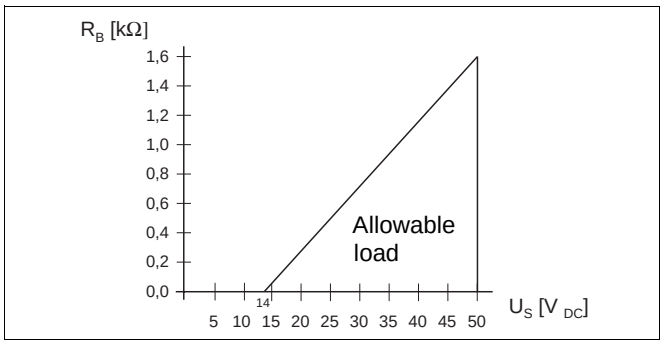
Ambient temperature to - 55 °C:
Upon request

Max. fluid temperature:
+280 °C
For fluid temperatures > +150 °C the connection box is to be mounted on the side or below the pipeline.
See also Section 2.2.3

Interconnection Diagram



1.) Terminals TW+/TW- Supply Voltage or Supply Current Circuit



U_S = Supply voltage
R_B = Max.allowable load in supply current circuit
e.g. Indicator, Recorder or load resistances

Safety Specifications

Valid for the range from -55 °C to +60 °C.

Ignition Class Intrinsically Safe EEx ib IIC

U_i = 28 V
I_i = 110 mA
P_i = 770 mW

Linear curve

The effective internal capacitance and induction are negligible.

2.) Terminals 3/2B/19 Sensor Current Circuit

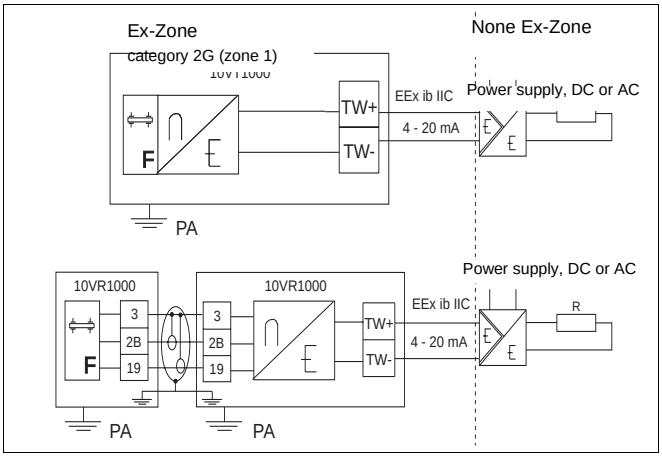
Interconnection cable between the flowmeter primary and converter. Cable length ≤ 10 m.
Part No.: D173B016U07
Part No. Ex: D173B016U09

Communication, HART®-Protocol

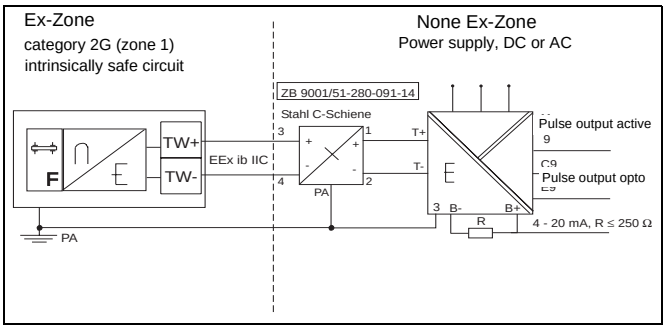
Pulse over TW+/TW-. Detailed information see Section 5.4.
Additional installation and operating notes see Section 4.3

9.1 Electrical Interconnections 10VT1000

Interconnection Examples



Shown with Power Supply 55TS1000/55TS2000 and Zener Barriers



Interconnection Diagram Safety Barriers:
Terminal box or 19" -Card: edge connector
Form F, DIN 41612 PA pre-aligning

Interconnection Diagram	Module	A1	A2	b1	b2	PA
Zener Barrier Ordering No.: 55SB111_	Terminal box	21	11	23	13	PA
19"-Card with 1 Module Ordering No.: 55SB112A1 Module A	A	d4	z14	z28	z22	d16
19"-Card with 2 Modules Ordering No.: 55SB113A1 Module A + B	B	d2	z12	d26	d22	z16
19"-Card with 3 Modules Ordering No.: 55SB114A1 Module A - C	C	z2	d12	d30	z20	d18
19"-Card with 4 Modules Ordering No.: 55SB115A1 Module A - D	D	z2	d12	d30	z20	d18

Power Supplies from Other Manufacturers

Contrans I V 17151-62	Hartmann & Braun
TZN 128-Ex	Hartmann & Braun
CS3/420	ABB Digital
KHD3-IST/Ex1	Pepperl & Fuchs
MTL 3046B	MTL

10. Certificate of Compliance

Elsag Bailey

Bailey-Fischer & Porter

EG-Konformitätserklärung
EC-Certificate of Compliance

CE

Hiermit bestätigen wir die Übereinstimmung der
Herewith we confirm that our

Vortex- und Drall-Durchflußmesser
Vortex and Swirl Flowmeter

Modell 10*...**
Model

- **1** ⇨ **ein Sensor** / *one sensor*
- **2** ⇨ **zwei Sensoren** / *two sensors*
- **T** ⇨ **Kompakt-Ausführung** / *compact design*
- **R** ⇨ **Remote-Ausführung** / *remote design*
- **M** ⇨ **Getrennt-Ausführung** / *external design*
- **V** ⇨ **Vortex** / *Vortex*
- **S** ⇨ **Drall** / *Swirl*

mit der Richtlinie 94/9/EG der Europäischen Gemeinschaft.
is in compliance with the council directive 94/9/EEC of the European Community.

Die Vortex- und Drall-Durchflußmesser dienen zur Messung des Durchflusses von Gasen, Dämpfen und Flüssigkeiten.
The Vortex and Swirl Flowmeter serves for the measurement of gases, steam and fluids.

EG-Baumusterprüfbescheinigung: *EC-Type Examination Certificate:*	TÜV 97 ATEX 1160
Benannte Stelle: *Notified Body:*	TÜV Hannover/Sachsen-Anhalt e.V., Kennummer 0032
Geräte-Kennzeichnung: *Apparatus code:*	⟨Ex⟩ II 2G EEx ib IIC T4
Umgebungstemperatur: *Ambient temperature:*	-55°C bis +60°C
Sicherheitstechnische Daten: *Safety values:*	siehe EG-Baumusterprüfbescheinigung TÜV 97 ATEX 1160
Angewandte Normen: *Standards:*	EN 50 014: 1994-03 EN 50 020: 1996-04

Göttingen, 10 März 1997

Unterschrift / Signature

Bailey-Fischer & Porter GmbH · ein Unternehmen der Elsag Bailey Process Automation N.V.

BZ-13-8002, Rev.0, E19194

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Volksbank Göttingen (BLZ 26090050) 160004400

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HRB Nr. 423

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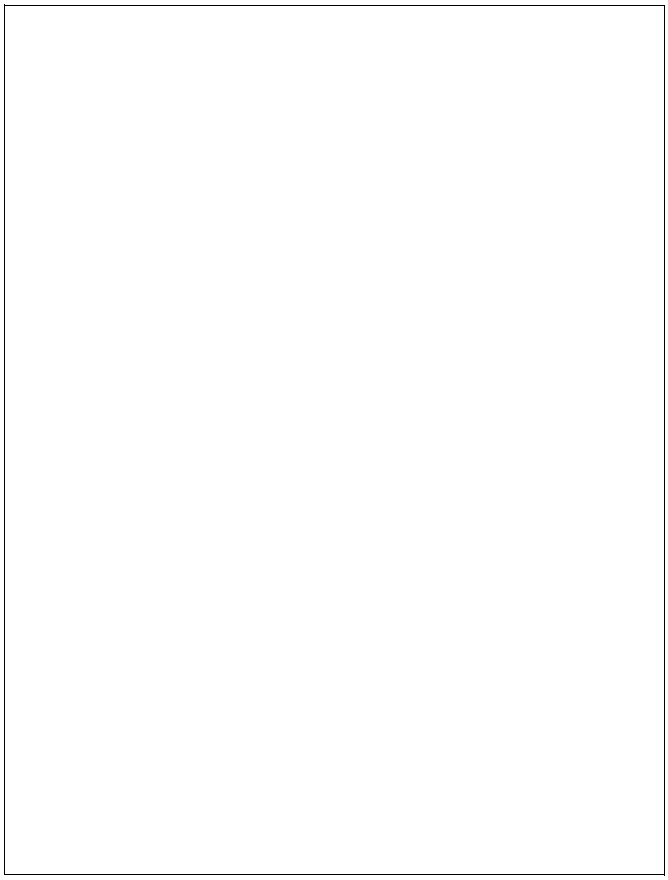
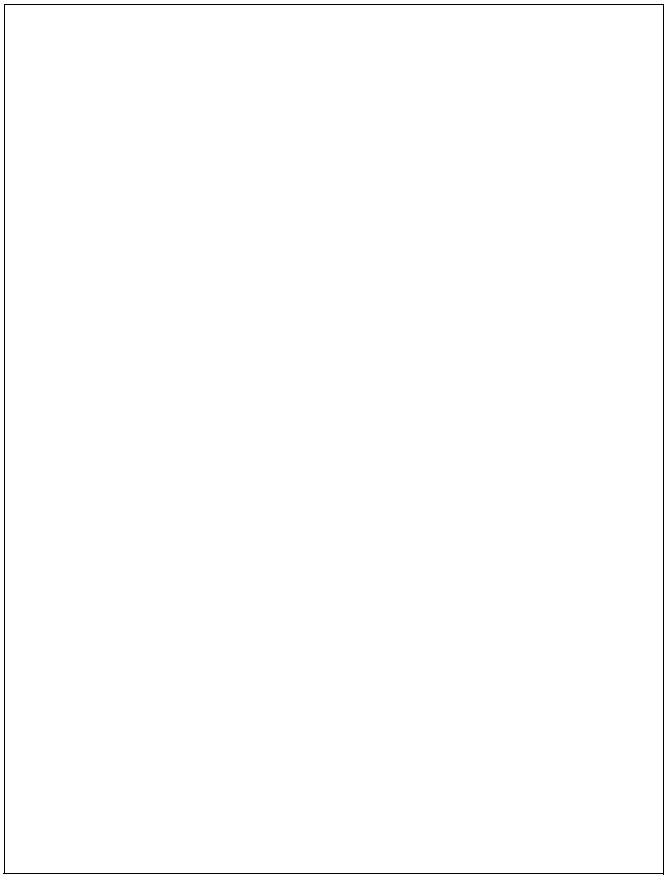
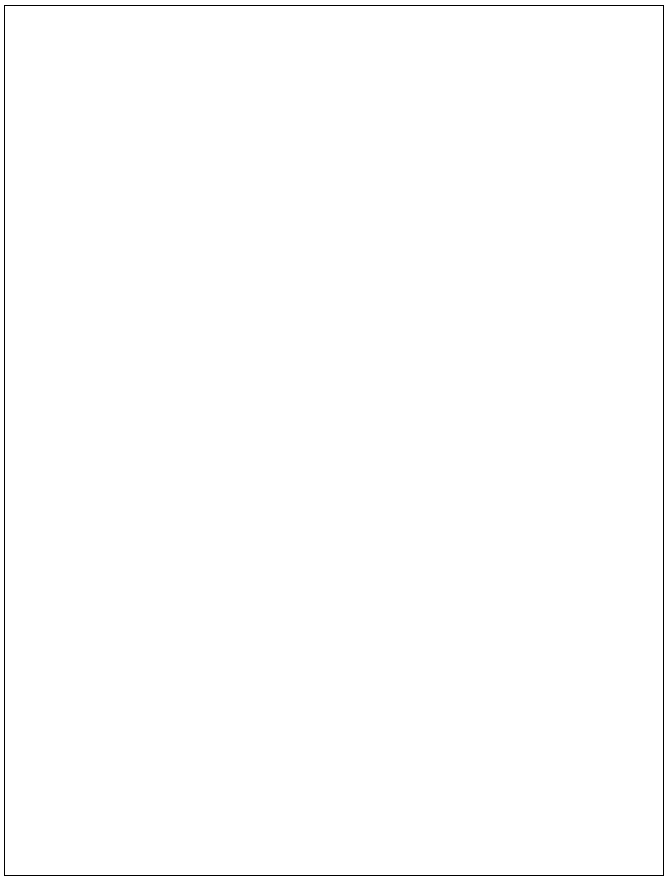
Geschäftsführer/General Manager:
Wilfried Kiene







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