Operating Instructions

Transducers UFA / UVA integrated in vane wheel sensors or vortex probes VA40 with connection housing AS80

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1 Safety Symbols

Warning!
Failure to observe the instructions can result in serious injury and damage to property!

Important notice!
Non-observance can result in serious damage to the equipment or restriction in performance!

2 Safety Instructions

Danger to life, risk of injury and damage to material or property.
Read the Operating Instructions carefully before initial operation.
Observe general safety precautions as well as those included in various sections of these Operating Instructions.

Hazard risks:
- non-observance of the Operating and Safety Instructions
- modifications to the device by the customer
- handling the device outside the specified operating conditions
- handling the transducers outside the specified operating conditions
- use of unsuitable power supplies and peripheral devices
- improper use of the device

Prevention of voltage hazards:
- use only the dedicated adapter plug for the mains supply
- make sure that the PC is correctly connected to the mains (earthed safety socket, earthing) when using a USB connection
- when connecting analog outputs or inputs to peripheral devices make sure that these are correctly connected to the mains (earthed safety socket, earthing)

Danger when installing the sensors in pressurized pipelines:
- sensors for use in pressurized pipelines are to be inserted or retracted only in depressurized conditions; non-observance may result in serious injuries to personnel
- when installing or removing under pressure, the appropriate protective equipment must be used, e.g. ball valve and probe guide pieces with chain guard or spindle probe guide pieces

3 Intended Use

Transducers UFA and UVA are instruments for measuring flow velocity and flow rate:
UFA for use with vane wheel flow sensors FA or FAR and measuring tubes FA Di or FAR Di and UVA for use with vortex flow sensors VA40 and measuring tubes VA Di. These instruments are designed for industrial Application. The AS80 is an aluminium housing in protection class IP65.
The manufacturer is not liable for damage caused by improper use and/or non-compliance with the regulations.
Do not carry out any structural modifications to the transducers.
Always follow the instructions on the type plate, especially the information regarding supply voltage.

4 Operating Safety

All steps described below must be carried out by qualified personnel only!

Please read the Operating Instructions carefully before unpacking theequipment!

Safety can only be guaranteed if the equipment is operated in accordance with the regulations. Improper handling can result in serious injury and damage to property.

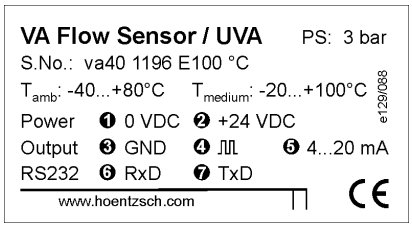
5 Scope of Delivery

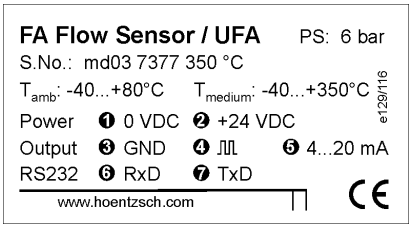
- Transducer UFA or UVA integrated in the connection housing of the FA or VA flow sensors
- Operating Instructions Flow Sensor FA or Va,
  data sheet flow sensor FA or VA with integrated transducer UFA or UVA
- CD-ROM with PC configuration software UCOM (optional)
- Programming adapter GO 070 / RS232 for PC connection COM port (optional)
- USB adapter in addition to programming adapter GO 070 / RS232 (optional)
- Cable socket GO 070

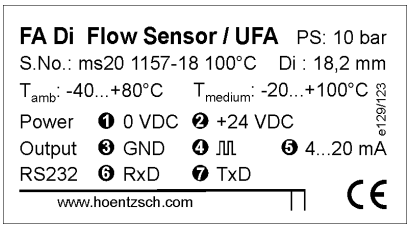
Please check that everything listed in the Delivery Note / Technical Data Sheet is included in the delivery.

5.1 Description, Type Plates

One of the following type plates (or similar) can be found on the connection housing:







VA Flow Sensor	: vortex flow sensor VA40
FA Flow Sensor	: vane wheel flow sensor
FA Di Flow Sensor	: vane wheel measuring tube
UVA	: transducer for vortex sensors VA
UFA	: transducer for vane wheel sensors FA
PS	: max. permissible pressure
S.No.	: serial number with max. temperature of the medium
Di	: inside diameter Di of the measuring tube
T_{amb}	: ambient air temperature range -40...+80 °C -30...+80 °C, only for type VA40/21,3 … GK … ZG10 sensors -5...+50 °C, with 'LCD display' option
T_{medium}	: temperature range of medium

Pin assignment of cable socket GO 070:

Power	1	: 0 VDC =	supply voltage 0 VDC
	2	: +24 VDC =	supply voltage +24 VDC
Output	3	: GND =	reference potential
	4	: ⎍⎍ =	digital output open-collector (internally connected to GND)
	5	: 4...20 mA =	current output 4-20 mA
RS232	6	: RxD =	serial interface
	7	: TxD =	serial interface
		(GND =	reference potential)

6 Technical Specifications

6.1 Conformity with Standards

Transducers UFA / UVA are manufactured according to the best available technology, are safe and reliable and comply with the relevant regulations, EU directives and standards.

6.2 Storage Conditions

Storage conditions: -30 to +70 °C

6.3 Operating Conditions

Ambient air temperature of connection housing when in use	: -40 ... +80 °C -30 ... +80 °C, only for type VA40/21,3 … GK … ZG10 sensors
with optional LCD display	: -5 ... +50 °C
protection class	: IP65
mounting attitude	: no restrictions

6.4 Housing and Connection

protection class	: housing IP65
material	: aluminium
external dimensions	: L/W/H = 80/80/60 mm
connection	: cable socket GO 070 with terminals for strands with cross-section 0.25 ... 1.0 mm²

6.5 Electrical Data

Supply voltage, mains supply	24 V DC (20 ... 27 V DC), power < 3 W

The mains supply is electrically isolated from the UFA/UVA outputs.

Analog output	: 4 ... 20 mA = 0 ... x m/s (or m³/h) 4 ... 20 mA = -x ... 0 ... +x m/s (or m³/h) with FAR function configurable. Terminal value x configurable / resistance max. 400 Ohm
Digital output	: (open-collector transistor), max. 50 mA / 27 V DC, configurable as limit value v, quantity pulse or ±direction of flow (see under 8 Functional Description)

RS232 interface : for connection with PC programme UCOM
(see under 8 Functional Description)
9600 Baud, 8Bit, no parity, 2 stop bits, Xon/Xoff

Accessible by unscrewing the housing cover:

Connection for optional LCD display : flat ribbon cable with 10-pin cable socket
Do not plug in or out when live!

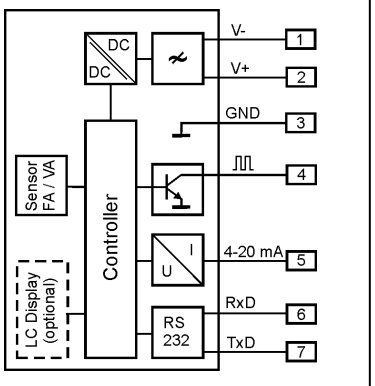
6.6 Measurement Uncertainty

Recording the measurement frequency (at 1000 Hz) : <0.1%
Analog output (terminal value) : <0.15%
Linearity error : <0.1%
Temperature coefficient : <20 ppm/K (at 25 °K temperature difference equivalent to <0.05%)

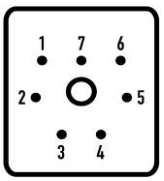
7 Installation

The current European Specifications for Assembly, the recognised standards of good practice and this Operating Instructions apply.

7.1 Block Diagram and Pin Assignment



Transducer UFA / UVA integrated



① Power V –
② Power V +
③ GND
④ Digital Output
⑤ 4...20mA Output
⑥ RxD
⑦ TxD

Pin assignment UFA / UVA

7.2 Wiring Diagrams

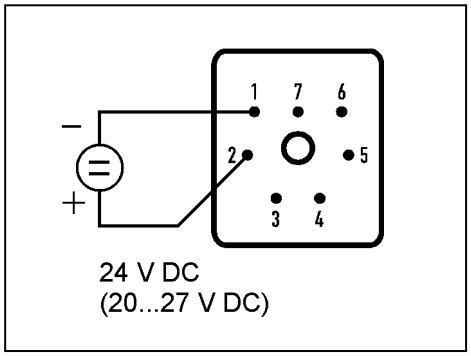
Electrical connection must be carried out according to the appropriate wiring diagram.
Faulty connection can cause damage to the electronics.

Do not install or wire up the transducer under mains voltage. **Non.compliance can cause damage to the electronics.**

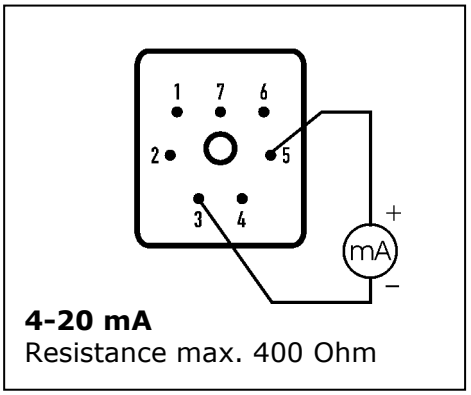
In this connection and depending on the configuration of the equipment, one of the following wiring diagrams must be taken into account. Wiring diagrams for measuring systems in customer-specific design will be supplied separately.

7.2.1 Power supply

Before connecting please check that the power supply is within the specification.
The type plate with all relevant information can be found on the connection housing of the flow sensor.



7.2.2 Analog output v

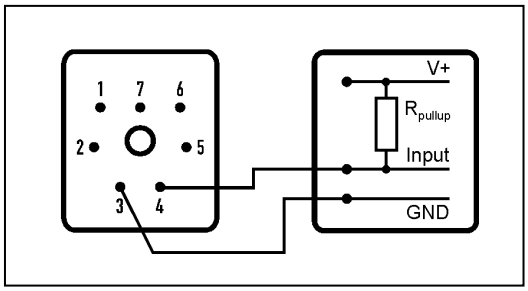


The terminal value of the analog output can be configured with the PC software UCOM via the RS232 interface. The factory-programmed values can be found in the accompanying documents.

7.2.3 Digital output (open-collector-transistor)

The digital output is an open-collector transistor output, internally connected to GND.

The function of the digital output and the corresponding setting parameter are configurable using the UCOM software via the RS232 interface. The factory-programmed settings can be found in the parameter printout.



The reference potential terminal (3) of the UFA/UVA is connected to the GND terminal of the data logging. The open-collector transistor output (4) is connected to the input of the data logging, to which a pull-up resistor for internal supply voltage of the data logging must be connected (with 24 V as a rule 5...10 kOhm).
The limit values for the digital output are: max. 50 mA / max.27 VDC.

Note: If the same voltage source is used for the UFA/UVA as for the internal supply for the data logging, then the electrical isolation between the supply voltage and the UFA/UVA outputs is deactivated.

7.2.4 RS232 interface

Fig. 1: Programming adapter GO 70 / RS232 for UCOM software, connector PC Sub-D 9-pin, adaptor plug 230 VAC/24VDC and USB adapter

To connect the RS232 interface, plug the programming adapter into the UFA/UVA. The transducer is powered by the adapter.

Connection to a PC is via a COM port or with an optional USB adapter.

7.2.5 Optional LCD display

Fig. 2: optional LCD in the housing cover

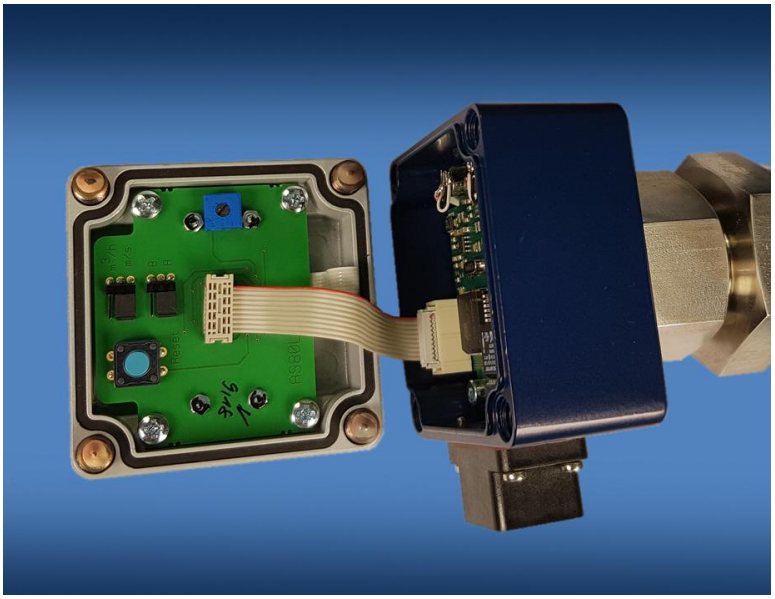


Fig. 3: LCD connection with cover open

The flat ribbon cable with the 10-pin connector should not be plugged in or out when live! Risk of damage to equipment!

Visible are the potentiometer for the LCD display, the reset button for the quantity counter, the jumpers m/s-m³/h and A-B (see under 8 Functional Description).

8 Functional Description

UFA transducers are designed for connecting to vane wheel probes FA and FAR (directional sensing) and vane wheel measuring tubes FA Di and FAR Di (directional sensing) for measuring flow velocity or flow rate of air/gases and water/liquids.
UVA transducers are designed for connecting to vortex sensors VA for measuring flow velocity or flow rate of air/gases.

The signal frequency generated from the flow sensor is converted to a linear **analog output signal 4-20 mA**. The analog terminal value is configurable.
When logging directional sensing data, the zero point can be selected in the middle of the analog range, or display of flow direction takes place with the aid of the digital output:

for FA and FAR*:	**4 ... 20 mA**	=	0 ... x m/s (or m³/h)
for FAR:	**4 ... 12 ... 20 mA**	=	-x ... 0...+x m/s (or m³/h)
for VA:	**4 ... 20 mA**	=	0 ... x m/s (or m³/h)

* for FAR sensors configuration of the digital output (see under): ±direction of flow

The actual velocity / actual flow rate can be converted to standard velocity / standard flow rate by entering the parameters 'temperature' and 'pressure'. Working temperature and pressure should be constant.

A **digital output** (open-collector transistor) can be configured for **1 of 3** different **functions**:

1. as **limit value** for the flow velocity or flow rate:
   flow velocity < or = limit value: open-collector transistor inactive
   flow velocity > limit value: open-collector transistor active

2. as **quantity pulse for** quantity measurement:
   max. pulse repetition frequency 1 Hz per unit of volume,
   configurable, e.g. 1 pulse per 1, 10 or 100 (norm)-m³ or (norm)-litre
   pulse duration 0.5 s (with FAR sensors: configurable for '+' or '-' amounts)

3. as **±direction of flow** ** (FAR sensors only):
   +direction: open-collector transistor inactive
   - direction: open-collector transistor active
   ** analog output (see above) is then absolute value of flow only, without direction

Self diagnosis according to NAMUR NE43:

No error	: analog output	= 4 mA (flow velocity = 0)
or	analog output	> 4 mA (flow velocity > 0)
Error	: analog output	< 3.6 mA

Monitoring of power supply, data logging, sensor interface, parameter settings (see under 16 Troubleshooting)

PC serial port RS232
for changing calibration data and setting parameters.

Connect programming adapter GO 070 (optional) to the UFA/UVA transducer, then plug in the adapter. Connect sub-D to the PC RS232 socket.
If PC connection is via USB, then an optional available USB / RS232 interface converter must be inserted.

Changes to the settings can now take place after starting the PC programme UCOM (optional) (see under 9 Settings).

Optional LCD display in housing cover:
2 x 16 digit, character height 3 mm.

Display line 1 : instantaneous value velocity or flow rate.
Display line 2 : 'quantity counter' or 'error code'.

Configuration (see Fig. 3, under 7.2.5 Optional LCD Display) via 2 jumper wrap connectors m/s-m³/h and A-B

Display line 1:

m/s-m³/h = m/s	and A-B = any:	velocity in (N)m/s *
m/s-m³/h = m³/h	and A-B = A:	flow rate in (N)m³/h
m/s-m³/h = m³/h	and A-B = B:	flow rate in (N)lt/h **

* standard values (N) only when parameter 'switching v/NV' =1 (see under 9 Settings)
** only when diameter Di < 75.0 mm, otherwise display in (N)m³/h

Display line 2:
Quantity counter in m³ with 0 ... 3 decimal places
(see under 9 Settings; parameter 'switching pulse m³(cbm) / l (litre)' and
parameter 'm³ (cbm) / l (litre) per pulse' and
parameter 'decimal places quantity display')
with error : error 01 = parameter error
error 02 = sensor error
(see under 16 Troubleshooting)

Reset button in the housing cover: see Fig. 3, under 7.2.5 in housing cover
Reset the quantity counter by pressing the reset button for more than 3 seconds.

9 Settings

The following setting parameters can be read using the PC software UCOM and are also alterable.
The customer-specific settings are shown on the parameter print-out, which is included in the documents.

Please find operation instructions PC software UCOM in document U385.

10 Initial Operation

(Pay attention to 7.2.1 Power supply)
(Pay attention to 7.2.2 Analog output v)
On connecting the supply voltage:
no flow at sensor: the analog output sends a value of 4 mA (or 12 mA depending on configuration with FAR sensors, see under 8 Functional Description)
flow at sensor: the analog output sends an analog value deviating from the zero flow conditions (see above).

11 Operation

(see under 6.3 Operationg conditions)
(see under 6.5 Electrical Data)

12 Shut-down, Dismantling

Before disconnecting the cable, please ensure that the supply voltage is switched off.

13 Inspection

see under 8 Functional Description, Self diagnosis

14 Maintenance

Only use cleaning agents which dry without leaving any residue and which are compatible with the housing materials.
Any repair work is to be carried out solely by Höntzsch GmbH & Co. KG.

15 Meaning of LEDs on the circuit board

LED	Description
LED red on	parameter error
LED yellow on	sensor error

16 Troubleshooting

Fault	Cause	Troubleshooting
analog output = 0 mA	no power supply	check connecting cable, measure voltage at connecting terminals
	transducer electronics faulty	return to factory
analog output = error (<3.6 mA)	parameter error	check parameter using UCOM software, save new checksum (or return to factory)
	transducer electronics faulty	return to factory
analog output = 4 mA, no measured value	sensor contaminated	clean sensor according to instructions
	profile factor set at 0.000	set profile factor to relevant nominal diameter and sensor type
measured value too low	sensor contaminated	clean sensor according to instructions
	profile factor setting too low	set profile factor to relevant nominal diameter and sensor type
	input/output section too short	change sensor position, improve flow conditions with a flow rectifier
	rotational flow	reposition sensor in flow direction, install flow rectifier
	vortex VA sensors: reduced acoustic coupling in the sensor elements as a result of intense vibration or powerful impact	return sensor to factory for performance test
	burden at current output is greater than specified in the Technical Data Sheet resulting in correct output values in the lower range and no longer increasing values at the top end of the measuring range	reduce resistance
	incorrect scaling of analog output	check setting and amend if necessary
measured value too high	profile factor set too high	set profile factor to relevant nominal diameter and sensor type
	EMC problem	see reference to electromagnetic compatibility (EMC)

17 Returns

When returning sensors, these should be cleaned thoroughly according to the instructions. A hazard warning or declaration of no objection must be supplied for substances which have been in contact with the sensor or possibly infiltrated the cavities in the sensor. If adhesion of hazardous substances cannot be ruled out, then detailed safety measures to be taken when handling the equipment must be itemised.

18 Disposal

The customer should assume the duty to dispose of the equipment at his own expense and according to statutory provisions (e.g. ElektroG in Germany).

19 Replacement Parts

Integrated transducers UFA /UVA have no replacement parts.
An electronic self-restoring fuse is used.

20 Declaration of Conformity, Declaration of Incorporation

We Höntzsch GmbH & Co. KG
Gottlieb-Daimler-Str. 37
D-71334 Waiblingen

bearing sole responsibility, hereby declare that the product

Transducer UFA / UVA in AS80 housing

referred to in this declaration, is in conformity with the following standards or normative documents:

Provisions of the Directive	**Reference and date of issue**
2014/30/EU: Electromagnetic Compatibility	EN 61000-6-4 EN 61000-6-2
2014/68/EU: Pressure Equipment Directive	
2006/42/EC: Safety of Machinery	
Safety requirements for electrical equipment for measurement, control, and laboratory use	EN 61010

Waiblingen, 14.01.2021 Jürgen Lempp / Managing Director

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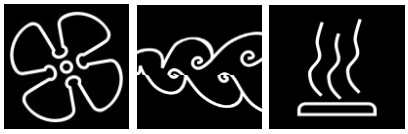
Subject to alteration



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flow measuring technology

zertifiziert nach
ISO 9001
certified quality

Operating Instructions

Transducers UFA / UVA / UTA integrated in vane wheel sensors, vortex sensors, or thermal sensors with Ex-d housing

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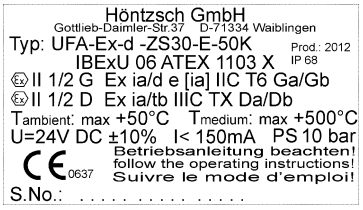
A1 Scope of Delivery

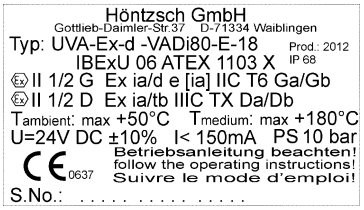
- Transducer UFA, UVA or UTA integrated in the connection housing of flow sensor FA, VA or TA
- Operating Instructions Flow Sensor FA, VA or TA
- Data Sheet flow sensor FA, VA or TA with integrated transducer UFA, UVA or UTA
- CD-ROM with PC configuration software UCOM (optional)
- HART® modem for PC connection to USB port (optional)

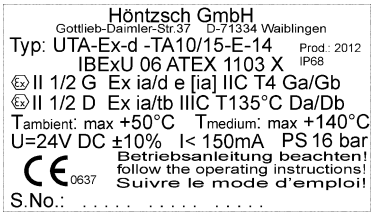
Please check that everything listed in the Delivery Note / Technical Data Sheet is included in the delivery.

A1.1 Description, Type Plates

One of the following type plates (or similar) can be found on the connection housing:







FA, FAR	: vane wheel flow sensor
VA	: vortex flow sensor VA40
TA	: thermal flow sensor
UFA	: transducer for vane wheel sensors FA
UVA	: transducer for vortex sensors VA
UTA	: transducer for thermal sensors TA
PS	: max. permissible pressure (absolute)
S.No.	: serial number
Di	: inside diameter Di of the measuring tube
$T_{ambient}$	: ambient air temperature range connection housing -20 ... +50 °C
T_{medium}	: temperature range of medium

Pin assignment of connecting terminals:

KL1	DC Power	L+	: +24 VDC	= supply voltage +24 VDC
		L-	: 0 VDC	= supply voltage 0 VDC
KL2	Output 4 ... 20mA	+	: +4 ... 20mA	= Output Flow
		-	: - 4 ... 20mA	= Output Flow
KL3	Output relay (2 terminals)		: = normally-open potential-free	

A2 Technical Specifications

A2.1 Operating Conditions

Ambient temperature of connection housing when in use	: -20 ... +50 °C
Type of protection	: IP68

A2.2 Housing and Connections

Type of protection	: housing IP68
Setup	: dual chamber system Ex-d = electronics, Ex-e = terminal compartment
Material	: aluminium
External dimensions	: D/L/H = 110/205/182 mm
Connections	: 2 cable bushings in Ex-e protection in the terminal compartment, in which 6 terminals in Ex-e protection for wires with cross-section 0.14 ... 1.5 mm² can be found

A2.3 Electrical Data

Supply voltage, mains supply	24 V DC (20 ... 27 V DC), power < 5 W
supply current	<150 mA

The mains supply is electrically isolated from the outputs.
The "-" connection of the analog output can be found on the housing and therefore on the equipotential bonding, i.e. for EMC reasons, signal evaluation should have potential-free inputs.
The relay output is potential-free.

Analog output	: 4 ... 20 mA = 0 ... x m/s (or m³/h) 4 ... 20 mA = -x ... 0 ... +x m/s (or m³/h) with FAR function configurable; terminal value x configurable / resistance max. 500 Ohm, with HART® interface 250 ... 500 Ohm
Digital output	: (relay contact, normally-open contact), max. 200 mA / 30 V DC, configurable as limit value v, quantity pulse or ±direction of flow (see A4 Functional Description)
HART® interface	: for communication with PC programme UCOM (see A4 Functional Description)

Accessible by unscrewing the glass housing (optional):

Connection for optional LCD display	: flat ribbon cable with 10-pin cable socket **DO NOT PLUG IN OR OUT WHEN LIVE!**

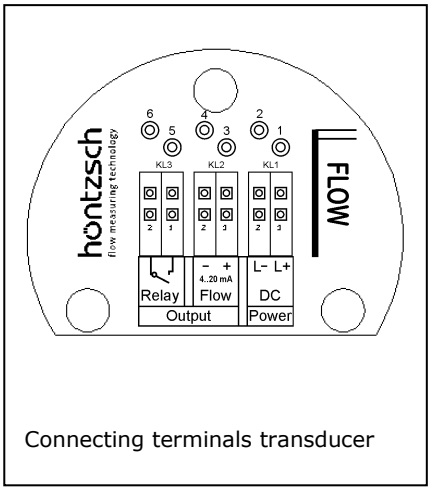
A2.4 Measurement Uncertainty

Acquisition of measurement frequency (at 1000 Hz)	: <0.1%
Analog output (terminal value)	: <0.15%
Linearity error	: <0.1%
Temperature coefficient	: <20 ppm/K (at 25 °K temperature difference equivalent to <0.05%)

A3 Installation

The relevant national regulations for installing electrical equipment, the General Engineering Regulations and these Operating Instructions apply.

A3.1 Terminal Connections



Connecting terminals transducer

Connecting terminals are accessible after removing the housing cover of the terminal compartment (housing cover on the cable gland side).

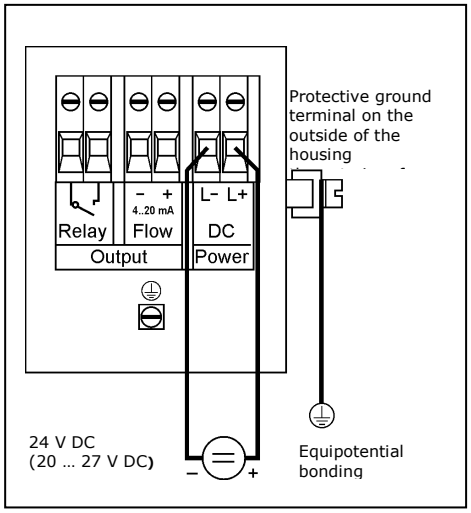
A3.2 Wiring Diagrams

Electrical connection must be carried out according to the appropriate wiring diagram. **Faulty connection can cause damage to the electronics.**

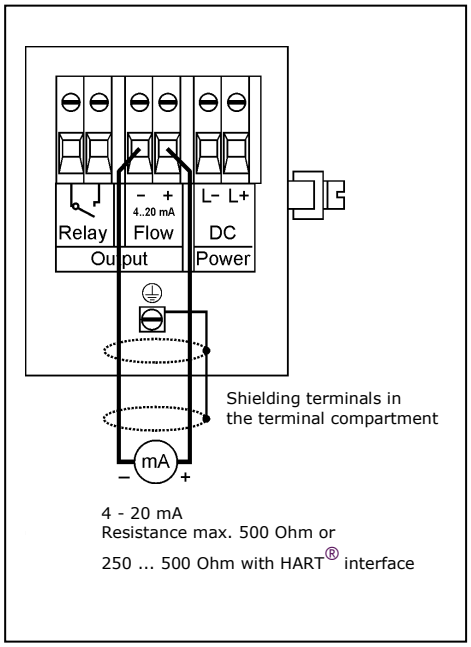
Do not install or wire up the transducer under mains voltage. **Non-compliance can cause damage to the electronics.**

A3.2.1 Power supply

Before connecting please check that the power supply is within the specification. All relevant information can be found on the type plate.



A3.2.2 Analog output v



The analog output is configurable with the UCOM software via the HART® interface. The factory-set values can be found in the accompanying documents.

A3.2.3 Digital output (relay contact)

The digital output is a potential-free relay contact (normally-open).

The function of the digital output and the corresponding setting parameter are configurable using the UCOM software via the HART® interface. The factory-programmed settings can be found in the parameter printout included with delivery.

The **digital output** (relay contact) can be configured for **1 of 3 functions**:

1. as **limit value** for the flow velocity or flow rate:
   flow velocity < or = limit value: relay contact open
   flow velocity > limit value: relay contact closed

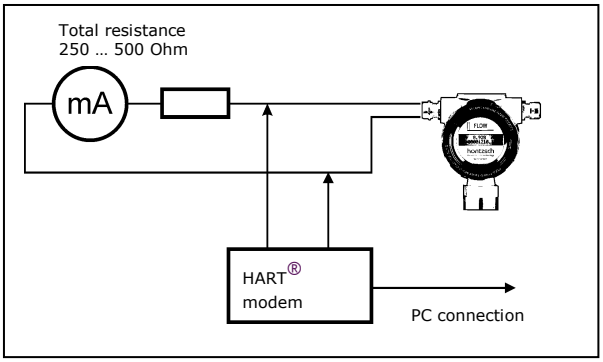
2. as **quantity pulse** for quantity measurement:
   max. pulse repetition frequency 1 Hz per unit of volume,
   configurable, e.g. 1 pulse per 1, 10 or 100 (norm)-m³ or (norm)-litre
   pulse duration 0.5 s (with FAR sensors: configurable for '+' or '-' amounts)

3. as **±direction of flow** ** (FAR sensors only):
   +direction: relay contact open
   - direction: relay contact closed
   ** analog output is then absolute value of flow only, without direction

A3.2.4 HART® interface

To connect the HART® interface an optional HART® modem is connected to the closed circuit of the analog output 4 … 20 mA (connect to +4 ... 20mA terminal and -4 … 20mA terminal). The polarity of the HART® modem connection is irrelevant. The resistance of the 4 ... 20 mA circuit must be between 250 Ohm and 500 Ohm.

Connection to PC is via a USB connection.



A3.2.5 LCD display (optional)

Fig. 1: optional LCD display behind glass

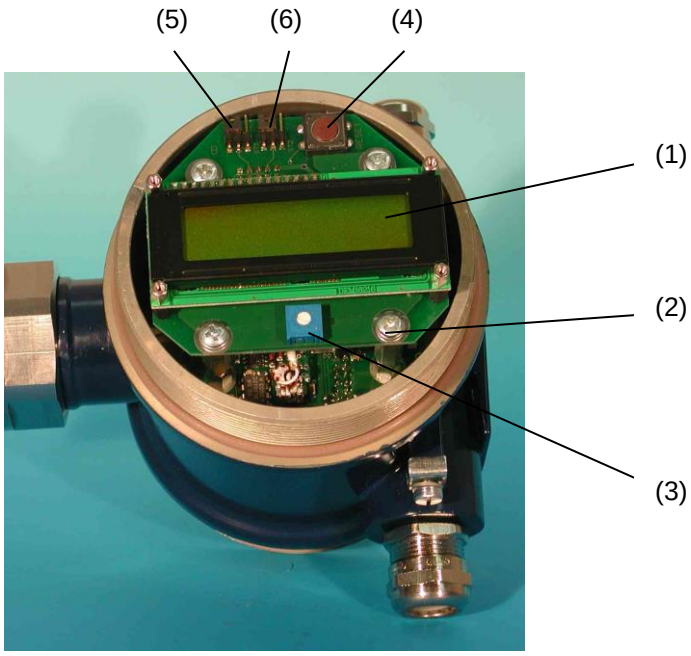


Fig. 2: LCD display with cover open

After unscrewing the housing cover with inspection glass and the display cover plate, the complete display module (1) can be rotated in steps of 90° after loosening the 4 retaining screws (2).

The flat ribbon cable with 10-pin connector should not be plugged in or unplugged when live! Risk of damage to equipment!

Visible are the readout potentiometer (3) for the display contrast, the reset button (4) for the counter, the jumpers St1 m/s-m³/h (5) and St2 A-B (6) (see A4 Functional Description).

A4 Functional Description

UFA transducers for vane wheel probes FA and FAR (directional sensing) and vane wheel measuring tubes FA Di and FAR Di (directional sensing) for measuring flow velocity or flow rate of air/gases and water/liquids.
UVA transducers for vortex sensors VA for measuring flow velocity or flow rate of air/gases.
UTA transducers for thermal sensors TA for measuring standard flow velocity or standard flow rate of air/gases.

The signal frequency or voltage generated from the flow sensor is converted to a linear **analog output signal 4-20 mA**. The analog terminal value is configurable.
When logging directional sensing data, the zero point can be selected in the middle of the analog range, or display of flow direction takes place with the aid of the digital output:

for FA and FAR*:	**4 ... 20 mA**	=	0 ... x m/s (or m³/h)
for FAR:	**4 ... 12 ... 20 mA**	=	-x ... 0 ...+x m/s (or m³/h)
for VA:	**4 ... 20 mA**	=	0 ... x m/s (or m³/h)

* for FAR sensors configuration of the digital output (see below): ±direction of flow

With transducers UFA and UVA the actual velocity/actual flow rate can be converted to standard velocity/ standard flow rate by entering the parameters 'temperature' and 'pressure'. Working temperature and pressure should be constant.

A **digital output** (relay contact) can be configured for **1 of 3 functions**:

1. as **limit value** for the flow velocity or flow rate:
   flow velocity < or = limit value: relay contact open
   flow velocity > limit value: relay contact closed

2. as **quantity pulse** for quantity measurement:
   max. pulse repetition frequency 1 Hz per unit of volume,
   configurable, e.g. 1 pulse per 1, 10 or 100 (norm)-m³ or (norm)-litre
   pulse duration 0.5 s (with FAR sensors: configurable for '+' or '-' amounts)

3. as **±direction of flow** ** (FAR sensors only):
   +direction: relay contact open
   - direction: relay contact closed
   ** analog output is then absolute value of flow only, without direction

Self-diagnosis according to NAMUR NE43:

No error	: analog output	= 4 mA	(flow velocity = 0)
or	analog output	> 4 mA	(flow velocity > 0)
Error	: analog output	< 3.6 mA	

For monitoring of power supply, data logging, sensor interface, parameter settings (see under A10: Troubleshooting)

HART® interface
for changing calibration data and setting parameters.

Connect HART® modem (optional) to transducer UFA/UVA/UTA on the closed circuit of the analog output (connect to both terminals of the analog output 4 ... 20 mA). Polarity of the connecting terminals of the HART® modem is irrelevant, resistance between 250 Ohm and 500 Ohm to be strictly observed). Connect USB plug to the USB PC connection.

Changes to the settings can now take place after starting the PC programme UCOM (optional)
(see under A5: Settings).

Optional LCD display:
2 x 16 digit, character height 5.5 mm

Display row 1 : instantaneous value - velocity or flow rate
Display row 2 : 'counter' or 'error code'

Configuration (see Fig. 2, under A3.2.5) via 2 jumper wrap connections St1 m/s-m³/h and St2 A-B

Display row 1:

m/s-m³/h = m/s	and A-B = any:	velocity in (N)m/s *
m/s-m³/h = m³/h	and A-B = A:	flow rate in (N)m³/h
m/s-m³/h = m³/h	and A-B = B:	flow rate in (N)l/h **

* standard values (N) UFA and UVA only, when parameter 'switching v/NV' =1 (see under A5)
** only when Di < 75.0 mm, otherwise display in (N)m³/h

Display row 2:
Quantity counter in m³ with 0 ... 3 decimal places
(see under A5: parameter 'switching pulse m³(cbm) / l (litre)' and
parameter 'm³ (cbm) / l (litre) per pulse' and
parameter 'decimal places quantity display')
with error : error 01 = parameter error
error 02 = sensor error

(see A10: Troubleshooting)

Reset button on the LCD display module behind the glass of the housing cover: see Fig. 2, A3.2.5:
Reset the counter by pressing the reset button for more than 3 seconds. This can also be carried out via the HART® interface.

A5 Settings

The following setting parameters can be read using the PC software UCOM and are also alterable. The customer-specific settings are shown on the parameter print-out, which is included in the documents.

Operating Instructions Software UCOM see document U385.

A6 Initial Operation

(Pay attention to A3.2.1 Power supply and A3.2.2 Analog output)
On connecting the supply voltage:
no flow at sensor: the analog output sends a value of 4 mA (or 12 mA depending on configuration with FAR sensors, see under A4 Functional Description)
flow at sensor: the analog output sends an analog value deviating from the zero flow conditions (see above).

A7 Operation

(Pay attention to A2.1 Operating Conditions)
(Pay attention to A2.3 Electrical Data)

A8 Shut-down, Dismantling

Please ensure that the supply voltage is switched off before disconnecting.

A9 Inspection

see under A4 Functional Description, self-diagnosis.

The screw threads of the housing cover have been treated with graphite to protect against corrosion.

A10 Troubleshooting

Fault	Cause	Troubleshooting
Analog output = 0 mA	No power supply	Check connecting cable; measure voltage at connecting terminals
	Transducer electronics faulty	Return to factory
Analog output = error (<3.6 mA)	Parameter error	Check parameter with UCOM software; save new checksum (or return to factory)
	Transducer electronics faulty	Return to factory
Analog output = 4 mA, no measured value	Sensor contaminated	Clean sensor according to instructions
	Profile factor set at 0.000	Set profile factor to relevant nominal diameter and sensor type
Measured value too low	Sensor contaminated	Clean sensor according to instructions
	Profile factor setting too low	Set profile factor to relevant nominal diameter and sensor type
	Input/output section too short	Change sensor position; improve flow conditions with a flow rectifier
	Rotational flow	Reposition sensor in flow direction; install flow rectifier
	VA sensors: Reduced acoustic coupling in the sensor elements as a result of intense vibration or a powerful impact	Return sensor to factory for performance check
	Resistance at current output is greater than specified in the Technical Data Sheet. This results in correct output values in the lower range and no longer increasing output values at the top end of the measuring range	Reduce resistance value
	Incorrect scaling of analog output	Check setting and amend if necessary
Measured value too high	Profile factor set too high	Set profile factor to relevant nominal diameter and sensor type
	EMC problem	See reference to electromagnetic compatibility (EMC)

A11 Replacement Parts

- Cable bush in Ex-e protection
- Inspection glass housing cover
- Housing cover (without inspection glass)
- Seals for housing cover
- The fuse is self-restoring

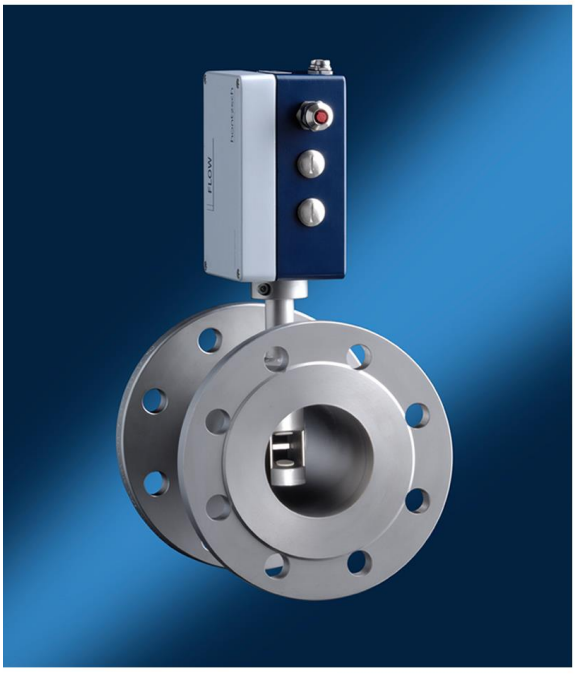
Safety Manual

- Probes VA40 ... ZG7 with integrated transducer UVA in AS80 housing
- Measuring tubes VA Di ... ZG1 with integrated transducer UVA in AS80 or AS102 housing

- Probes VA40 ... ZG8 Ex-d with integrated transducer UVA-Ex-d in Ex-d flameproof housing
- Measuring tubes VA Di ... ZG1 Ex-d with integrated transducer UVA-Ex-d in Ex-d flameproof housing

VA40 ... ZG7

VA40 ... ZG8 Ex-d



VA DI ... ZG1

VA DI ... ZG1 Ex-d

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3.3 Safe Applications according IEC 61508
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1 Safety Symbols

Warning! Failure to observe the instructions can result in serious injury and damage to property!

Important notice! Non-observance can result in serious damage to the equipment or performance restriction!

2 Operating Safety

All steps described below must be carried out by qualified personnel only!

Please read the Operating Instructions carefully before unpacking the equipment!

Safety can only be guaranteed if the equipment is operated in accordance with the regulations. Improper handling can result in serious injury and damage to property.

The Safety Manual is only effective in connection with the relevant Operating Instructions or Instruction Manual for Ex-instruments.

3 Planning / Layout

3.1 Ex-application

Approved appliances only are to be used for applications in potentially explosive atmospheres. Special attention should be paid to Instruction Manual UVA-Ex-d.

3.2 Choice of Installation Location

The place of installation must be chosen with care to optimise measurement accuracy. For tips refer to the Operating Instructions.

3.3 Safety Instrumented Systems according IEC 61508 SIL 1, SIL 2 and SIL2/SC3 (SIL 3 with 1oo2)

Requirements:
- Operation in Low Demand Mode
- The analog output values ≥21 mA and ≤3.6 mA are diagnosed as faults by the subsequent control unit; the process goes into safe mode.
- Safety functions cannot be implemented with the digital output, as no fault tracking can be effected via this output.
- A measurement error of less than 10 % of the measured value has no impact on the safety function.
- The efficiency of the equipment must be checked at regular intervals by repeated inspection.

4 Scope of Delivery

Please check that everything listed in the Technical Data Sheet is included in the delivery.
Also look out for potential small parts such as screw sets, seals, etc.

For use in 'Safe Applications (SIL 1, SIL 2 und SIL 3 in 1oo2)' the device must have a SIL logo on the **electronics housing and the SIL conformity must be confirmed in the Technical Data Sheet.**

5 Conformity with Standards

In addition, the following standards apply for the functional safety:

DIN EN 61508 Part 1 to Part 7:
Functional safety of electrical/electronic/programmable electronic safety-related systems

DIN EN 61511 Part 1 to Part 3:
Functional safety - Safety instrumented systems for the process industry sector

The flow measuring equipment complies with DIN EN 61508 Part 1 to Part 7 and may be used in safety instrumented systems according to DIN EN 61511 Part 1 to Part 3

6 Abbreviations and Definitions

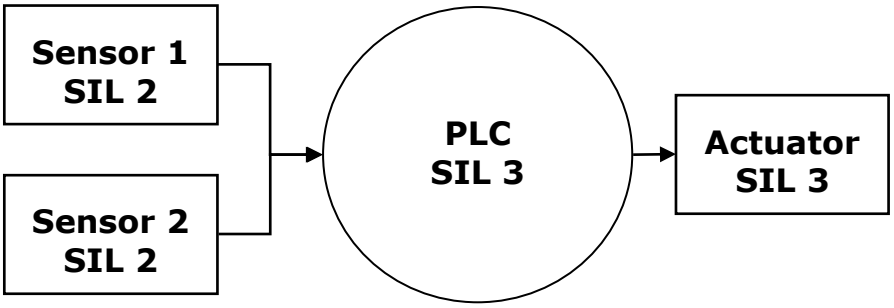
Abbreviation	Designation	Definition
	Functional Safety	Describes the part of the safety of a system that depends on the correct function of the safety-related (sub-) systems and external equipment for risk minimisation.
SIL	**S**afety **I**ntegrity **L**evel	To assess electrical / electronic / programmable electronic (E/E/PE) systems relating to the reliability of the safety functions. From the target level arises the safety-directed design principle, which must be observed to reduce the risk of failure. SIL 4 = highest level, SIL 1 = lowest level.
SIS	**S**afety **I**nstrumented **S**ystem	Safety instrumented system for carrying out one or more safety instrumented functions. A SIS consists of sensor(s), logic system and actuator(s).
	Mission Time	Mission time of the failure mode and effects analysis
PFDG/PFD_{avg}	**Av**era**g**e **P**robability of **F**ailure on **D**emand	Averaged probability of failure on demand of the safety function
PFS_{avg}	**Av**era**g**e **P**robability of **F**ail **S**afe	Averaged probability of causing a spurious trip of the process
OK		Probability product is running without any failures
FMEA	**F**ailure **M**ode and **E**ffects **A**nalysis	Failure mode and effects analysis
	Mode of operation	- operation in low demand mode, whereby the demand on the safety-related system is no more than once a year and not greater than the double frequency of the repeat test - operation in high demand or continuous mode, whereby the demand on the safety-related system is more than once a year or greater than the double frequency for the repeat test
SFF	**S**afe **F**ailure **F**raction	Fraction of safe failures relating to the total average failure rate
HFT	**H**ardware **F**ault **T**olerance	The capability of a functional unit to continue the execution of a demanded function in case of faults or deviations
FIT	**F**ailure **I**n **T**ime	1 FIT = 1 failure per 10^9 hours
λ	Failure rate	sd =safe detected su =safe undetected dd =dangerous detected du =danger undetected
MTTF	**M**ean **T**ime **T**o **F**ailure	s = safe d = dangerous
1oo2 SIL 3 (SC 3)	**1oo2 SIL 3 by redundancy setup, systematic capability (SC 3)**	Two identical devices are suitable for SIL 3 in architecture 1oo2. Each device can perform the safety function.
DC	**D**iagnostic **C**overage	s = safe d = dangerous

7 Safety Instrumented System (SIS)

A safety instrumented system generally consists of the three subsystems – input subsystem (sensor), Logic subsystem (PLC) and output subsystem (actuator).
The average probability of failure on demand PFDG/PFD_{avg} is usually distributed over the subsystems as follows:

Single-Channel SIS in 1oo1

Multi-Channel SIS in 1oo2



8 Average Probability of Failure on Demand (PFDavg)

This table indicates the attainable Safety Integrity Level (SIL) subject to average probability of failure on demand. The specified failure boundaries here are effective for a safety function in low demand mode.

Safety Integrity Level (SIL)	PFD_{avg} (low demand mode)
4	$\geq 10^{-5}$ bis $< 10^{-4}$
3	$\geq 10^{-4}$ bis $< 10^{-3}$
2	$\geq 10^{-3}$ bis $< 10^{-2}$
1	$\geq 10^{-2}$ bis $< 10^{-1}$

9 Safety Integrity of the Hardware

This table indicates the attainable Safety Integrity Level (SIL) for Type B devices (according to IEC61508-2) subject to Safe Failure Fraction (SFF) and the Hardware Fault Tolerance (HFT):

Safe Failure Fraction (SFF)	Hardware Fault Tolerance (HFT)		
	0	1 (0)*	2
< 60%	not allowed	SIL 1	SIL 2
60% to < 90%	SIL 1	SIL 2	SIL 3
90% to < 99%	SIL 2	SIL 3	SIL 4
≥ 99%	SIL 3	SIL 4	SIL 4

* With proof of operational reliability according to IEC / EN 61511 for SIL 1 to SIL 3

The certified equipment complies with SIL 2 with a systematic capability of SC3 according to IEC 61508 route 2. Deployment according to IEC 61511 for SIL 1 and SIL 2 in 1oo1 and for SIL3 in 1oo2 configurations.

10 Initial Operation

Initial operation is described in the respective Operating Instructions. For Ex-applications the respective Instruction Manual must also be observed.

11 Behaviour during Operation and in case of Failure

Behaviour during operation and in case of failure is described in the respective Operating Instructions.

12 Periodic Testing

12.1 Safety Checks

The safety function of the entire safety loop must be checked regularly in accordance with IEC 61508/61511. Check intervals are determined when calculating the individual safety loop.

12.2 Performance Check

The proper functional operability of the flow measuring device must be checked regularly at least every 5 years. This can only be carried out by the manufacturer.
In the case of unfavourable operating conditions shorter proof test intervals may be determined by the user.

13 Repairs

Defective devices should be returned to Höntzsch service and repairs department, preferably with a detailed breakdown of type of failure and possible reasons.

14 Safety-related Characteristics

Extract from Reliability Study No. 2266.465.1 Version 1 - Vortex Sensors

Properties:

Device Type: B
Mode of operation: low demand mode
Hardware fault tolerance: 0

Table 1 - Results FMEDA at +55 °C

Properties	VA40 ... ZG7 VA40 ... ZG8 Ex-d VA Di ... ZG1 VA Di ... ZG1 Ex-d		
	FMEDA	Proven In Use	90% Confidence
Safe failure rate	248	40	62
Safe detected failure rate	0	n.a.	n.a.
Safe undetected failure rate	248	n.a.	n.a.
Dangerous failure rate	56	5.7	18
Dangerous detected failure rate	34	n.a.	n.a.
Dangerous undetected failure rate	22	n.a.	n.a.
DC	61%	n.a.	n.a.
Safe failure fraction	93%	n.a.	n.a.
MTTFd [years]	1768		

Notes:
Failure rates are in FIT 10^{-9}/h.
Confidence interval according to IEC 61508 route 2h.
IEC 61508 requires a minimum DC of 60% for Type B products for route 2h, 2s.

Table 2 - Results PFDG Calculations (1oo1)

	VA40 ... ZG7 VA40 ... ZG8 Ex-d VA Di ... ZG1 VA Di ... ZG1 Ex-d				
Years	1	2	5	10	20
PFDG	9.8E-05	1.95E-04	4.9E-04	9.7E-04	2E-03
%SIL 2	1%	2%	5%	10%	20%
PFSavg			9.7E-05		

MRT, MTTR 8h

Table 3 - Results PFDG Calculations (1oo2)

	VA40 ... ZG7 VA40 ... ZG8 Ex-d VA Di ... ZG1 VA Di ... ZG1 Ex-d				
Years	1	2	5	10	20
PFDG	5.7E-06	1.12E-05	2.77E-05	5.52E-05	1.10E-04
%SIL 2	1%	2%	5%	10%	20%

MRT, MTTR 72h, β 5% (common cause)

Summary results
The proven in use analysis demonstrates that the hardware of the Vortex Sensors VA40 ... ZG7/ZG8 and VA Di ... ZG1/Ex-d are corresponding with SIL 2 safety properties according to IEC 61508, route 2h and route 2s SIL 3 in 1oo2 configuration.

15

RISKNOWLOGY
SIL Certified Product

Certificate of compliance
Product

Holder	Höntzsch GmbH, Waiblingen, Germany
Compliant Item	Vortex Sensors VA40 ... ZG7 and VA40 ... ZG8 Vortex Sensors VA Di...ZG1 and VA Di...ZG1 Ex-d
Basis of Certification	IEC 61508:2010
Certification Include(s)	☑ Safety requirements specification ☑ Hardware requirements ☑ Reliability requirements ☑ Software requirements ☑ Basic safety ☑ User documentation

Functional Safety Data

Safety function:	See report
Mode:	Low demand
Type:	B
HFT:	0
Hardware compliance route:	2_H
Systematic compliance route:	2_S
Systematic capability:	SC3
Failure rates (FIT):	SD=0, SU=248, DD=34, DU=22
Safe failure fraction:	93%
Diagnostic coverage:	61%
Fit for use up to:	SIL 3
Fit for use up to:	STL 5

Certification Results	Risknowlogy certifies that the above Compliant Item meets the requirements of the Basis of Certification for the selected assessment(s). The Risknowlogy report 2266.465.1 are an integral part of this certificate.
Certificate Number	2266.465.2
Issue Date	2019-06-09
Expiry Date	After modification of Compliant Item

Certifier Dr. Michel Houtermans

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Subject to alterations