TRIO-WIRL V

Vortex Flowmeter
Model VT 4000/VR4000

TRIO-WIRL S

Swirl Flowmeter
Model ST4000/SR4000

Instruction Bulletin

D184B097U04

Rev. 1

TRIO-WIRL VT

TRIO-WIRL ST

TRIO-WIRL VR

TRIO-WIRL SR

Valid for Software Versions from A.10
(PROFIBUS-PA,
FOUNDATION Fieldbus)

Instrument Designation
TRIO-WIRL V/TRIO-WIRL S

Instruction Bulletin

Part No. D184B097U04

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1 Safety Information

1.1 Regulated Usage of the Pressure Equipment Types TRIO-WIRL VT4.., VR4.., ST4.. and SR4..

Pressure equipment of the Types TRIO-WIRL VT4.., VR4.., ST4.. and SR4.. are designed for transporting fluids; liquid, gases and steam, and are used to measure their volume flowrate. If the operating conditions (pressure, temperature) are constant, the flowrate can also be expressed in normal or mass flowrate units. If a temperature sensor (option) is installed in the flowmeter primary, a temperature dependent density compensation for saturated steam measurements can be made.

Included in the intended Usage are:

- Operation within the specified limits
- Observing the information regarding allowable fluids
- Observing the information regarding installation, operation, maintenance, etc.

The operating, service and maintenance requirements included in this Instruction Bulletin must be satisfied.

Damages resulting from improper or non-regulated usage will not be the responsibility of the manufacturer.

Not permitted are:

- Use as an elastic compensation element in the pipeline, e.g. to compensate for pipeline misalignment, pipeline vibrations, pipeline expansions, etc.
- To be climbed on, e.g. for installation purposes
- Use as a support for external loads, e.g. a mounting support for pipelines, etc.
- Any changes to the instrument, e.g. material removal by machining, welding, etc.
- The use of accessories or replacement parts not approved by the manufacturer

Specified Limits

- The allowable pressure (PS) and the allowable temperature (TS) must be £ the pressure and temperature values listed in the Instruction Bulletin. The specifications on the factory tag and the EEx Application Area Codes are to be observed.
- The maximum operating temperature listed in the Specifications may not be exceeded.
- Allowable Fluids are those for which, based on the based on the present state of the art or user experience, assurance can be given that the chemical and mechanical properties of the fluid wetted parts (process connections, meter tube, sensor and sensor seals) will not be negatively affected during an expected life span of at least 15 years.

Special Information

If such changes to the properties of the materials cannot be excluded or if abrasive fluids are being

metered, then the pressurized instruments of the Types TRIO-WIRL VT4.., VR4.., ST4.. and SR4.. may only be used if damage resulting from the operating conditions can be recognized by conducting periodic, suitable non-destructive tests.

1.2 Safety Signs and Symbol

Observe the safety information in the Instruction Bulletin identified by the following symbols:

	**Warning!**	This symbol is shown next to sections in this Instruction Bulletin to draw attention to possible dangers. Follow these instructions **exactly** otherwise personnel injuries or death may result.
!	**Attention!**	This symbol is shown next to sections in this Instruction Bulletin that are of special importance. Follow these instructions **exactly** otherwise incorrect operation or damage to the instrument may result. Read the instructions carefully.
i	**Information**	An information note indicates an important task or procedure. Follow these instructions **exactly** otherwise the process may be directly affected or an unexpected instrument reaction may result.
	**Ex-Protection**	Then Ex-Symbol indicates a description for the explosion protected TRIO-WIRL design.

1.3 Installation, Start-Up, Operating and Maintenance Requirements

- The electrical Installation, start-up and maintenance of the instrument should only be carried out by trained technicians who have been authorized to perform these tasks by the system operator. The technicians must read, understand and follow the instructions contained in this Instruction Bulletin.
- For corrosive or abrasive fluids the user must take into consideration the resistance of all fluid wetted parts. Fluid wetted parts are the meter tube, shedder (Vortex Flowmeter TRIO-WIRL V only), in- and outlet guide bodies (Swirl Flowmeter TRIO-WIRL S only), sensors and seals. ABB will gladly support you with the material selections, but cannot accept any liability.
- The technicians have the responsibility to assure that the electrical connections to the measurement system are in accord with the Interconnection Diagrams.
- Observe the safety information for the use and connection of the supply power and contact outputs.
- Observe in particular, the National Codes in your country relative to the installation, functional tests, repair and maintenance of electrical equipment.

1.4 Safe Operation

- The instrument is designed to the latest state of the art and safety standards. It was tested for compliance with the safety requirements at the factory and was shipped in proper operating condition.
- Please observe the special instructions for start-up of the explosion protected instrument designs. They may be found in a Chapter 10 in this Instruction Bulletin (Specifications Ex-Design).
- The housing Protection Class is IP 67 per EN60529
- The instrument satisfies the EMC-Requirements per EN61326 / NAMUR NE21.
- All instrument parameters are securely stored in an FRAM during power outages (including the actual totalizer values). The instrument is immediately operational once the power is turned on again.

!

Attention!

When the housing cover is removed the EMC- and personnel contact protection are lost. In particular, note the information regarding explosion protected instrument designs in the Ex-Chapter in this Instruction Bulletin.

- This Instruction Bulletin includes the instructions for start-up and testing of the instrument as well as the specifications for the instrument design. The manufacturer reserves the right to make hard- and software changes which represent technical advances. Information regarding updates and eventual extensions to the design may be obtained from the main plant in Göttingen, Germany of from your local ABB-Sales Bureau.

1.5 Returns

If it becomes necessary to return an instrument for repair or recalibration to the Main Plant of ABB in Göttingen, Germany, use the original or other suitable protective packing material. Please include the reason for the return.

Hazardous Material Information per General Protection Responsibility

In view of the Disposal Law of 7 Aug. 86 (AbfG. §11 Special Wastes) the owner of special wastes is responsible for its disposal and at the same time the employer, according to the Hazardous Material Law of 01 Oct. 86 (GefStoffV, §17 General Protection responsibility), a responsibility to protect his employees, we must make note that

1. all flowmeter primaries and/or flowmeter converters which are returned to ABB Automation Products for repair are to be free of any hazardous materials (acids, bases, solvents, etc.).
2. the flowmeter primaries must be flushed so that the hazardous materials are neutralized. There are cavities in the primaries between the metering tube and the housing. Therefore, after metering hazardous materials, these cavities are to be neutralized (see Hazardous Material Law -GefStoffV).
3. for service and repairs written confirmation is required that the measures in 1) and 2) have been carried out.
4. any costs incurred to remove and neutralize the hazardous materials during a repair will be billed to the owner of the equipment.

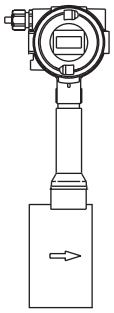
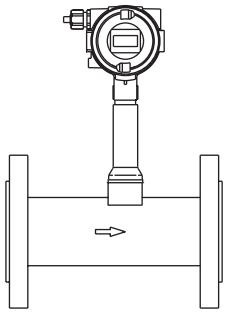
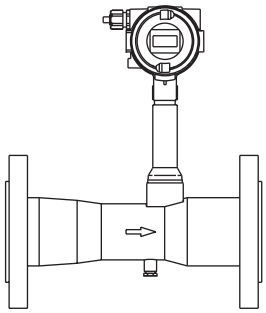
2 Overview and Designs of the TRIO-WIRL

This Instruction Bulletin is subdivided into the following sections:

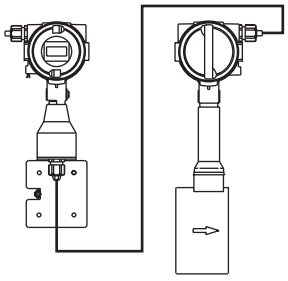
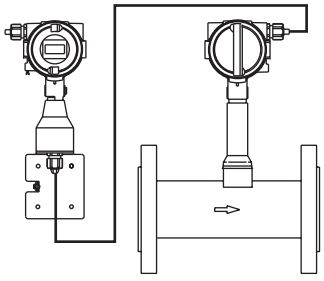
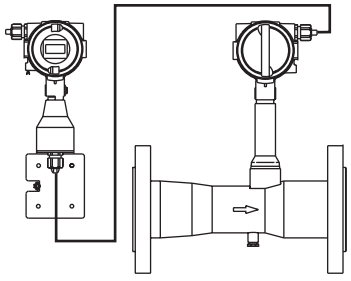
The introductory safety chapter, two chapters with information about the operation and installation of the TRIO-WIRL V and TRIO-WIRL S, one chapter which describes the electrical interconnections and configuration of the instrument and a special chapter for the Ex-Design. The instrument specifications may be found in a separate document, Specifications "TRIO-WIRL".

There are essentially two TRIO-WIRL designs:

a) **Compact Design:**
Converter is mounted directly on the flowmeter primary

		
Vortex Flowmeter **TRIO-WIRL VT** Wafer Design	Vortex Flowmeter **TRIO-WIRL VT** Flange Design	Swirl Flowmeter **TRIO-WIRL ST** Flange Design

b) **Remote Design:**
The converter can be mounted up to 10 m remote from the flowmeter primary. The cable is permanently connected to the converter. It can be shortened as required.

		
Vortex Flowmeter **TRIO-WIRL VR** Wafer Design	Vortex Flowmeter **TRIO-WIRL VR** Flange Design	Swirl Flowmeter **TRIO-WIRL SR** Flange Design

3 Swirl Flowmeter TRIO-WIRL S

3.1 Functionality

The flowrate of gases, steam and liquids can be metered with the Swirl Flowmeter (SFM) over a wide range of flowrates independent of the properties of the fluid being metered.

There are no moving parts in the SFM making it maintenance and wear free.

Principle of Operation

The inlet guide body causes the axially entering flow to rotate. A vortex core is formed in the center of this rotation, which due to the backflow is forced into a spiral shaped secondary rotation (see Fig. 1 and Fig. 2).

The frequency of the secondary rotation is proportional to the flowrate and is linear over a wide flow range in designs with optimized internal geometries. This frequency is detected by a Piezo sensor. The flowrate proportional frequency signal from the flowmeter primary is processed in the converter.

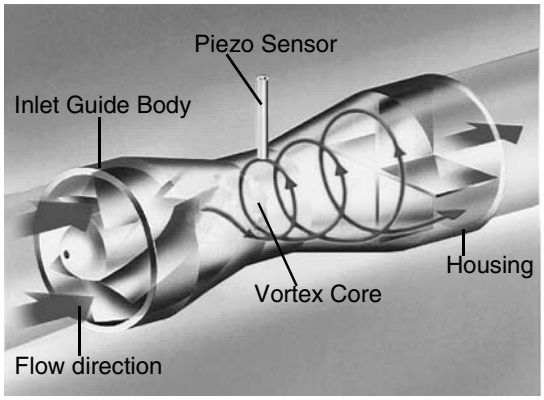


Fig. 1: Principle of Operation, TRIO-WIRL S

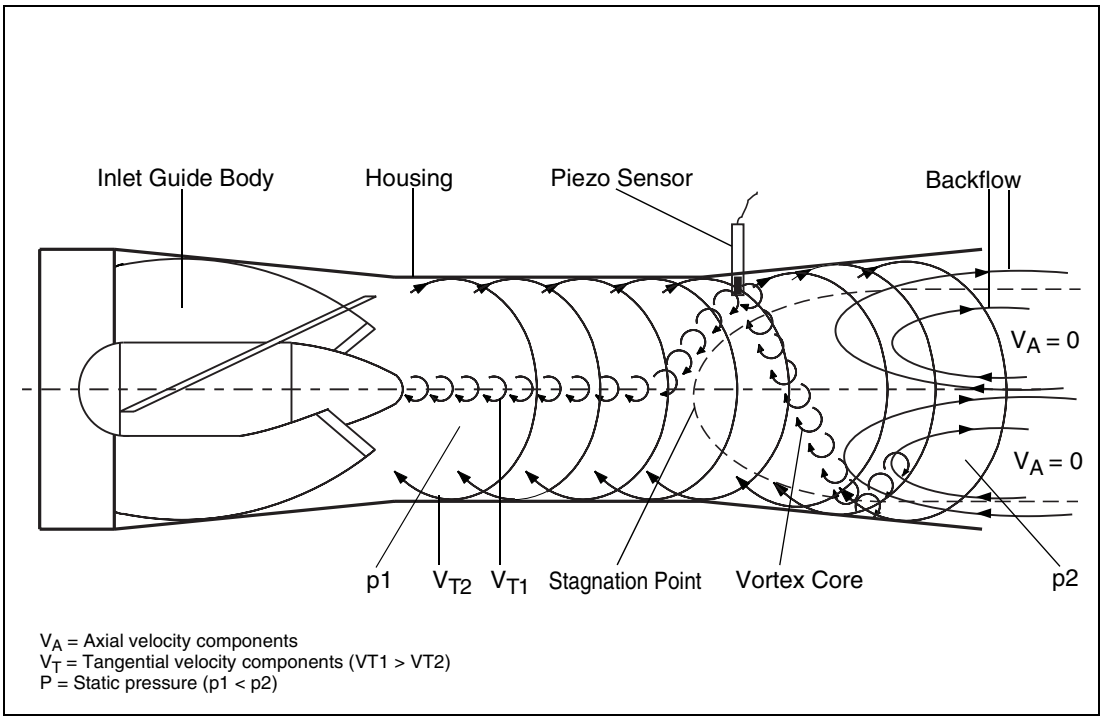


Fig. 2: Principle of Operation, Swirl Flowmeters

3.2 Assembly and Installation Flowmeter Primary

3.2.1 Inspection

Prior to installing the SFM check for mechanical damage to the flowmeter due to possible mishandling during shipment. All claims for damage are to be made promptly to the shipper.

3.2.2 Installation of the Flowmeter Meter Primary in the Pipeline

3.2.2.1 Installation Requirements

The SFM can be installed at any arbitrary location in the pipeline. Care should be exercised to assure that

- the ambient requirements are not exceeded (see Specifications TRIO-WIRL D184S035U02).
- the recommended in- and outlet straight sections are provided (Fig. 4).
- the flow direction corresponds to the direction indicated by the arrow on the flowmeter primary.
- the required minimum distance for removing the converter and exchanging sensors is available (see Specifications TRIO-WIRL D184S035U02).
- mechanical vibrations in the pipeline are eliminated using supports if necessary.
- the inside diameters of the flowmeter primary and the pipeline are the same.
- pressure fluctuations at zero flowrate in long pipelines should be eliminated by installing intermediate shut off valves.
- flow pulsations resulting from piston pump or compressor operation should be reduced by using appropriate dampeners. The residual pulsations can be a maximum of 10%. The frequency of the flow supply may not be in the same range as the measurement frequency of the flowmeter.
- valves/gates should generally be installed downstream from the flowmeter primary (typ. 3 x D). If the flow supply is a piston pump or compressor (pressures for liquids > 10 bar) hydraulic pressure oscillations may occur when valves are closed. In these situations it is essential that the valves be installed upstream from the flowmeter. If necessary, suitable damping devices (e.g. volume tanks) should be provided.
- when metering liquids, the flowmeter primary is always completely filled with fluid and cannot drain.
- no cavitation can occur when metering liquids or steam.
- **for high fluid temperatures (> 150°C), the flowmeter primary should be installed so that the electronic assembly is mounted at the side or bottom of the flowmeter (Fig. 3).**

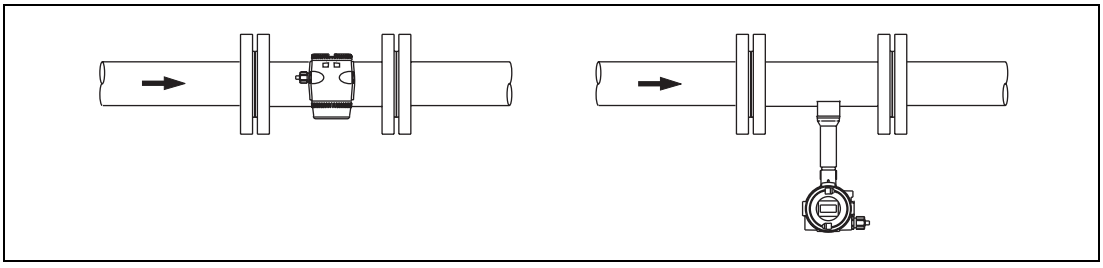


Fig. 3: Installations for High Fluid Temperatures > 150°C

3.2.2.2 Recommended In- and Outlet Sections

The measurement principle of the Swirl Flowmeter requires only minimal in- and outlet lengths of straight pipe. Fig. 4 shows the recommended lengths for the in- and outlet straight sections for various installation conditions. No in- or outlet straight sections are required when single or double elbows are installed up- or downstream from the flowmeter primary whose radius is greater than 1.8 x D. No additional in- or outlet straight sections are required downstream from reducers per DIN 28545 ($\alpha/2 = 8°$).

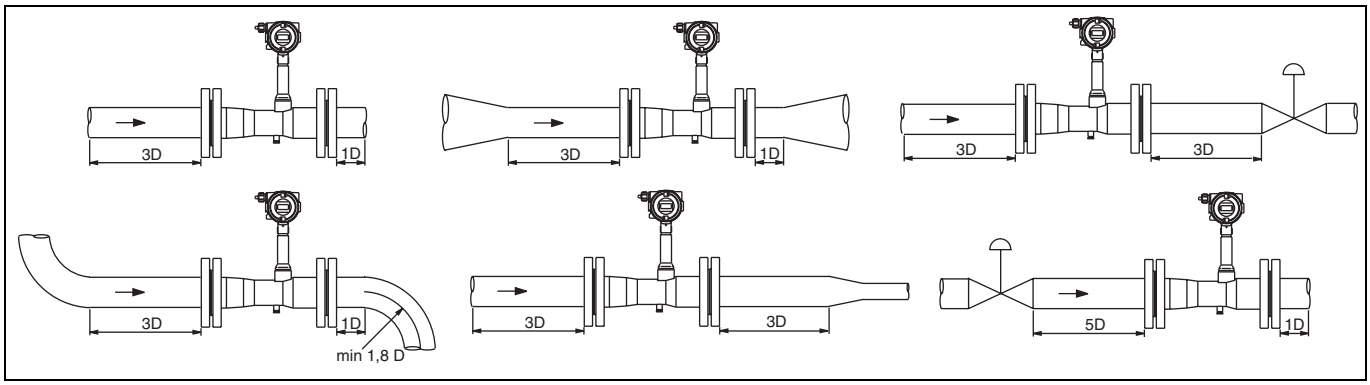


Fig. 4: Recommended In- and Outlet Straight Sections

3.2.2.3 Relationship Between the Fluid and Ambient Temperatures

The interdependence between the fluid and ambient temperatures must be considered (Fig. 5).

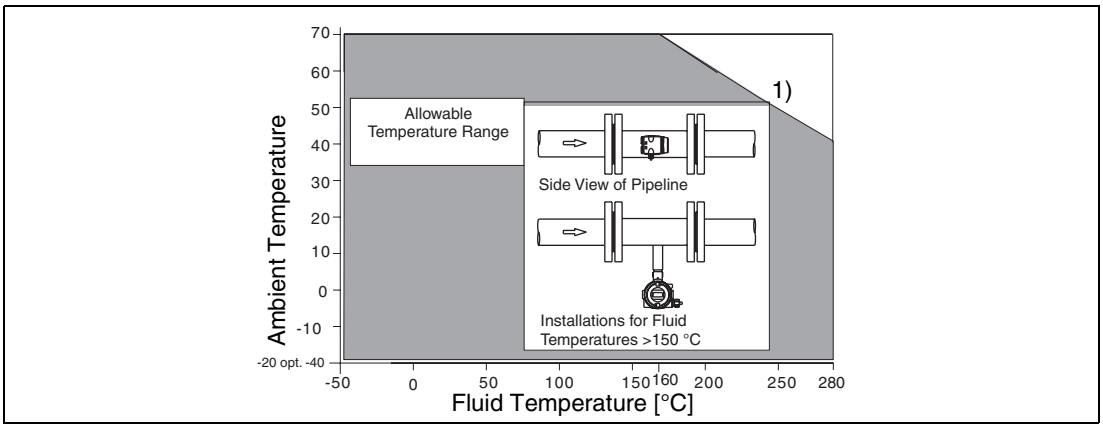


Fig. 5: Relationship Ambient Temperature – Fluid Temperature

1) Cables suitable for T=110°C can be used for the supply power terminals 31, 32 and the contact output terminals 41, 42 without any reduction in the temperature range specifications. Cables suitable only to temperatures T=80°C reduce the temperature range of the flowmeter.

3.2.2.4 Insulating the SFM

The pipeline can be insulated to a max. thickness of 100 mm (see Fig. 6).

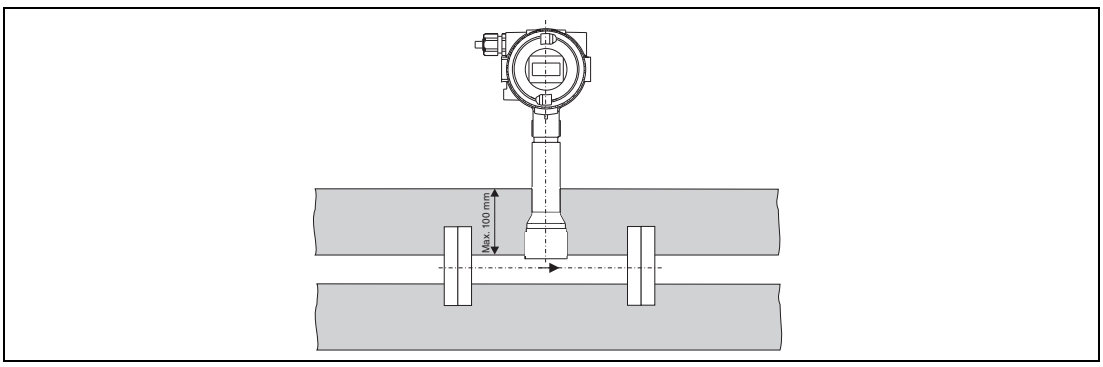


Fig. 6: Pipeline Insulation

3.2.2.5 Pressure and Temperature Measurements

A Pt100 temperature sensor can optionally installed in the SFM for direct temperature measurements. These temperature measurements can be used to monitor the fluid temperature or for the measurement of saturated steam in mass units.

If an external pressure and temperature compensation is to be made (e.g. with Sensycal) then the measurement should be made at the locations as described in Fig. 7. The pressure measurement must be made at the pressure tap on the flowmeter primary.

If the pressure is measured downstream from the flowmeter primary large errors in the pressure values will occur. They are a function of the flowrate and the flowmeter size.

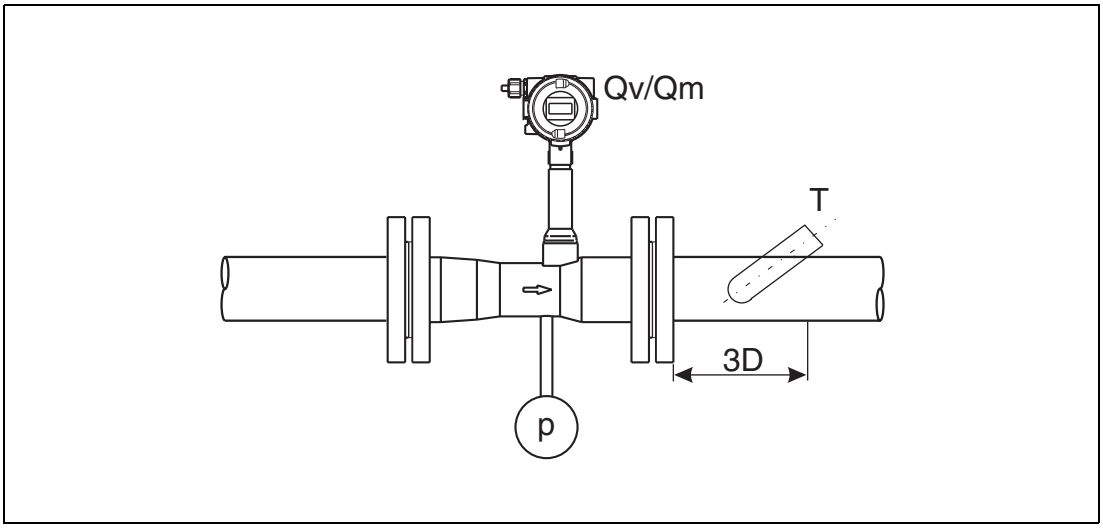


Fig. 7: Installation Locations for Pressure and Temperature Measurements

3.2.2.6 Orientation of the Converter

The electronic housing can be rotated after installation to a preferred position.A simple mechanical stop prevents the housing from being rotated more than 330°. This protects the cable which is connected to the flowmeter primary.

1. Unscrew the locking screw on the converter housing with a 4 mm hex wrench.
2. Push out the bolt.
3. Rotate the converter housing in the desired direction.
4. Reinsert the bolt.
5. Tighten the locking screw.

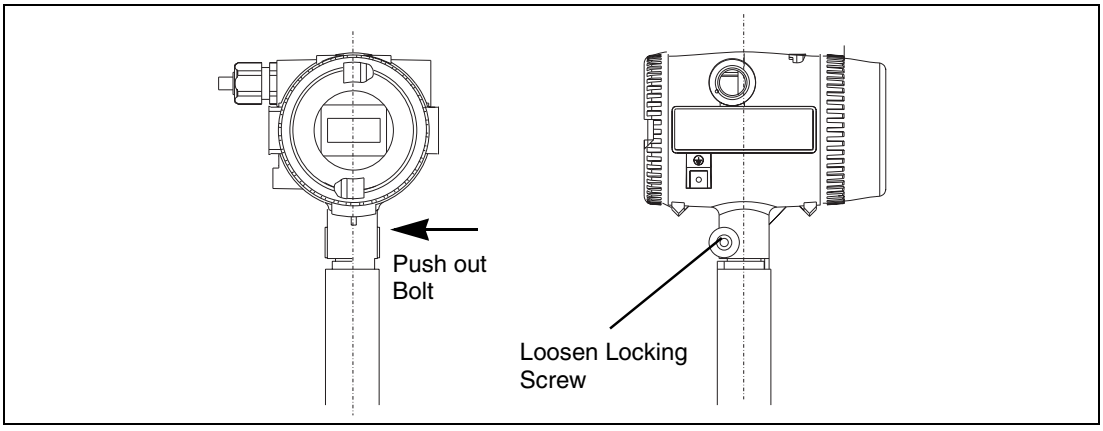


Fig. 8: Rotating the Converter Housing

4 Vortex Flowmeter TRIO-WIRL V

4.1 Functionality

The flowrate of gases, steam and liquids can be metered the Vortex Flowmeter (VFM) over a wide flow range independent of the properties of the fluid being metered.

Principle of Operation

The operation of the Vortex Flowmeter (VFM) is based on the Karman Vortex Street principle. Vortices are formed alternately on both sides as a fluid flows around the shedder body. The flow causes these vortices to be shed forming a vortex street (Karman Vortex Street) (Fig. 9).

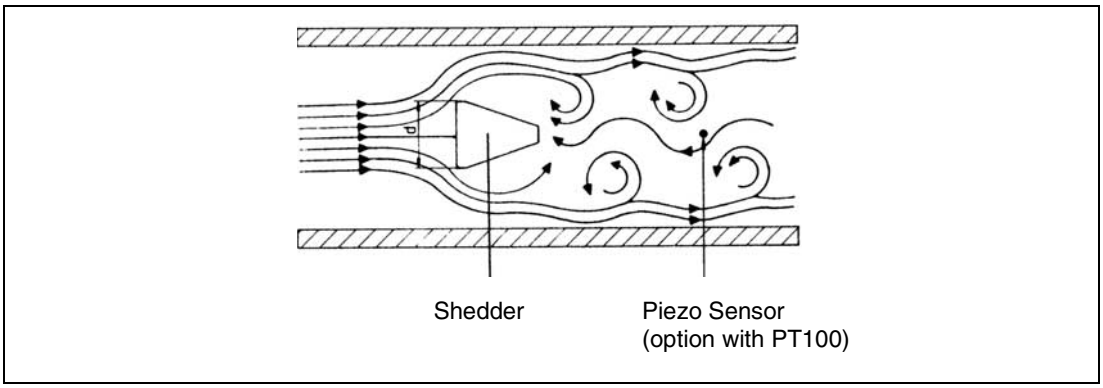


Fig. 9: Karman Vortex Street

The frequency **f** of the vortex shedding in proportional to the flow velocity **v** and inversely proportional to the width of the shedder body **d**:

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

St, the Strouhal Number, is a dimensionless number which defines the quality of the vortex flowrate measurements. By appropriate design of the shedder body, **St** is constant over a wide Reynolds Number range $\mathbf{R_e}$ (Fig. 10).

ν = kinematic viscosity
v = flow velocity
D = inside diameter of the meter tube

$$R_e = \frac{v \cdot D}{\nu}$$

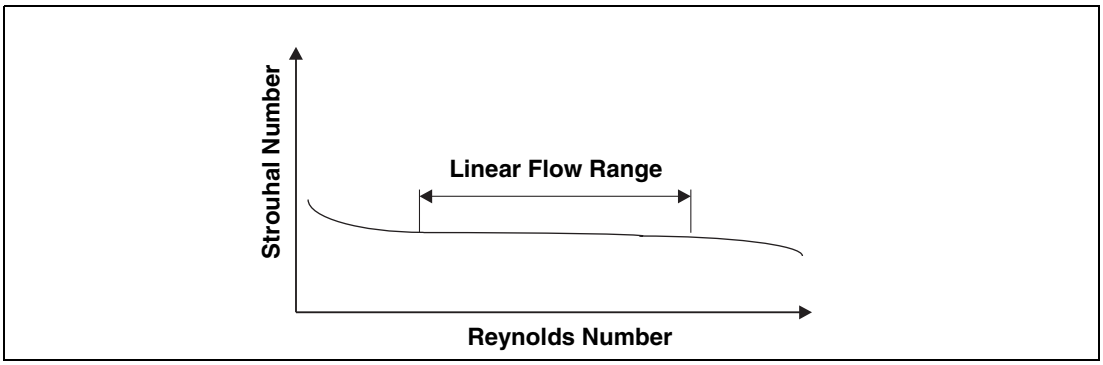


Fig. 10: Strouhal No. / Reynolds No. Relationship

As a result, the vortex shedding frequency to be evaluated, is a function only of the flow velocity and is independent of the fluid density and viscosity.

The local pressure changes resulting from the vortex shedding are detected by a Piezo sensor and converted into electrical impulses corresponding to the vortex shedding frequency. The flowrate proportional frequency signal generated in the flowmeter primary is processed in the converter.

4.2 Assembly and Installation Flowmeter Primary

4.2.1 Inspection

Prior to installing the VFM check for mechanical damage to the flowmeter due to possible mishandling during shipment. All claims for damage are to be made promptly to the shipper.

4.2.2 Installation of the Flowmeter Meter Primary in the Pipeline

4.2.2.1 Installation Requirements

The VFM can be installed at any arbitrary location in the pipeline. Care should be exercised to assure that:

- the ambient requirements are not exceeded (see Specifications TRIO-WIRL D184S035U02).
- the recommended in- and outlet straight sections are provided (Fig. 11).
- **the flow direction corresponds to the direction indicated by the arrow on the flowmeter primary.**
- the required minimum distance for removing the converter and exchanging sensors is available (see Specifications TRIO-WIRL D184S035U02).
- mechanical vibrations in the are eliminated, using supports if required.
- the inside diameters of the flowmeter primary and the pipeline are the same.
- pressure fluctuations at zero flowrate in long pipelines should be eliminated by installing intermediate gate valves.
- flow pulsations resulting from piston pump or compressor operation should be reduced by using appropriate dampeners. The residual pulsations can be a maximum of 10%. The frequency of the flow supply may not be in the same range as the measurement frequency of the flowmeter.
- valves/gates should generally be installed downstream from the flowmeter primary (typ. 5 x D). If the flow supply is a piston pump or compressor (pressures for liquids > 10 bar) hydraulic pressure oscillations may occur when valves are closed. In these situations it is essential that the valves be installed upstream from the flowmeter. If necessary, suitable damping devices (e.g. volume tanks) should be provided.
- when metering liquids the flowmeter primary is always completely filled with fluid and cannot drain.
- no cavitation can occur when metering liquids or steam.
- **for high fluid temperatures the flowmeter primary should be installed so that the electronic assembly is mounted at the side or bottom of the flowmeter (Fig. 12).**

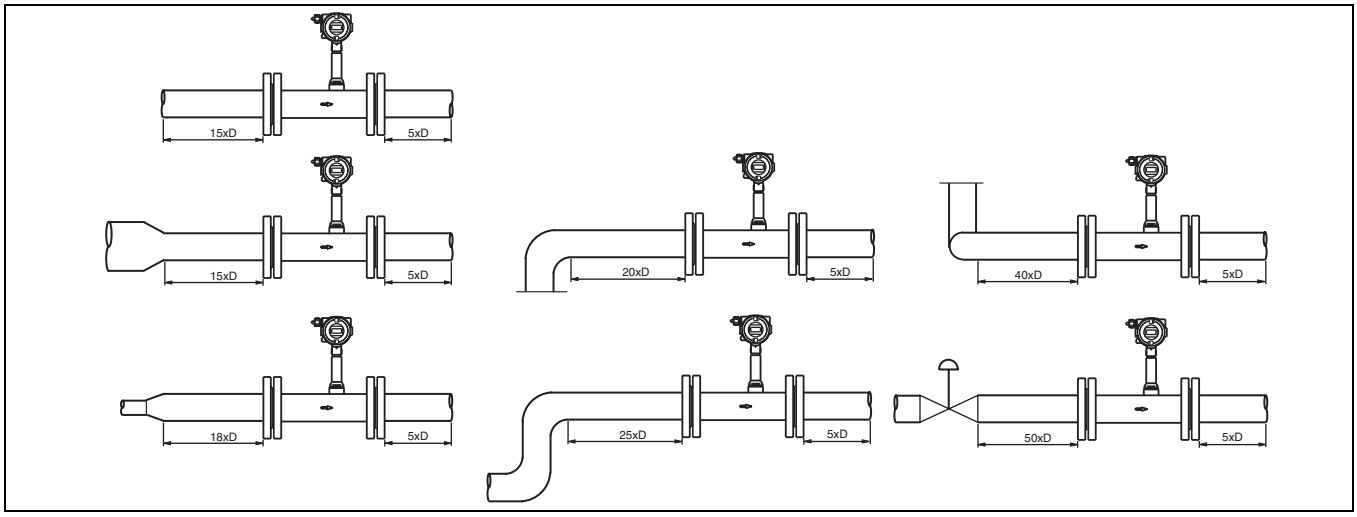


Fig. 11: Recommended In- and Outlet Straight Sections

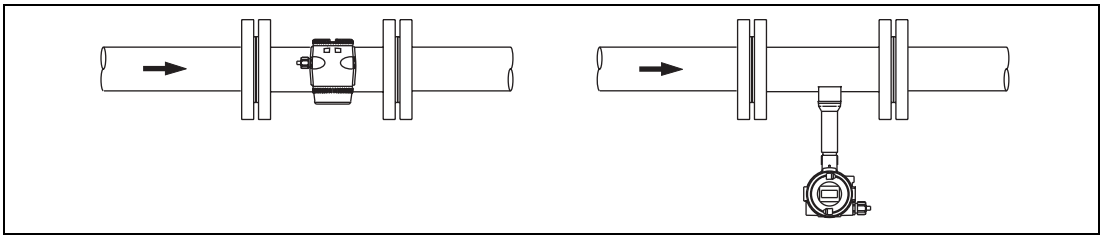


Fig. 12: Installations for High Fluid Temperatures > 150 °C

4.2.2.2 Relationship Between the Fluid and Ambient Temperatures

The interdependence between the fluid and ambient temperatures must be considered (Fig. 13).

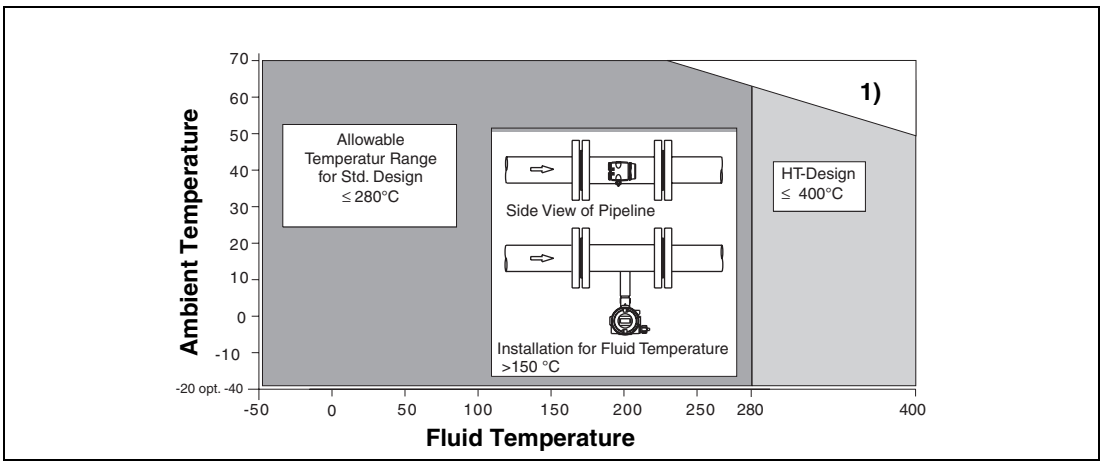


Fig. 13: Relationship Ambient Temperature – Fluid Temperature

1) Cables suitable for T=110°C can be used for the supply power terminals 31, 32 and the contact output terminals 41, 42 without any reduction in the temperature range specifications. Cables suitable only to temperatures T=80°C reduce the temperature range of the flowmeter.

4.2.2.3 Insulating the VFM

The flowmeter primary can be insulated to a max. thickness of 100 mm (Fig. 14).

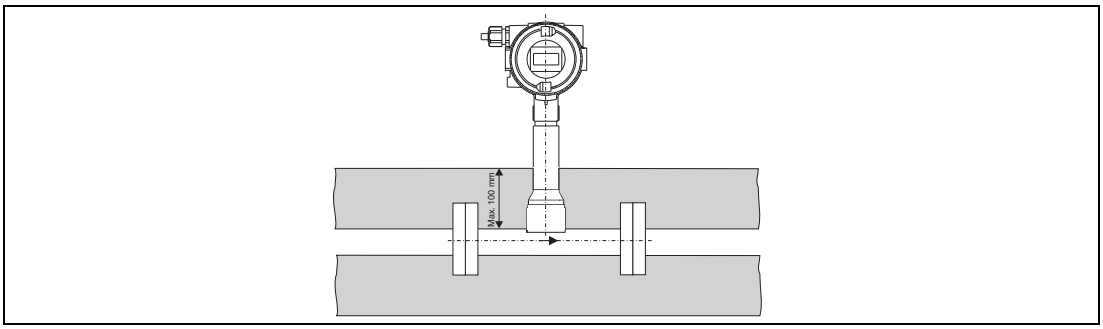


Fig. 14: Pipeline Insulation

4.2.2.4 Control Valve Installation

Control valves and devices should preferably be installed downstream.

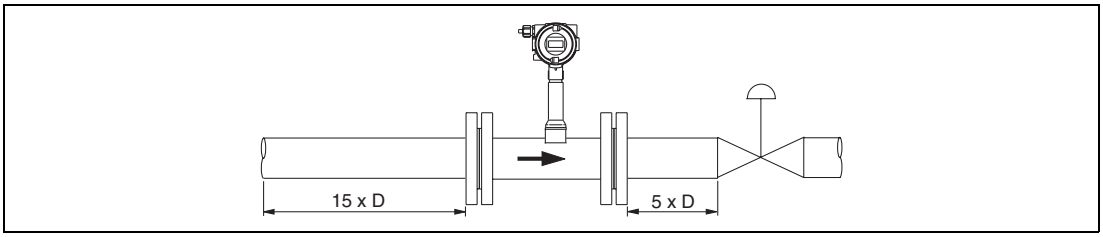


Fig. 15: Control Device Installation

4.2.2.5 Centering the Wafer Design

The outside diameter of the flowmeter primary and the bolts are utilized to center the Wafer Design flowmeters in the pipeline. Dependent on the pressure rating of the flowmeter primary, sleeves to be placed over the bolts or centering rings are included with the shipment (Option).

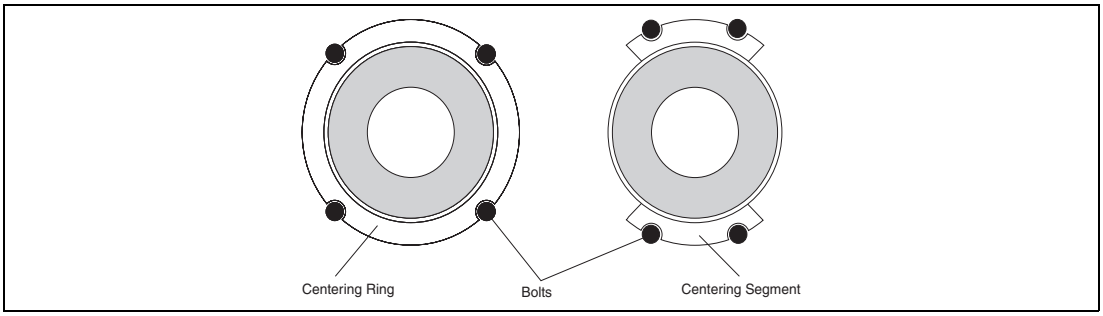


Fig. 16: Wafer Design Centering using Rings or Segments

4.2.2.6 Pressure and Temperature Measurements

A Pt100 temperature sensor can optionally installed in the VFM for direct temperature measurements. These temperature measurements can be used to monitor the fluid temperature or for the measurement of saturated steam in mass units. If an external pressure and temperature compensation is to be made (e.g. with Sensycal) then measurement locations as described in Fig. 17 should be installed.

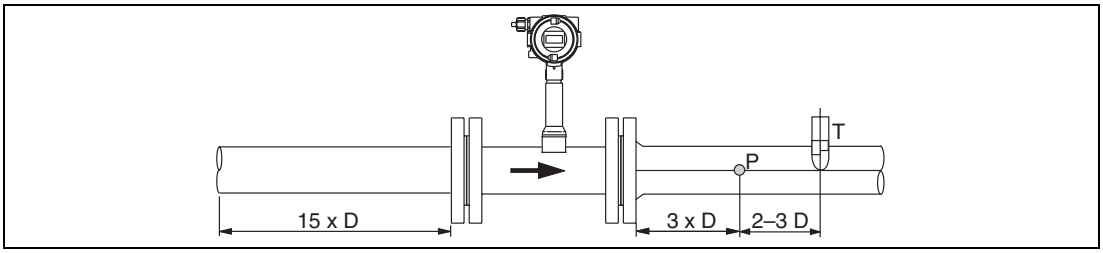


Fig. 17: Installation Locations for Pressure and Temperature Measurements

4.2.2.7 Orientation of the Converter

The electronic housing can be rotated after installation to a preferred position.A simple mechanical stop prevents the housing from being rotated more than 330°. This protects the cable which is connected to the flowmeter primary.

1. Unscrew the locking screw on the converter housing with a 4 mm hex wrench.
2. Push out the bolt.
3. Rotate the converter housing in the desired direction.
4. Reinsert the bolt.
5. Tighten the locking screw.

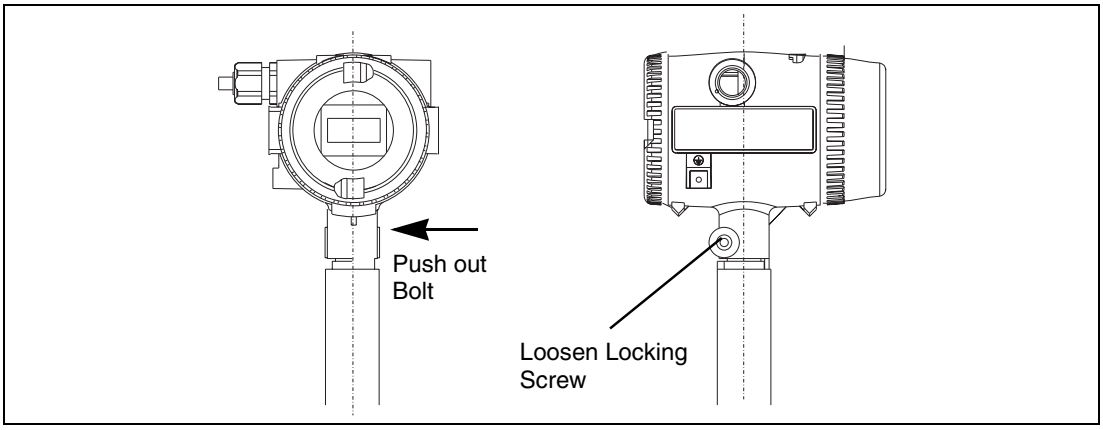
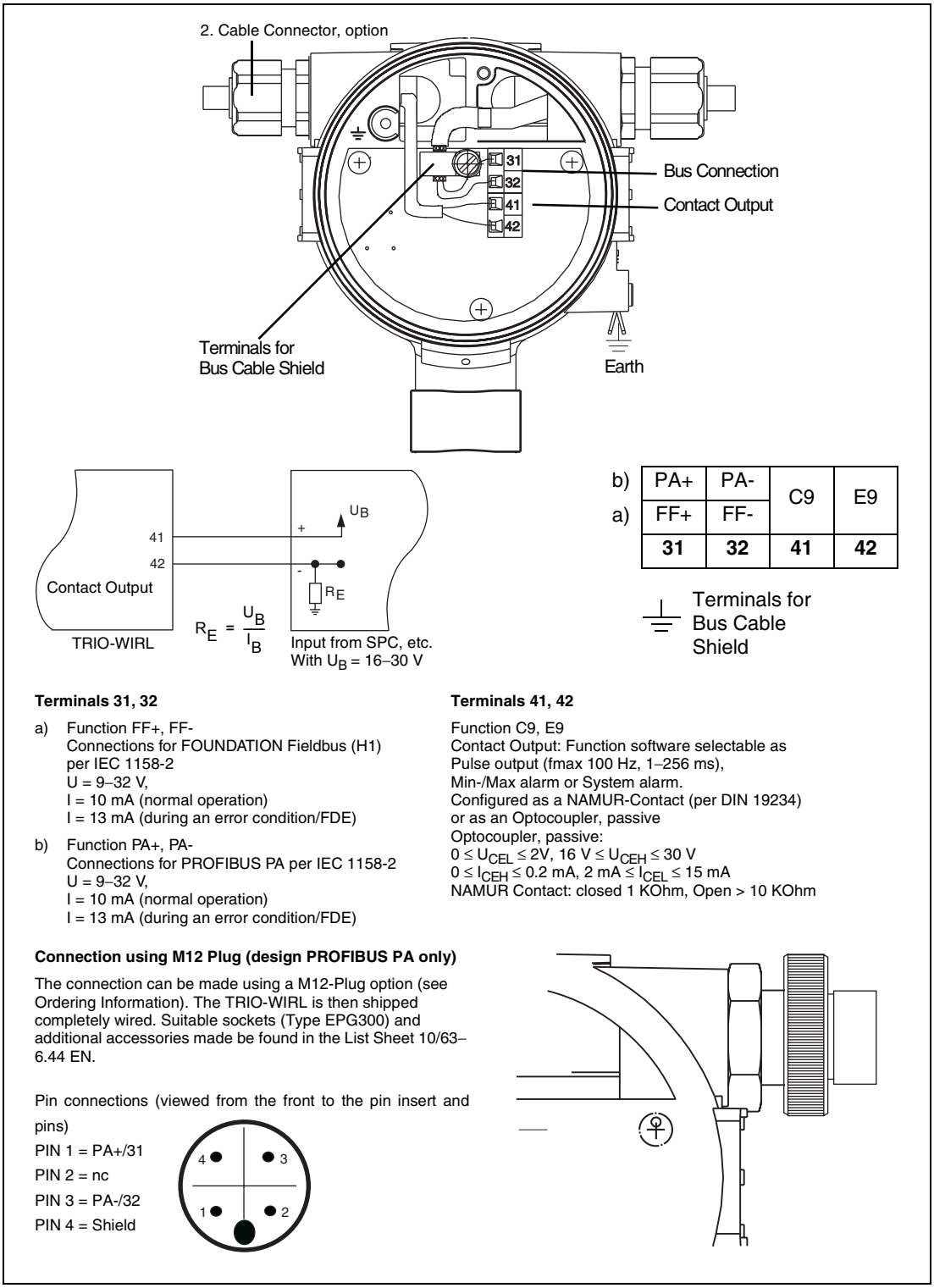


Fig. 18: Rotating the Converter Housing

5 Electrical Interconnections

The Fieldbus Converter is suitable for connection to an ABB Multibarrier, Segment Coupler (design PROFIBUS PA only), a special power supply or a Linking Device (design FOUNDATION Fieldbus only). In addition to the bus connection terminals (31/32) an additional user configurable contact output is available (terminals 41/42).

5.1 Interconnection Diagram TRIO-WIRL VT/ST Standard Design



Terminals 31, 32

a) Function FF+, FF-
Connections for FOUNDATION Fieldbus (H1) per IEC 1158-2
U = 9–32 V,
I = 10 mA (normal operation)
I = 13 mA (during an error condition/FDE)

b) Function PA+, PA-
Connections for PROFIBUS PA per IEC 1158-2
U = 9–32 V,
I = 10 mA (normal operation)
I = 13 mA (during an error condition/FDE)

Terminals 41, 42

Function C9, E9
Contact Output: Function software selectable as
Pulse output (fmax 100 Hz, 1–256 ms),
Min-/Max alarm or System alarm.
Configured as a NAMUR-Contact (per DIN 19234)
or as an Optocoupler, passive
Optocoupler, passive:
$0 \le U_{CEL} \le 2V$, $16\ V \le U_{CEH} \le 30\ V$
$0 \le I_{CEH} \le 0.2$ mA, $2\ mA \le I_{CEL} \le 15$ mA
NAMUR Contact: closed 1 KOhm, Open > 10 KOhm

Connection using M12 Plug (design PROFIBUS PA only)

The connection can be made using a M12-Plug option (see Ordering Information). The TRIO-WIRL is then shipped completely wired. Suitable sockets (Type EPG300) and additional accessories made be found in the List Sheet 10/63–6.44 EN.

Pin connections (viewed from the front to the pin insert and pins)
PIN 1 = PA+/31
PIN 2 = nc
PIN 3 = PA-/32
PIN 4 = Shield

Fig. 19:

5.2 Interconnections TRIO-WIRL VR/SR

The TRIO-WIRL VR/SR is based on the VT/ST technology and includes all the options of the VT/ST. The converter is mounted remote from the flowmeter primary for installations where the flowmeter primary is difficult to access. This design is also advantageous for installations where extreme ambient conditions exist at the meter location. The maximum distance between the flowmeter primary and the converter is 10 m. A special cable is used to connect the flowmeter primary to the converter (permanently connected to the converter).

Note

It is recommended that the connection cable be installed in a grounded metal conduit.

After the installation has been completed, the cable can be cut to the length required to reach the flowmeter primary. Because the signals between the flowmeter primary and converter are not amplified, all connections must be made with care and the leads, as short as possible, positioned in the connection box (see Fig. 21) so that they are not affected by vibrations.

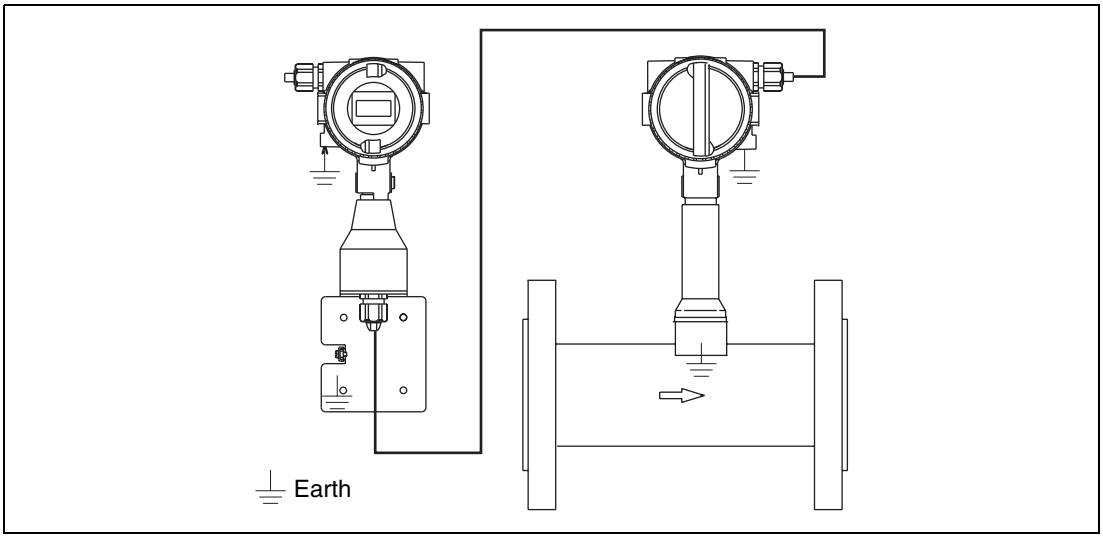


Fig. 20: TRIO-WIRL VR/SR

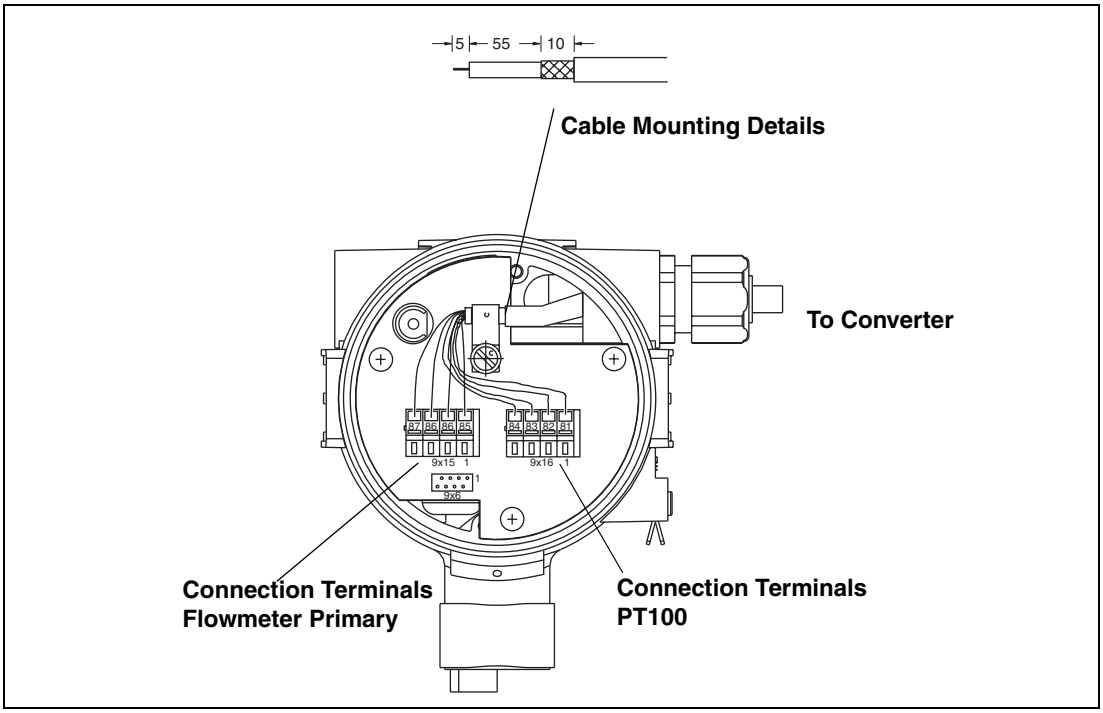


Fig. 21: Connection Box TRIO-WIRL VR/SR Flowmeter Primary

5.2.1 Interconnection Diagram TRIO-WIRL VR/SR Standard Design

The connections to the converter are made as described in Section 4.1.

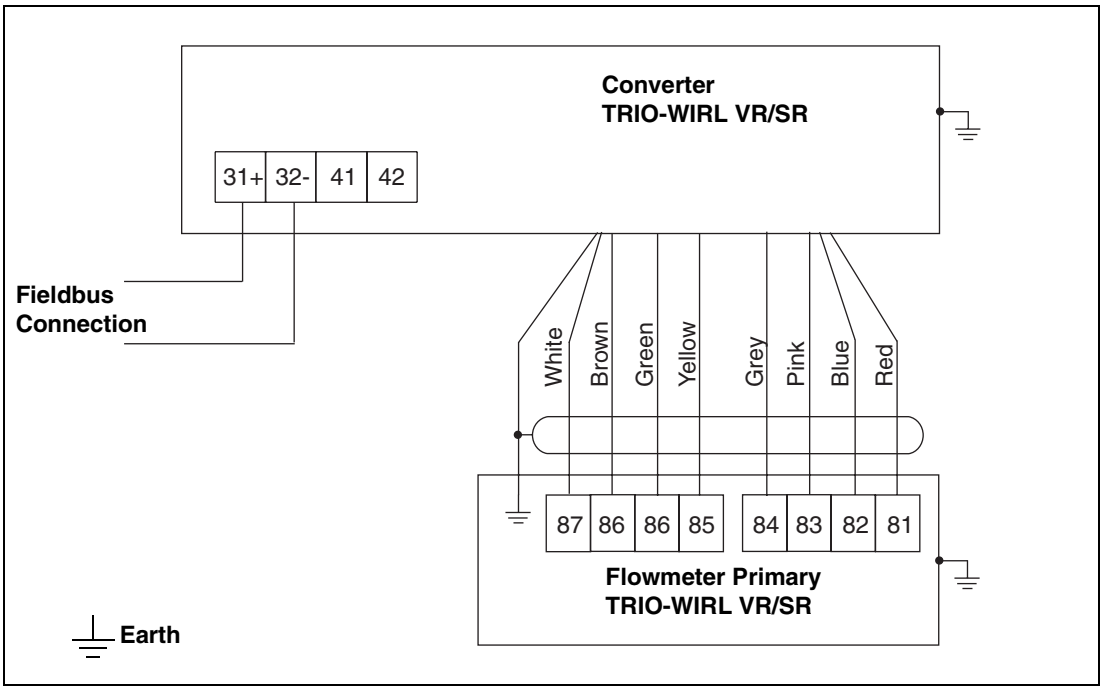


Fig. 22:

Note

Terminals 81−84 are only used for instruments which include a temperature sensor (PT100).

6 Communication

This section of the Instruction Bulletin contains the basic information for the converter designs which include the PROFIBUS PA and FOUNDATION Fieldbus options. Detailed information may be found in the separate „Data Link Description PROFIBUS PA" for the TRIO-WIRL (Part No. D184B093U22). If may be found on the CD (Part No.: D699D002U01) included with the shipment. It can also be ordered at no charge at any time from ABB.

6.1 Communication PROFIBUS PA

The Fieldbus-Converter is suitable for connection to a Segment Couple DP/PA and the ABB Multibarrier MB204.

The PROFIBUS PA data link in the TRIO-WIRL conforms to Profile B V.3.0 (Fieldbus Standard PROFIBUS, EN 50170, alias DIN 19245 [PRO91]). The transmission signal from the converter is designed in accordance with IEC 61158-2. The certification of the TRIO-WIRL confirmed conformity to the standards.

The PROFIBUS-PA Ident-No.: is 05DC hex and it can also be operated using the Standard-Ident-Numbers 9700 hex and 9740 hex.

The design of the Intrinsic Safe version of the TRIO-WIRL corresponds to the FISCO-Model.

6.1.1 Layout Information

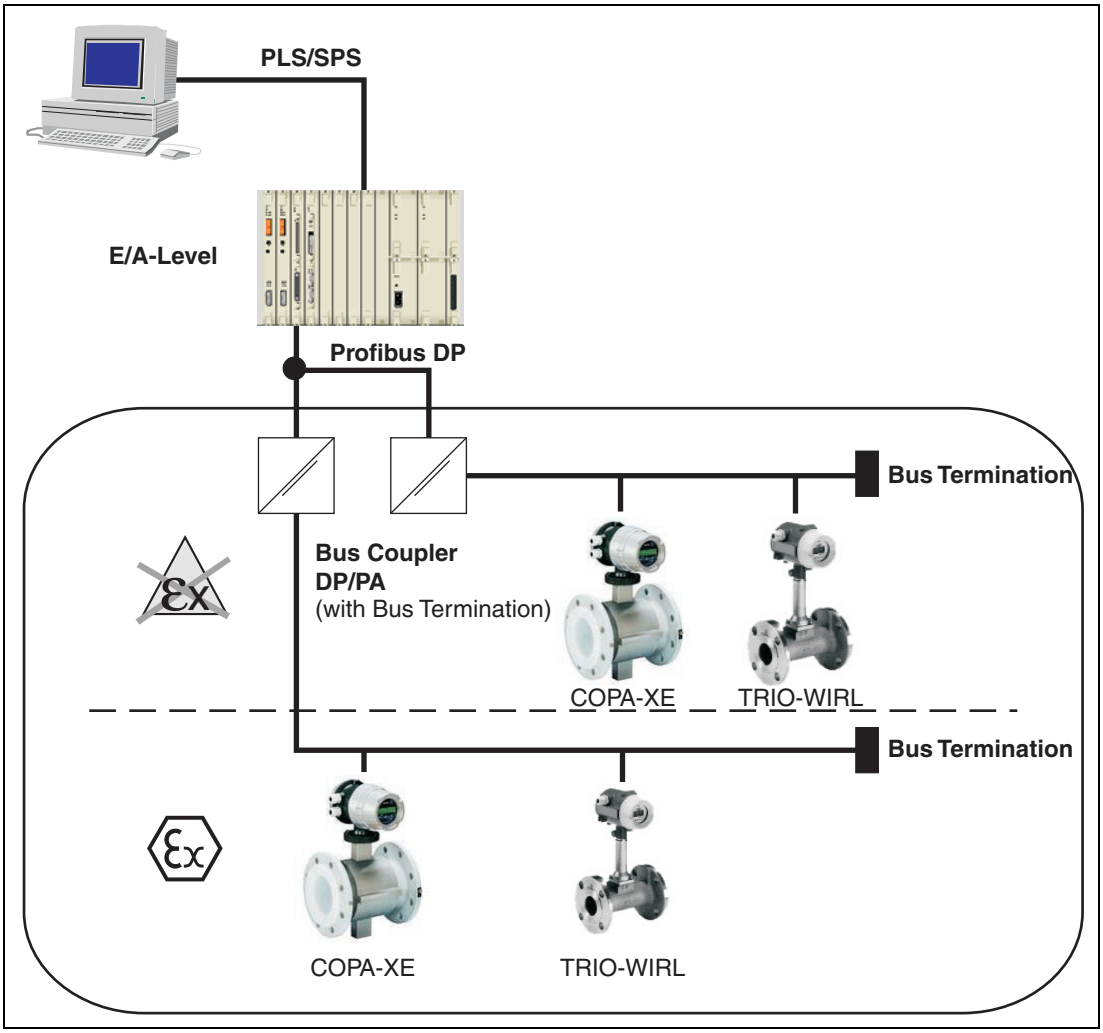


Fig. 23: Typical PA-Network

The allowable segment cable length including all tap lines is limited to max. 1900 m. It is a function of the cable type and the Ignition Type (Ex-Protection). For Ex-Protection, lengths up to 1000 m per the FISCO-Model require no special Ex-Considerations. For longer cable lengths they are required. A shielded, twisted cable is recommended (referring to IEC 61158-2, Types A or B are preferred).

The maximum number of bus participants in the segment is shown in the following table:

DP/PA-Segment Coupler	Type I	Type II	Type III	Type IV
Application area	EEx ia/ib IIC	EEx ib IIC	EEx ib IIC	non-Ex
Supply voltage	13.5 V	13.5 V	13.5 V	24 V
Supply current	≤ 110 mA	≤ 110 mA	≤ 250 mA	≤ 500 mA
Loop resistance Rs	≤ 40 Ω	≤ 40 Ω	≤ 18Ω	≤ 130 Ω
Cable length Type B (0.5 mm²)	≤ 500 m	≤ 500 m	≤ 250 m	≤ 1700 m
Cable length Type A (0.8 mm²)	≤ 900 m	≤ 900 m	≤ 400 m	≤ 1900 m
Participants at 10 mA	8	8	19	32

Additional detailed layout information may be found in the Brochure "PROFIBUS - Solutions from ABB" (No. 30/FB-10). Accessories such as hubs, connectors and cables may be found in the List Sheet 10/63-6.44. Additional information may also be found on our home page http://www.abb.de and on the home page of the PROFIBUS User Group http://www.profibus.com.

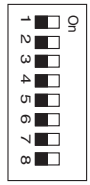
6.1.2 Setting the Bus-Address

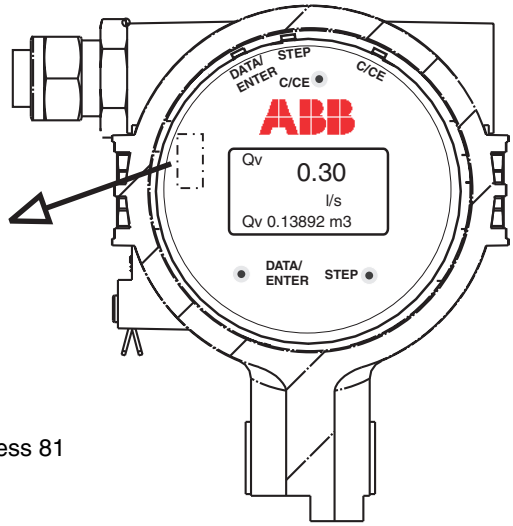
If no special customer specifications relating to the bus address were provided, the address is set at the factory to "126"(Addressing over the Bus). This address must be changed during the TRIO-WIRL start-up procedure to a value within the allowable range (0, 2 - 125). An address in a segment may only be used once.

The setting can be made directly at the instrument (using the mini-switch 8 on the digital board), using a system tool or using a PROFIBUS DP Master Class 2, such as SMART-VISION. The factory default setting for switch 8 = Off, i.e. addressing is made over the fieldbus.

The front cover should be unscrewed to make the setting.

Switch Designations
Switched 1 to 7:
PROFIBUS Address
Switch 8:
Define the Address Mode:
Off = Addressing over the Bus
On = Addressing using the Mini-switches 1–7





Note

Changing in the local address setting take only effect after switching off and on the power supply.

Example for setting the address locally (Switch 8 = On):
Switches 1, 5, 7 = On → 1 + 16 + 64 = Bus address 81

Switch / Status	1	2	3	4	5	6	7	8
	Instrument Address							Address Mode
Off	0	0	0	0	0	0	0	Bus
On	1	2	4	8	16	32	64	Local

Fig. 24: Address Settings for PROFIBUS PA

6.1.3 Information Regarding Voltage/Current Values

The turn on behavior corresponds to the Draft DIN IEC 65C/155/CDV of June 1996. The average current draw of the TRIO-WIRL is **10 mA**. During an error condition the current draw is limited to max. **13 mA** by an FDE-Function (= Fault Disconnection Electronic) integrated in the instrument. The upper value of the current is electronically limited. The supply voltage range is 9–32 Volt DC for the standard design (Model V_40/S_40). The Intrinsic Safe design (Model V_4A/S_4A) has a supply voltage range of 9–24 V DC.

6.1.4 System Integration

Through use of the PROFIBUS PA Profile B, V3.0 the instruments are not only interoperable, that is, instruments of different manufacture can be physically interconnected and can be communicated with on a single bus, and they are also interchangeable, i.e. instruments of different manufacture can be interchanged with each other without requiring a configuration change in the process control system.

In order to assure the interchangeability, 3 different GSD-Files (GSD= Instrument Master File) are made available by ABB for system integration. Thereby the user can make a decision during system integration whether to use the complete function set of the TRIO-WIRL or only a portion. The switching is made over the Parameter ID-Number-Selector, which can only be changed acyclically. The available GSD-Files are described in the following table. They are included on the CD included in the shipment. The Standard-GSD-Files PA1397xx.gsd are also available for download on the PNO-Home Page http://www.profibus.com.

The GSD-Files and the "Data Link Description PROFIBUS PA" for TRIO-WIRL (Part No. D184B093U22) are also contained on the CD included in the shipment (Part No.: D699D002U01).

It can also be ordered at no charge at any time from ABB.

Number and Type of the Function Blocks	Ident Number	GSD File Name	Bitmaps
1 × AI	0 × 9700	PA 139700.gsd	ABB05DCb.bmp ABB05DCn.bmp ABB05DCs.bmp
1× AI; 1 × TOT	0 × 9740	PA 139740.gsd	
2 × AI; 1 × TOT; and all manufacturer specific parameter	0 × 05DC	ABB_05DC.gsd	

6.1.5 Block Diagram for the TRIO-WIRL with PROFIBUS PA Communication

The available blocks in the TRIO-WIRL are shown as a function block diagram. A communication tool or a SPC with Master Class 2 functionality can but used acyclically to configure all the blocks.

Individual Description of the Blocks:

Physical Block (Instrument properties and actual status)	Includes instrument specific properties such as software version, TAG-No. etc.
Transducer Block (Measurement parameters)	Contains data for the flowmeter primary such as meter size, K-Factor, flow range etc. together with all the manufacturer specific parameters which are not contained in the function blocks.
Analog Input Block (Output of measured values and status)	The user can access his relevant measurement values (Qv (volume flowrate), Qn (volume flowrate at normal conditions), Qm (mas flowrate) or Temperature (option) using the channel selector.
Totalizer Block (Totalizer)	The totalizer value can be acyclically monitored/changed using the PROFIBUS PA-DTM in SMART-VISION. The totalizer can be cyclically reset.

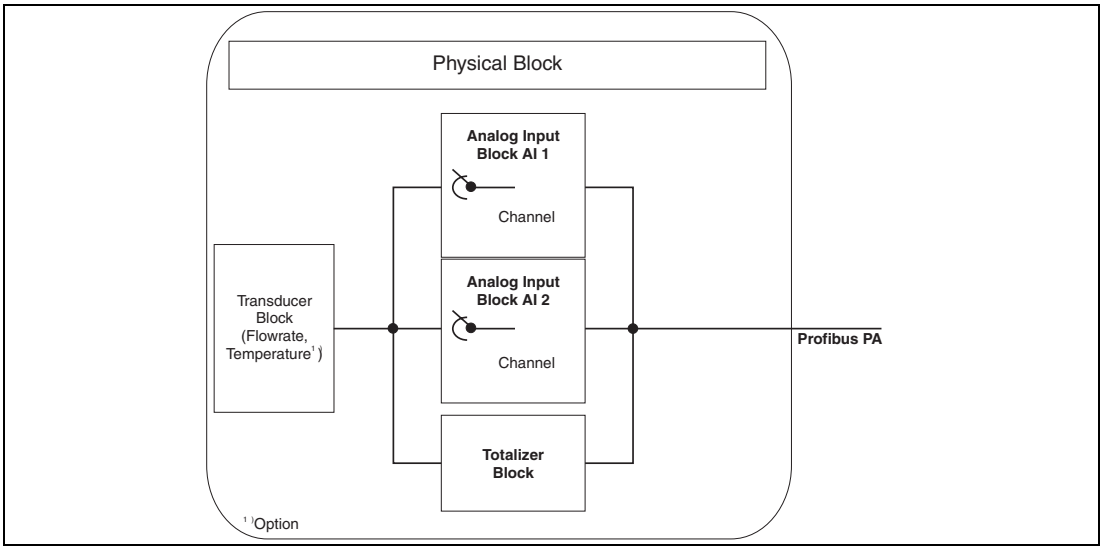


Fig. 25:

Note

1. A detailed description of the blocks/parameters may be found in the separate "Data Link Description PROFIBUS PA" for TRIO-WIRL (Part No. D184B093U22). This is contained in the CD included with the shipment.
2. Configuration is accomplished acyclically using PROFIBUS PA-DTM in the TRIO-WIRL.

6.2 Communication FOUNDATION Fieldbus

The Fieldbus-Converter is suitable for connection to special bus power supply instruments and to the ABB Multibarrier MB204. The output voltage range is 9–32 Volt DC for the standard design (Model ..40). The voltage range is limited to 9–24 V DC for the Intrinsic Safe design (Model ..4A). The FOUNDATION Fieldbus-Data Link in the TRIO-WIRL conforms to the Standards FF-890/891 and FF-902 / 90. The transmission signal from the converter is designed in accord with IEC 61158-2.

The TRIO-WIRL is registered with the Fieldbus Foundation and satisfies the latest requirements, i.e. successful completion of the FF-Conformance Test, fulfillment of the FF-Spec. 1.4 and successful completion of the tests with ITK 4.0. The Reg.-No. is: IT013600. The TRIO-WIRL is registered with the Fieldbus Foundation under Manufacturer ID: 0x000320 and Device ID 0x0015. The TRIO-WIRL includes LAS-Functionality. The design of the Intrinsic Safe version of the TRIO-WIRL corresponds to the FISCO-Model.

6.2.1 Layout Information

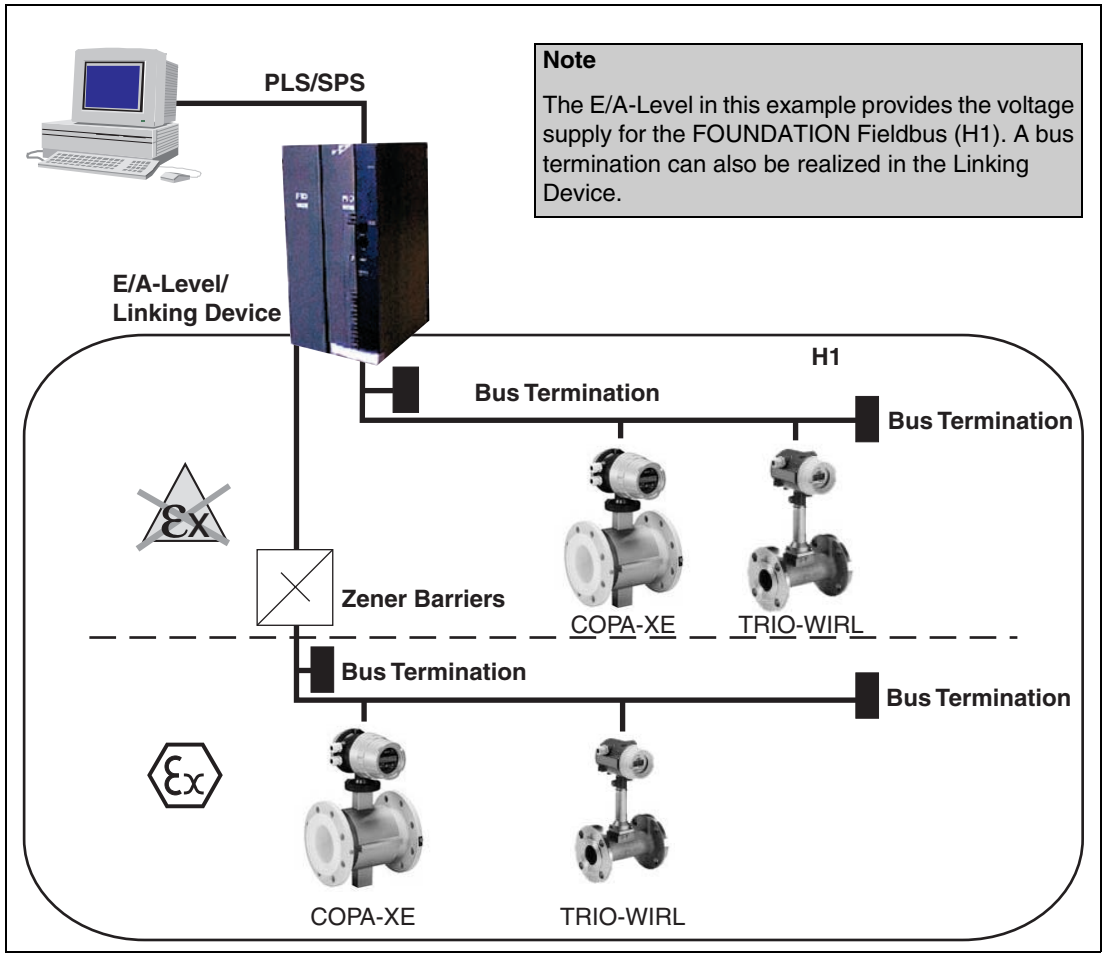


Fig. 26: Typical FF-Network

The allowable segment cable length including all tap lines is limited to max. 1900 m. It is a function of the cable type and the Ignition Type (Ex-Protection). For Ex-Protection, lengths up to 1000 m per the FISCO-Model require no special Ex-Considerations. For longer cable lengths they are required. A shielded, twisted cable is recommended (referencing IEC 61158-2, Types A or B are preferred).

The maximum number of bus participants in the segment is shown in the following table.:

2 or 4-Wire Design	No Ex-Protection	Ex ia (Intrinsic Safety)
2-Wire (bus supplied)	2–12	2–6
4-Wire design	2–32	2–6

Additional detailed layout information may be found in the Brochure "FOUNDATION Fieldbus Solutions from ABB" (or Brochure 7592 FF). Additional information may also be found on our home page http://www.abb.de and on the home page of the Fieldbus FOUNDATION http://www.fieldbus.org.

6.2.2 Setting the Bus Address

The bus address in the FF is automatically assigned by the LAS (LinkActiveScheduler). The address recognition uses a unique number (DEVICE_ID), made up of the Manufacturer-ID, Instrument-ID and Instrument Serial-No.

6.2.3 Information Regarding Current/Voltage Values

The turn on behavior corresponds to the Draft DIN IEC 65C/155/CDV of June 1996. The average current draw of the TRIO-WIRL is 10 mA. During an error condition the current draw is limited to max. 13 mA. The upper current value is electronically limited.

The supply voltage range is 9–32 Volt DC for the standard design (Model V_40/S_40). The Intrinsic Safe design (Model V_4A/S_4A) has a supply voltage range of 9–24 V DC

6.2.4 System Integration

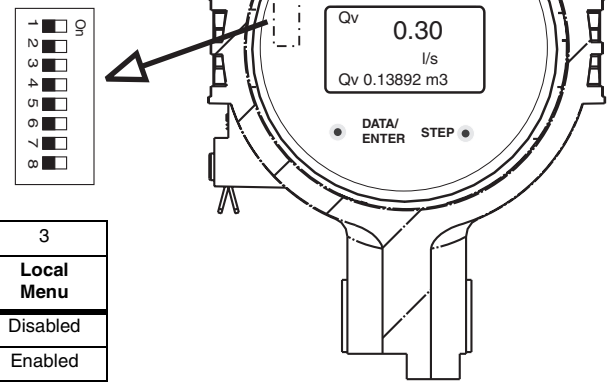
For integration in a process control system a DD-File (Device Description), which includes the instrument description, and a CFF-File (Common File Format) are required. The CFF-File is required for the Engineering of the segment. The Engineering can be processed On- or Offline.

The descriptions of the function blocks may be found in the separate "Data Link Description **FOUNDATION Fieldbus** for TRIO-WIRL" (Part No. D184B093U24).

Both files and the data link description are contained on the CD (Part No.: D699D002U01) included with the shipment. They can also be ordered at no charge at any time from ABB. The DD and the CFF-file can also be downloaded from http://www.fieldbus.org.

In order to start-up the AI-Function Blocks in the AUTO-Mode it is essential that the local menu entry (local instrument operation) be blocked. The mini-switches located on the digital board of the converter can be used to block local data entry. To set the switches, unscrew the front cover. Set switch "3" to "Off". If switch "3" is turned on again after the AI-Blocks were in the AUTO-Mode, then they are reset to "OOS" ("Out of Service").

Switch Functions
Switch 1:
Enable the Simulation of the AI-Function-blocks
Switch 2:
Hardware-Write-Protect for write access over the Bus (all Blocks disabled)
Switch 3:
Write-Protect for local instrument and Magnet Stick operation



Switch / Status	1	2	3
	Simulation Mode	**Write Protect**	**Local Menu**
Off	Disabled	Disabled	Disabled
On	Enabled	Enabled	Enabled

Fig. 27:

6.2.5 Block Diagram of the TRIO-WIRL with FOUNDATION Fieldbus Communication

The available blocks in the TRIO-WIRL are shown as a function block diagram. Communication tools such as a NI-Configurator, System Tools or a SPC with appropriate functionality can but used acyclically to configure all the blocks.

Description of the Individual Blocks:

Resource Block	Includes instrument specific properties such as software version, TAG-No.
Transducer Block	Contains data for the flowmeter primary such as meter size, K-Factor, etc. together with all manufacturer specific parameters, which are not contained in the AI-Block. In addition the Transducer Block also contains a flow totalizer.
Analog Input Block	The user can access his relevant measurement values (Qv (volume flowrate), Qn (volume flowrate at normal conditions), Qm (mass flowrate) or Temperature (option)) using the channel.

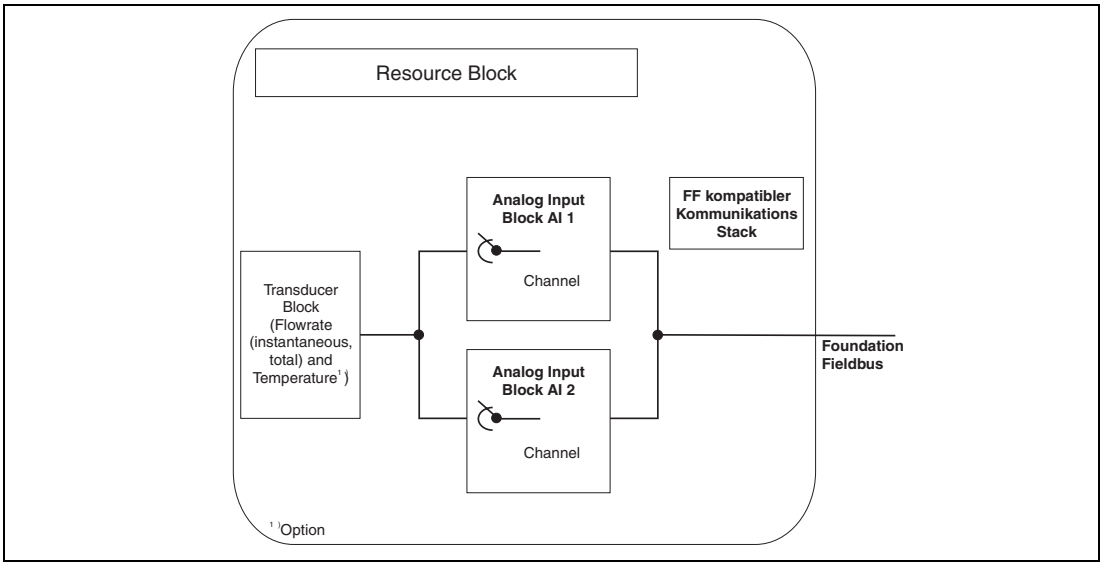


Fig. 28:

Note

1. A detailed description of the Blocks/Parameters may be found in the separate "**Data Link Description FOUNDATION Fieldbus for TRIO-WIRL**" (Part No. D184B093U24). This is also contained on the CD included with the shipment.
2. Configuration is accomplished acyclically.

7 Date Entry/Operation and Configuration

7.1 LC-Display

After the power is turned on the instrument automatically executes a number of self test routines. After they have been completed, the Standard–Process–Display (process information) appears. The values which are to be displayed can be user configured:

Example:
Instantaneous flowrate and totalizer display

```
Qv
                0.30
                 l/s
Qv 0.13892 m3
```

Example:
Error message during an error condition

```
Error-56
M-Database

Qv 0.08750 m3
```

The display orientation can be rotated to match to the local installation conditions by loosening the cover plate and the 4 screws beneath it. The display can be rotated in 90° steps.

7.2 Data Entry

The data can be entered using either the 3 keys, DATA, STEP and C/CE on the converter or with the Magnet Stick when the housing cover is closed. During data entry the transducer block in the converter remains online, i.e. the flowrate continues to be measured.

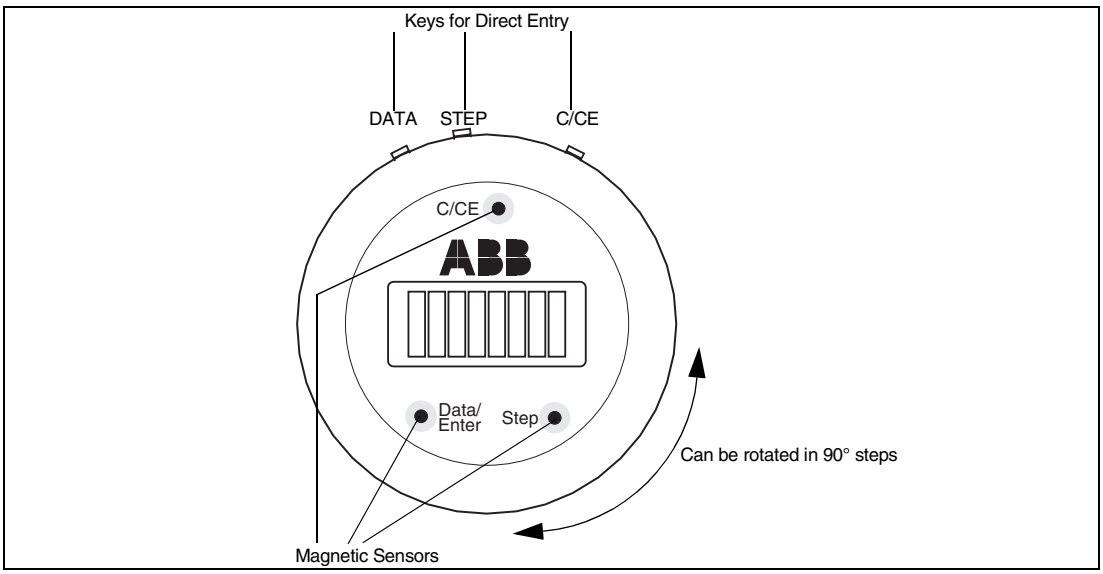


Fig. 29:

In the following the functions for the individual keys are described:

C/CE — The C/CE-key is used to toggle in and out of the operating mode.

STEP ↑ — The STEP-key is one of two arrow keys. STEP is used to scroll forward through the menu. All desired parameters can be accessed.

DATA ↓ — The DATA-key is one of two arrow keys. DATA is used to scroll backward through the menu. All desired parameters can be accessed.

ENTER — The ENTER function requires that both arrow keys, STEP and DATA, be pressed simultaneously. ENTER turns the Program Protection on and off. ENTER is used to access the values in the parameter to be changed and to accept the new values or selections. The ENTER function is only active for approx. 10 Sec. If no entries are made during this 10 Sec. time interval the old value is redisplayed on the converter. If an additional 10 seconds elapses without any action, the standard process display reappears.

ENTER Function for Magnet Stick Operation

The ENTER function is initiated when the DATA/ENTER sensor is activated for more than 3 seconds. The display blinks to indicate that the function is active.

7.2.1 Data Entry for Converters Without a Display

In this design version the converter is operated and configured acyclically using an operator tool (e.g. SMART-VISION). Please see the notes for setting the address (PROFIBUS PA only) or for the special hardware write protect possibilities (FOUNDATION Fieldbus only) in Chapter 6 and the separate Data Link Description.

7.3 Menu System TRIO-WIRL - 3 User Levels

1. **Level: Standard Menu**
   The standard menu provides a quick means for configuring the instrument. All user specific menu entries required for operating the instrument can be set in this menu.
2. **Level:**
   In contrast to the standard menu, the complete set of user specific parameters are accessible in this menu.
3. **Level: Service**
   The Service-Menu is only accessible to ABB Automation Products Customer Service personnel.

7.3.1 .Configuring Gases, Steam or Flow

The selections for the possible operating modes, the required parameters and the additional menus displayed are listed in the following table.

Flow Mode[1)]	Fluid	Flow Type	Equations	Correction Parameters	Additional Menus Displayed
Liquid Qv	Liquid	Volume flowrate	—	—	—
Liquid Qm (D)	Liquid	Mass flowrate	$Qm = Qv \cdot \rho_b$	Ref. density ρ_b constant	Units Density Ref. Density Units Qm
Liquid[2)] Qm (D, T)	Liquid	Mass flowrate	$Qm = Qv \cdot \rho(T_0)$ $\rho(T) = \rho_b \cdot (1 + (T_{oper} - T_0) \cdot \beta 2)$	Ref. density ρ_0 Ref. temp. T_0 Operating temp. T_{oper} Density expansion coefficient ß2	Units Density Ref. Density Ref.Temperature Units Qm
Liquid[2)] Qm (V, T)	Liquid	Mass flowrate	$Qm = Qn \cdot \rho_b$ $Qn = \frac{Qv}{(1 + (T_{oper} - T_0) \cdot \beta 1)}$	Volume expansion coefficient [%/K]ß1 Ref. Temp. T_0 Operating temp. T_{oper} Ref. density ρ_b	Units Density Ref. Density Ref.Temperature Vol._Exp_Coef Units Qm
Gas Qv	Gas	Actual Flowrate	—	—	—
Gas Normal[2)] Qn (pT)	Gas	Normal flowrate 1.013 bar/0 °C 0–1.013 bar/20 °C	$Qn = Qv \cdot \frac{Poper}{1.013\ bar} \cdot \frac{273\ K}{273\ K + T_{oper}}$	Operating press. P_{oper} abs Operating temp. T_{oper}	Ref. Pressure Units Pressure Normal Conditions
Gas Std.[2)] Qs (pT)	Gas	Standard flowrate 14.7 psia/60 °F	$Qs = Qv \cdot \frac{Poper}{14.7\ psia} \cdot \frac{60\ °F}{60\ °F + T_{oper}}$	Operating press. P_{oper} abs Operating temp. T_{oper}	Ref. Pressure Units Pressure Normal Conditions
Gas Normal Qn (KmpF)	Gas	Normal flowrate 1.013 bar/0 °C	$Qn = Qv \cdot \text{Normal Factor}$ $\text{Normal Factor} = \frac{\rho_b}{\rho_0}$	Normal factor constant (compressibility factor)	Normal Factor
Gas Mass[2)] Qm (pT)	Gas	Mass flowrate Normal conditions 1.013 bar/0 °C or 1.013 bar/20 °C	$Qm = \rho_0 \cdot Qn$ $Qn = Qv \cdot \frac{Poper}{1.013\ bar} \cdot \frac{273\ K}{273\ K + T_{oper}}$	Operating press. P_{oper} abs Normal density p_0 Operating temp. T_{oper}	Units Density Normal Density Normal Conditions Ref.Temperature Pressure P_{oper} abs Units Qm
Gas Mass Qm (D)	Gas	Mass flowrate	$Qm = Qv \cdot \rho_b$	Ref. density ρ_0 constant	Units Density Ref. Density Units Qm
Sat. Steam[)] Qm	Satura ted Steam	Mass flowrate	$Qm = Qv \cdot \rho_b(T_{oper})$ Correction using Steam Tables	Operating temp. T_{oper}	Units Qm
Sat. Steam Qv	Satura ted Steam	Actual Flowrate	—	—	—

Qm = Mass flowrate
Qv = Actual flowrate
Qn = Normal flowrate
P_o = Reference pressure
ß1 = Volume expansion coefficient
ß2 = Density expansion coefficient
ρ_0 = Normal density
ρ_b = Reference Density

1) Selection of the possible flow modes is a function of the type of flowmeter calibration.

2) These flow modes can only be selected when the flowmeter includes a temperature measurement option.

7.3.2 Data Entry in Condensed Form

Note
The program protection must be turned off before data can be entered.

Action	keys	Display
Turn off Program Protection		Qv 0.30 l/s Qv 0.13892 m3 (Standard Display)
1.Enter Programming Mode	C/CE	An arbitrary parameter is displayed
2.Find Menu **„Prog. Level“**	STEP or DATA	Prog. Level Locked
3.Select the desired Programming Level (Standard or Specialist) for processing .	ENTER	Prog. Level Standard_
	STEP or DATA	Prog. Level Specialist
4.Turn off Program Protection.	ENTER	Prog. Level Specialist

Direct Numeric Entry

Example: Set the Qmax value

Action	keys	Display
1.Find parameter „Qmax“	STEP or DATA	Qmax 1.600 m3/h
2.Change parameter „Qmax“ The limits are shown in the lower part of the display.	ENTER	Qmax 0_ m3/h Min 0.24 Max 1.600
3.Enter the numbers of the desired value in order .		Qmax 1.2 m3/h
	1 x DATA STEP 10 x DATA (period) STEP 2 x DATA	
	To cancel the entry press „C/CE“-key!	
4.Accept the changed „Qmax“ value		Qmax 1.200 m3/h

Entry from a Table

Example: Change volume flowrate units

Action	keys	Display
1.Find parameter „Units Qvol“	STEP or DATA	Units Qvol l/s
2.Change parameter „Units Qvol“	ENTER	Units Qvol l/s_
3.Select new units from table.	STEP or DATA	Units Qvol m3/h_
4.Accept new units	ENTER	Units Qvol m3/h

Reactivate the Program Protection

Action	keys	Display
1.Menu Find **„Prog.Level“**	STEP or DATA	**Prog.Level** Specialist
2.**„Programming Level“** Select Locked.	ENTER STEP	Prog.Level Locked
3.Program Protection active	ENTER	Prog.Level Locked
4.Return to standard display	C/CE	Qv 0.05 m3/h Qv 0.14002 m3

7.4 Parameter Overview and Data Entry

All Program Level **Standard** parameters are shaded in gray.

Submenu/ Parameter	Submenu/ Parameter	Submenu/ Parameter	Selections/ Value Range	Entry Type	Comments
Prog. Level Locked		**ENTER** = Data/Step simultaneously or Data > 3 s (for Magnet Stick) **C/CE** = Return to main menu or cancel the entry		from table	
ENTER	Prog.Level Locked_				**„Locked“**: All entries in the Standard Menu can be read.
	Prog. Level Standard_				**„Standard“**: Standard Menu includes all the user specific menu entries required to operate the instrument (are shaded).
	Prog. Level Specialist_				**„Specialist“**: Technician Menu with the complete user specific menu set.
	Prog. Level Service_	Service-Code? 0_	0–9999	numeric	„Service“: Additional display of the Service Menus after the correct Service-Code has been entered (only for ABB Service).
	Prog. Level Prog.Prot. Code	Old PP-Code 0_	0–9999	numeric	If a number differing from „0“ (Factory setting) has been selected for the Prog. Protection Code, then this PP-Code (1-9999) must be entered in order to turn the protection off.
		New PP-Code 0	0–9999	numeric	
Language English				from table	Language
Enter	Language German				
	Language English				
Primary SWIRL ST/SR					Display of the flowmeter primary type SWIRL = TRIO-WIRL S VORTEX = TRIO-WIRL V
Meter Size 15 mm 1/2 in					Display the flowmeter size
Median k-Factor 60000.0 1/m3					Display the mean Calibration k-Factor
Shedule Correct. Schedule40			Schedule40 Schedule80	from table	Parameter only displayed for Vortex-Primaries with ANSI-Process connections: Correction for the inside diameter differences for connection pipes Sch. 40 or 80

Submenu/ Parameter	Submenu/ Parameter	Submenu/ Parameter	Selections/ Value Range	Entry Type	Comments
Flow Mode Liquid Qv		**For explanations of the Flow Modes see Page 27.**		from table	
ENTER	Flow Mode Liquid Qv_				Fluid Liquid Flow mode: Volume flowrate metering
Note: The selection of possible operating modes is a function of the fluid and the sensor design (see Ordering Information)!	Flow Mode Liquid Qm (D)_				Fluid Liquid Flow mode: Mass flowrate metering with constant density
	Flow Mode Liquid Qm (D,T)_				Fluid Liquid Flow mode: Mass flowrate metering with temperature dependent density
	Flow Mode Liquid Qm (V,T)_				Fluid Liquid Flow mode: Mass flowrate metering with temperature dependent volume expansion coefficient
	Flow Mode Gas Qv_				Fluid Gas Flow mode; Actual flowrate metering
	Flow Mode Gas Norm Qn (pT)_				Fluid Gas Flow mode: Normal flowrate metering with temperature dependent Normal factor
	Flow Mode Gas Std Qs (pT)_				Fluid Gas Flow mode: Standard flowrate metering with temperature dependent standard factor
	Flow Mode Gas Norm Qn(KmpF)				Fluid Gas Flow mode: Normal flowrate metering with constant compressibility factor (KmpF) (visible at German language)
	Flow Mode Gas Std Qs(CmpF)				Fluid Gas Flow mode: Standard flowrate metering with constant compressibility factor (CmpF) (visible at English language)
	Flow Mode Gas Mass Qm (pT)_				Fluid Gas Flow mode: Mass flowrate metering with temperature dependent density
	Flow Mode Gas Mass Qm (D)_				Fluid Gas Flow mode: Mass flowrate metering with constant density

Legends for Liquid, Gas and Steam Calculations

1) Liquid Qv	= Volume flowrate	6) Gas Normal Qn(KmpF)	= Normal flowrate
2) Liquid Qm (D,T)	= Mass flowrate	7) Gas Mass Qm (pT)	= Mass flowrate
3) Liquid Qm (V,T)	= Mass flowrate	8) Gas Mass Qm (D)	= Mass flowrate
4) Gas Qv	= Actual flowrate	9) Sat. Steam Qm	= Saturated steam mass flowrate
5) Gas Normal Qn	= Normal flowrate	10) Sat. Steam Qv	= Saturated steam volume flowrate

Submenu/ Parameter	Submenu/ Parameter	Submenu/ Parameter	Selections/ Value Range	Entry Type	Comments
	Flow Mode Steam satu Qm_				Fluid Saturated Steam Flow mode: Mass flowrate metering with temperatur dependent density
	Flow Mode Steam satu Qv_				Fluid Saturated Steam Flow mode: Actual flowrate metering
Units Density g/ml			g/ml, g/l, g/cm³, kg/l, kg/m³, lb/ugl, lb/ft³	from table	**Parameter displayed for flow mode** Liquid Qm (D), Liquid Qm (D,T), Liquid Qm (V,T), Gas Mass Qm (pT), Gas Mass Qm (D)
Ref. Density 1.0 kg/l			0.001–1000.000 kg/l Units dependent	numeric	**Parameter displayed for flow mode** Liquid Qm (D), Liquid Qm (D,T), Liquid Qm (V,T), Gas Mass Qm (pT), Gas Mass Qm (D)
Normal Density 0.001293 kg/l			0.000–0.1 kg/l Units dependent	numeric	**Parameter displayed for flow mode** Gas Mass Qm (pT)
Compressibility 1.0			0.001–1000.000	numeric	**Parameter displayed for flow mode** Gas Norm Qn (KmpF), Gas Std Qs (CmpF), Normal factor = Operating density/Normal density
Norm. Cond. 1.0133bara 0C				from table	**Menu displayed for flow mode** Gas Mass Qm (pT), Gas Norm Qn (pT), Gas Std Qs (pT)
ENTER	Norm. Cond. 1.0133bara 0C				
	Norm. Cond. 1.0133bara 20C				
	Std. Cond. 14.7psiabs 60F				
	Std. Cond. 14.7psiabs 70F				
Units Tempera C			C. K. F	from table	**Parameter only displayed when** PT 100 sensor is installed (see Ordering Information)
Reference Temp 20.0 C			-200 to +500 °C Units dependent	numeric	**Parameter only displayed for flow mode:** Liquid Qm (V,T),Liquid Qm (D, T)
Unit Pressure bara			bara. PSIA	from table	**Parameter only displayed for flow mode:** Gas Mass Qm (pT), Gas Norm Qn (pT), Gas Std Qs (pT)
PressurePropr abs 1.0133 bara			0–100 bara Units dependent	numeric	**Parameter only displayed for flow mode:** Gas Mass Qm (pT), Gas Norm Qn (pT), Gas Std Qs (pT)

Submenu/ Parameter	Submenu/ Parameter	Submenu/ Parameter	Selections/ Value Range	Entry Type	Comments
Vol. extension 1.0			0.00–10.00 ‰/K	numeric	**Parameter only displayed for flow mode:** Liquid Qm (V,T)
Density extens. 1.0			0.00–10.00 ‰/K	numeric	**Parameter only displayed for flow mode:** Liquid Qm (D,T)
Unit Qvol l/s			l/s, l/min, l/h, m³/s, m³/min, m³/h, m³/d, ft³/s, ft³/min, ft³/h, ft³/d, usgps, usgpm, us-gph, usgpd, igps, igpm, ig-ph, igpd, bbl/s, bbl/min, bbl/h, bbl/d	from table	Selection of the volume flowrate units for Qv, Qn and Qs
Unit Qm g/s			g/s, g/min, g/h, kg/s, kg/ min, kg/h, kg/d, t/min, t/h, t/d, lb/s, lb/min, lb/h, lb/d	from table	Selection of the mass flowrate units for Qm **Parameters displayed for flow mode**s Liquid Qm (D), Liquid Qm (D,T), Liquid Qm (V,T), Gas Mass Qm (pT), Gas Mass Qm (D), Sat.Steam Qm
QmaxDN operat. 6.0 m3/h					Display max. actual flowrate
Qmax 5 m3/h			0.15–1.15 QmaxDN	numeric	Relative flowrate value required for flowrate display in „%“ and flowrate alarm.
Qmin operat. 0.5 m3/h			0–10 % QmaxDN	numeric	**Low flow cutoff value** **May not be changed!**
Submenu Totalizer				numeric	
ENTER	Totalizer 3743 m3	**Note:** In the FOUNDATION Fieldbus design only, the totalizer value for the local display corresponds to the totalizer in the AI-Block.	0–9999999		Set the totalizers to a specific value.
	Overflow 0				Display of the totalizer overflows; max. 65,535 1 overflow = 10,000,000
	Unit totaliz. l		l, m³, ft³, ugl, igl, bbl, g, kg, t, lb		Selection of the totalizer units as a function of the selected flow mode, Volume or Mass flowrate
	Totatli. reset .	Reset totalizer Reset→ENTER			Reset totalizers and overflow counters
Damping 3s			0,2–100 s	numeric	Effective for the local display, TB and pulse output (response time 1 τ (= 63 %) for a step flowrate change)

Submenu/ Parameter	Submenu/ Parameter	Submenu/ Parameter	Selections/ Value Range	Entry Type	Comments
Hardware Config. OFF					
					Configure contact output (41/42)
	ENTER → Hardware Config. OFF			from table	no function
	Hardware Config. Pulse				Pulse output
	Hardware Config. Flowrate Alarm				Flowrate limit alarm Contact closes during alarm condition.
	Hardware Config. Temp. Alarm				**Parameter only available for flowmeters with a temperature measurement option.** Temperature limit alarm Contact closes during alarm condition.
	Hardware Config. System Alarm				System alarm Contact closes during alarm condition.
Minalarm Flow 0.0 %	**Note:** Parameters Min- and MaxAlarm Flow are only displayed for selection: Hardware Config./Flowrate Alarm.		0–100 % of Qmax	numeric	Min. alarm flowrate 0 % = off
Maxalarm Flow 100.0 %			0–100 % of Qmax	numeric	Max. alarm flowrate 100 % = off
Minalarm Temp -60.0 C	**Note:** Parameters Min- and MaxAlarm Temp. are only displayed for selection: Hardware Config./Temp. Alarm.		-60 °C to 510 °C	numeric	Min. alarm temperature -60 °C = off
Maxalarm Temp 510.0 C			-60 °C to 510 °C	numeric	Max. alarm temperature 510 °C = v
Pulse Factor 20.0	**Note:** Parameter Pulse Factor only displayed for selection: Hardware Config./Pulse Factor.		0.001–1000 Pulses/unit	numeric	For internal and external flow totalizers Pulses per selected totalizer unit
Pulse Width 5.0	**Note:** Parameter Pulse Width only displayed for selection: Hardware Config./Pulse Width.		1–256 ms	numeric	Pulse on/off ratio max. 1:1. A warning is displayed if exceeded and pulse width adjusted.
Submenu Display					
	ENTER → Display Mode 1 large, 1 small	Display Mode 1 large, 1 small		from table	Display indication mode: 1 large and 1 small or 4 small lines
		Display Mode 4 small			

Submenu/ Parameter	Submenu/ Parameter	Submenu/ Parameter	Selections/ Value Range	Entry Type	Comments
	Display 1.row Q Operating Mode	Display 1.row Q Operating Mode		from table	**Selection of the displayed value** Q operating mode: Operating mode dependent flowrate display in actual-/ normal-/standard volume or mass units
		Display 1.row Qv Actual			Qv actual: Display actual volume flowrate at process conditions
		Display 1.row Percent			Percent: Display the flowrate relative to Qmax
		Display 1.row Totalizer		from table	Display the flow totalizer value
		Display 1.row Temperature			**Parameter only available for flowmeters with a temperature measurement option.** Display the process temperature
		Display 1.row Frequency			Display the sensor frequency
		Display 1.row AI1 Out		from table	Selection of the displayed values Display the OUT-Value of AI1, decimal places result from the decimal point in the OUT_SCALE-Structure. The displayed units correspond to the UNIT_INDEX of the OUT_SCALE-Structure.
		Display 1.row AI1 Status			Display of the Actual-Mode of AI1 and Status of the output variables (OUT.Status).
		Display 1.row AI2 Out			Display the OUT-Value of AI2. See description of „AI1 Out“.
		Display 1.row AI2 Status			Display of the Actual-Mode of AI2 and Status of the output variables (OUT.Status).
		Display 1.row Totalizer Total			**Only for Communication PROFI-BUS PA!** Display the Total-Value of the Totalizer-Blocks. The displayed unit is the UNIT_TOTAL.
	Display 2.row Totalizer	Display 1.row Totalizer Status			Display the Actual-Mode of the Totalizers and Status of the output variables (Total.Status).
	Display 4.row Q Operating Mode	Display 1.row Adr + State			Display the Address and the state of the cyclical communication (Stop, Clear, Operate)
	Contrast			from table	Set the contrast of the display using DATA/STEP

Submenu/ Parameter	Submenu/ Parameter	Submenu/ Parameter	Selections/ Value Range	Entry Type	Comments
Submenu Error Register					
ENTER	Error Register . . . 3				Display errors encountered, reset with „ENTER“ (see Note in Chapter 9)
	Mains Interrupt 0				Counter for the number of power interruptions since start-up
Submenu Function Test					
ENTER	Q Simulation 0.00 Hz				Simulation (display and pulse output), Initiate by entering a starting value in „Hz“. Turn off by entering 0 Hz. After it switches to process display the frequency can be changed (DATA/ STEP +/-5 Hz) .
	Function Main FRAM	**Note:** Main FRAM and Backup FRAM are used to store the meter location parameters and calibration data.			Test Main FRAM: Check the internal converter database.
	Function Backup FRAM				Test Backup FRAM: Check the external database (on the sensor board).
	Function Pulse Output		On/Off	from table	Test the Pulse Output: Toggle approx. 4 Hz frequency on/off using „ENTER“
	Function Contact Output		On/Off	from table	Test Contact Output: (Terminals 41/42)
	Function DIP-Switch	1: Simulate Enable 2: Write Protect 3: MenuInput Enable →any key ENTER x = on - = off xx----- 12345678			**Only for Communication FOUNDATION Fieldbus.** Display the actual settings of the DIP-Switches on the digital board. **Switch 1:** Release the Simulation for the AI-Function blocks. **Switch 2:** Hardware-Write protection for write access over the bus (all blocks locked). **Switch 3:** Write protection for local instrument operation (keypad and Magnet Stick).

Submenu/ Parameter	Submenu/ Parameter	Submenu/ Parameter	Selections/ Value Range	Entry Type	Comments
	Function DIP-Switch	PA-Addr.: 50 set by switch →any key ENTER 1–7: Bus-Addr. 8: on = Addr by swit 8: off = Addr by bus ENTER x = on - = off -x--xx-x 12345678			**Only for Communication PROFIBUS PA** Display the actual settings of the DIP-Switches on the digital board. **Switches 1–7:** PROFIBUS Address **Switch 8:** Define the Address mode: Off = Address from the bus On = Address from the Mini-Switches 1–7 **Note** Changes in the local address setting take only effect after switching "ON"/ "OFF" the power supply.
Submenu PROFIBUS PA					**Only for Communication PROFIBUS PA**
ENTER	Software Rev Communication: 0				Display the communication Software Version.
	IdentNo Selector Triowirl 05DC 2*AI+TOT	IdentNo Selector Profile 9740 AI+TOT IdentNr Selector Profile 9700 AI			Set the Ident-Number-Selector. **Note** Settings cannot be made from cyclical communication, only in the STOP status.
	AI1 Channel Qv	**AI1 Channel** Qoper. mode **AI1 Channel** Temperature **AI1 Channel** Frequency **AI1 Channel** int. Total.			Channel settings for the first AI-Block. When changing the channels the units are also copied from the AI-Block (per OUT_SCALE.UNIT_INDEX).
	AI2 Channel Qv	**AI2 Channel** Qoper. mode			Channel setting for the second AI-Block. Selection and description, see first AI-Block.
	TOT Channel Qv	TOT Channel Qoper. mode			Channel settings for the Totalizer-Block.

Submenu/ Parameter	Submenu/ Parameter	Submenu/ Parameter	Selections/ Value Range	Entry Type	Comments
Submenu FF					**Only for communication FOUNDATION Fieldbus.**
ENTER	Software Rev. Communication: 0				Display the communication Software Version only for FOUNDATION Fieldbus.
TRIO-WIRL FF 50VT4 FF 11/2001 D200F002U01 A.1_					**Only for communication FOUNDATION Fieldbus.** Display the actual Software Version and the Revision Date.
TRIO-WIRL PA 50VT4 PA 11/2001 D200F003U01 A.1_					**Only for communication PROFIBUS PA** Display the actual Software Version and the Revision Date.

8 Configuring Converter at Start-Up

The measurement system has been configured by ABB Automation Products prior to shipment based on the information included with the Order. All the required values have been entered. Because the instruments can be universally installed, i.e., for liquids or gases, it is recommended that the following parameter settings be checked and if required, changed at start-up:

- **Meter Size:**
  Check that the meter size agrees with the value on the Factory Tag
- **k-Factor:**
  Check that the displayed value agrees with the value on the Factory Tag.
- **Operating Mode:**
  Select the desired operating mode. See Page 27.
- Which units are to be used for the flowrate and totalizer displays? Select between volume and mass units (selection is dependent on the operating mode selection).
- Enter desired flow range in the units selected above in the parameter RangeMax actual. Range can be set between 0.15 to 1.15 x QmaxDN actual. This parameter is only required for the Fieldbus Design of the TRIO-WIRL, when the local display indication is in „%“.
- **Qmin Actual:**
  Check the low flow cutoff value: Range 0 to 0.1 x QmaxDN.
- **Totalizer Units:**
  Select the flowrate units for the internal totalizer in this parameter. This unit is also used for the pulse output (Contact Output Terminals 41/42).
- **Damping:**
  Response time of the electronic circuitry, affects the local display, the pulse output and the Transducer Block.
- **Submenu Display:**
  Configure the local display indications, 2 or 4 line display.
- **Configure the Fieldbus Data Link in the TRIO-WIRL:**
  Please see the information in Chapter 6 of this Instruction Bulletin and the separate Data Link Description.

9 Additional Configuration Information

9.1 Meter Size

This parameter is used to define the flowmeter size of the installed flowmeter since the same converter can be used for all flowmeter sizes. The meter size was set at the factory for the flowmeter primary assigned to the converter (see Factory Tag).

9.2 Calibration K-Factor

The average k-Factor value displayed must be identical to the value listed on the Factory Tag. Each flowmeter is calibrated on a test stand at 5 flowrate values. The calibration factors are entered in the converter and recorded on a calibration report. An average calibration factor value is calculated and listed on the Factory Tag. Typical calibration factor values and signal frequencies for liquids and gases are listed in the following table. These values are approximate guidelines only:

Vortex Flowmeter TRIO-WIRL V

Meter Size		Typ. k-Factor	Liquid f_{max} at Q_{vmax} [Hz]		Gas f_{max} at Q_{vmax} [Hz]	
DN	Inch	max [1/m³]	DIN	ANSI	DIN	ANSI
15	½“	225000	370	450	1520	1980
25	1“	48000	240	400	2040	1850
40	1½“	14500	190	270	1550	1370
50	2“	7500	140	176	1030	1180
80	3“	2100	102	128	700	780
100	4“	960	72	75	500	635
150	6“	290	50	50	360	405
200	8“	132	45	40	285	240
250	10“	66	29	36	260	225
300	12“	39	26	23	217	195

Swirl Flowmeter TRIO-WIRL S

Meter Size		Typ. k-Faktor	Liquid f_{max} at Q_{vmax}	Gas f_{max} at Q_{vmax}
DN	Inch	max [1/m³]	[Hz]	[Hz]
15	½“	440000	185	1900
20	¾“	165000	100	1200
25	1“	86000	135	1200
32	1¼“	33000	107	1200
40	1½“	24000	110	1330
50	2“	11100	90	1100
80	3“	2900	78	690
100	4“	1620	77	700
150	6“	460	40	470
200	8“	194	23	270
300	12“	54	16	92
400	16“	27	13	80

The converter calculates the actual flowrate based on the following equation:

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

Q = Actual flowrate [m³/s]
f = Frequency [1/s]
k = Calibration k-Factor [1/m³]

9.3 Submenu Hardware Configuration (Contact Output Terminals 41/42)

The parameters assigned to the Contact Output (Terminals 41, 42) are set in this submenu. The menus which are displayed,"Pulse Width", "Min and Max Q_Alarm" or "Min and Max T_Alarm" are a function of the desired output selected (pulse, flowrate alarm, temperature alarm, system alarm).

9.3.1 Contact Output Configuration

The contact output in the converter is configured at the factory based on the ordering information as either

- Design VT40/VR40/ST40/SR40: Optocoupler

or

- Design VT4A/VR4A/ST4A/SR4A: NAMUR-Contact

It is possible to change the configuration after installation. The supply power to the flowmeter primary must be shut off and the threaded cover removed. The converter must be removed from the housing in order to change the switch settings. Loosen the three Phillips head screws and remove the converter. Set the switches as shown in Fig. 30. Carefully reinstall the converter in the housing, making sure it is centered and tighten the three screws. Reinstall the threaded cover.

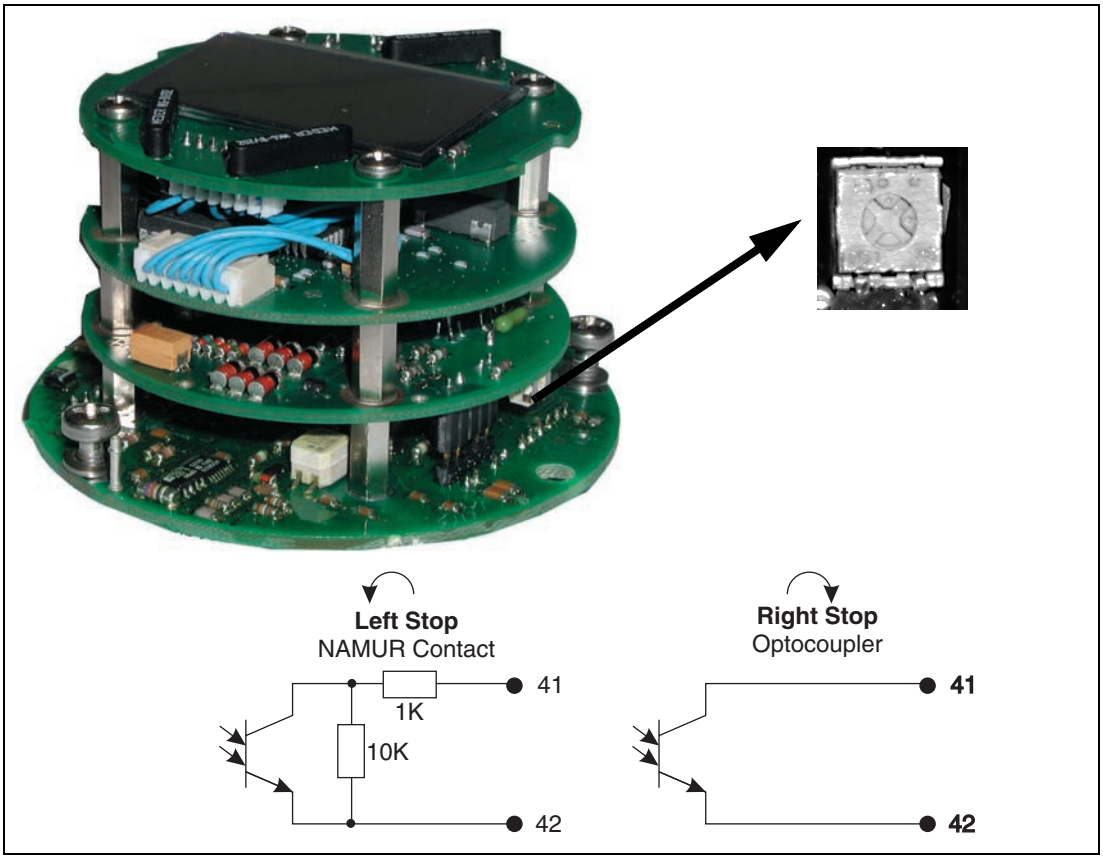


Fig. 30:

9.4 Submenu Pulse Output

This menu is used to configure the scaled pulse output to match the user requirements. Selections can be made between 0.001 and 100 pulses per selected unit. The pulse factor is the number of pulses per flowrate unit. It affects the internal totalizers and the pulse output. The maximum output frequency is limited to **100 Hz**.

9.4.1 Submenu Pulse Width

To configure the pulse width it is necessary to select the parameter "Pulse" in the Submenu "Hardware Config". Otherwise the parameter Pulse Width is hidden. The pulse width (length of the pulses) for the scaled pulse output can be set between 1 and 256 ms. The converter monitors the relationship of the pulse width to the period of the max. pulse frequency (at 115 % flowrate). If an on/off ratio Š 50 % results, a warning is displayed and the old value is retained.

9.5 Submenu Error Register

This menu contains the error register and the supply power interruption counter.

All errors detected are permanently stored in the error register, whether they occurred momentarily or for a longer time period. Every number in the error register display represents a specific error type:

Ok:.....Error.....3.56....

The error register can be cleared by pressing the"ENTER" key.

Error No.	Clear Text	Priority	Description	Possible Cause	Corrective Measures
0	Steam calculation	7	Incorrect mass flowrate calculations for saturated steam	Steam temperature < 55 °C	Increase steam temperature
				Steam temperature > 370 °C	Decrease steam temperature
1	Front End	1	Preamplifier board defective	—	Exchange converter module/Contact ABB Service
2	Not used	—			
3	Flowrate > 115 %	2	The flowrate value set for Qmax was exceeded by 15 % .	Flow range too small	Increase flow range Qmax
				Flowrate too large	Reduce flowrate
4	Not used	—			
5	M-Database	0	Master-Database corrupted, loss of the converter internal database	Internal database damaged	Turn instrument off and on, exchange converter module. If necessary, contact ABB Service
6	Totalizer defective	1	Flow totalizer corrupted. Indicated values are invalid		Reprogram totalizer
7	Temperature (Error only displayed in the flowmeter primary includes a PT100)	7	Temperature measurement defective	PT100 defective	Exchange sensor
				For Model VR/SR cabling error between the flowmeter primary and converter	Check cabling
8	Not used	—			
9	Qv > 115 % QmaxDN	2	Max. allowable flow range (QmaxDN) exceeded		Reduce flowrate
B	B-Database	0	Backup-Database corrupted, loss of the external database (sensor board)	External database damaged	Turn instrument off and on again, sensor board may be damaged, contact ABB Service

9.5.1 Power Interruptions

The converter counts the number of times the power was turned off or interrupted and displays the value.

The Mains Interrupt counter can only be reset by ABB-Service.

9.6 Normal Factor (compressibility)

For constant process conditions (pressure and temperature) a Normal Factor can be entered here. The Normal Factor defines the relationship between the normal and actual flowrates:

$$\frac{Q_n}{Q_v} = \frac{(1.013\ \text{bar} + p)}{1.013\ \text{bar}} \cdot \frac{273}{273 + T}$$

Q_n = Normal flowrate
Q_v = Actual flowrate
p = Process pressure
T = Process temperature [°C]
ρV = Actual density
ρN = Normal density

Because the mass flowrate is the same for both operating modes, the following equation applies:

$$\frac{Q_n}{Q_v} = \frac{\rho V}{\rho N}$$

10 Specifications Ex-Design

EC-Type Examination Certificate TÜV 01 ATEX 1771

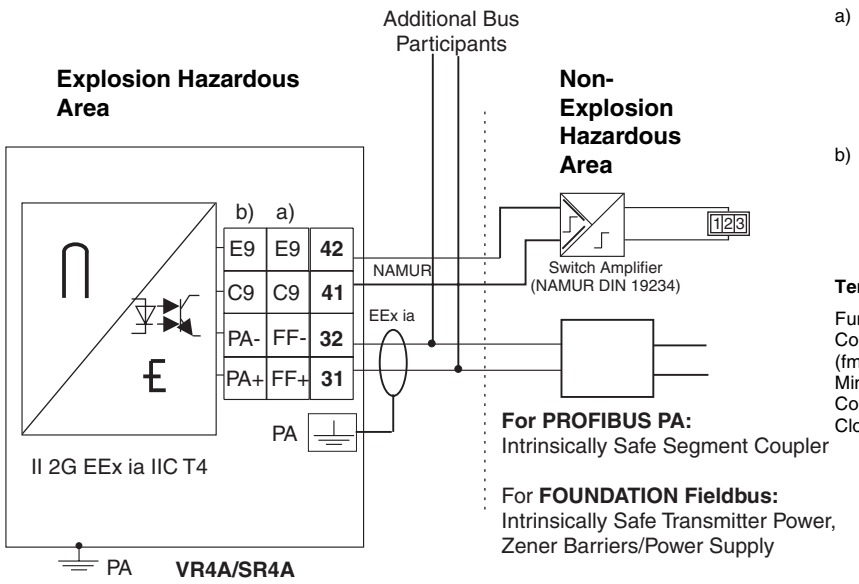
Identification: II 2G EEx ia IIC T4

10.1 Note to the FISCO-Model

The Ex-Design of the TRIO-WIRL corresponds to the FISCO-Model (FISCO = **F**ieldbus **i**ntrinsically **S**afe **Co**ncept) published by PTB. Certification of the intrinsic safety of the connection to other intrinsically safe instruments is not required if the boundary conditions listed below are maintained:

- All participants must be FISCO approved, e.g. by PTB, TÜV, BVS, KEMA.
- The max. cable length in a segment for EEx ia is limited to 1000 m, for EEx ib to 1900 m.
- The bus cable (Type A) must satisfy the following values: R' = 15 Ω/km, L' = 0.4...1 mH/km, C' = 80...200 nF/km.
- For each field instrument (U_I, I_I, P_i) applies: $U_0 \leq U_I$, $I_0 \leq I_I$, $P_0 \leq P_i$.
- All participants operate as passive current sinks.
- When a bus participant transmits, no power is to be added.
- There can only be one active instrument in the segment (power supply/segment coupler).

10.2 Interconnection Diagram VT4A/ST4A Ex-Design



Terminals 31, 32

a) Function FF+, FF-
Connections for FOUNDATION Fieldbus (H1) per IEC 1158-2
U = 9–24 V,
I = 10 mA (normal operation)
I = 13 mA (during error condition/FDE)

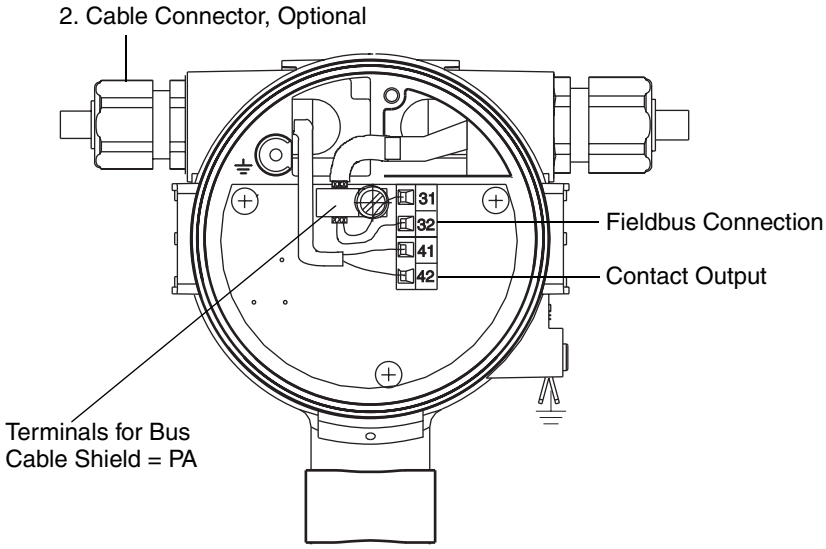
b) Function PA+, PA-
Connections for PROFIBUS PA per IEC 1158-2
U = 9–24 V,
I = 10 mA (normal operation)
I = 13 mA (during error condition/FDE)

Terminals 41, 42

Function C9, E9
Contact output: Function software selectable as pulse output (fmax 100 Hz, 1–256 ms),
Min-/Max alarm or System alarm).
Configured as NAMUR-Contact (per DIN 19234)
Closed 1 KOhm, open > 10 KOhm

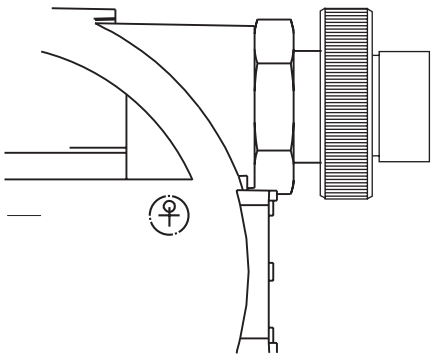
Note

The fieldbus cable shield is connected to the Potential Equalization at the supply end or per FISCO.



Connections Using M12 Plug (Design PROFIBUS PA only)

Optionally the connection can also be made using a M12-Plug (see Ordering Information). The TRIO-WIRL in this option is delivered completely wired. Suitable sockets (Type EPG300) and additional accessories may be found in the List Sheet 10/63–6.44 DE.



Pin Assignments (viewed from the front to the pin insert and pins)
PIN 1 = PA+/31
PIN 2 = nc
PIN 3 = PA-/32
PIN 4 = Shield

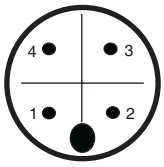


Fig. 31:

10.3 TRIO-WIRL VR/SR

The TRIO-WIRL VR/SR is based on the VT/ST technology and includes all the options of the VT/ST. The converter is mounted remote from the flowmeter primary for installations where the flowmeter primary is difficult to access. This design is also advantageous for installations where extreme ambient conditions exist at the meter location. The maximum distance between the flowmeter primary and the converter is 10 m. A special cable is used to connect the flowmeter primary to the converter (permanently connected to the converter).

Note

It is recommended that the connection cable be installed in a metal conduit connected to PA.

After the installation has been completed, the cable can be cut to the length required to reach the flowmeter primary. Because the signals between the flowmeter primary and converter are not amplified all connections must be made with care and the leads, as short as possible, positioned in the connection box (see Fig. 33) so that they are not affected by vibrations.

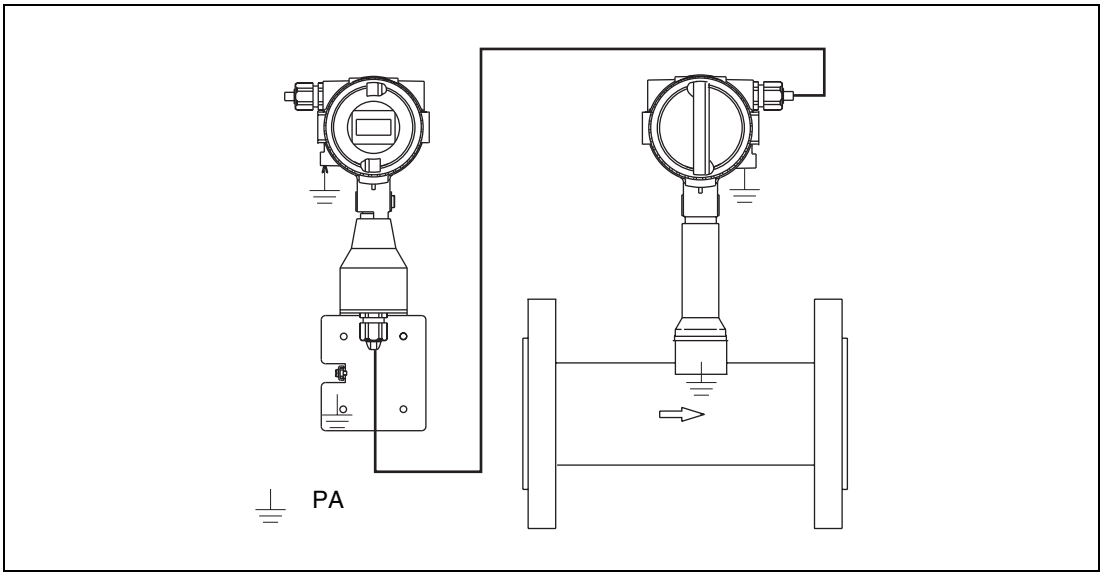


Fig. 32: TRIO-WIRL VR/SR

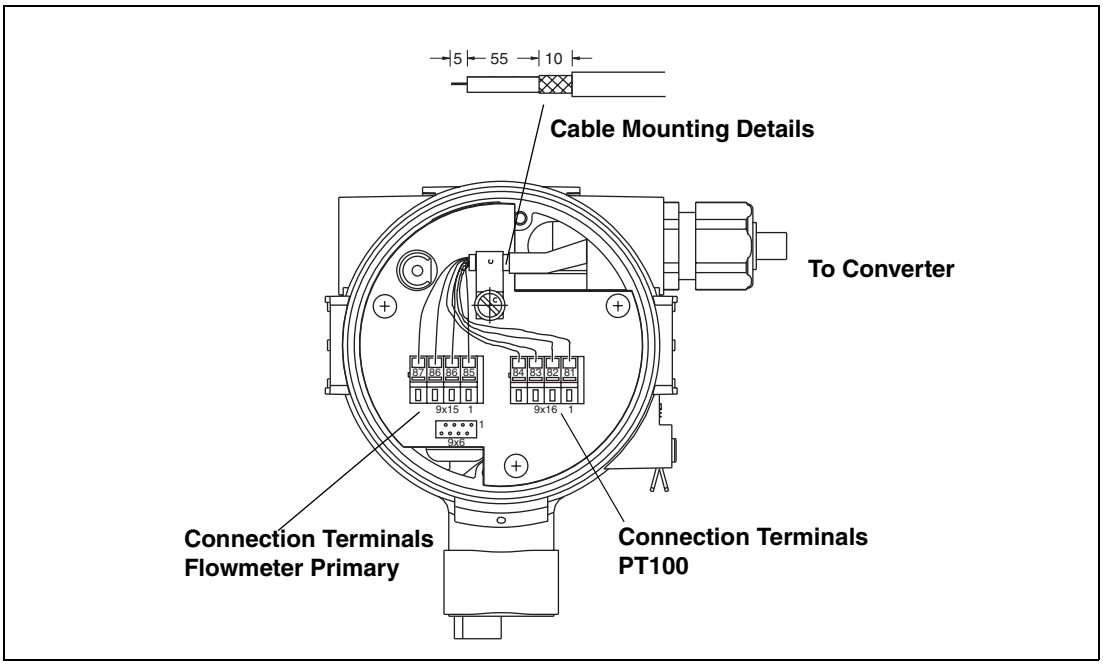
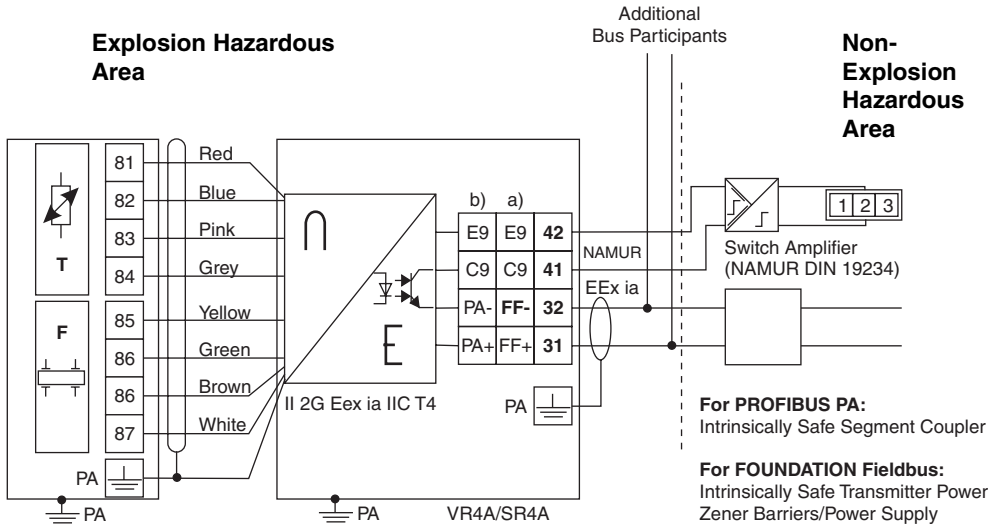


Fig. 33: Connection Box TRIO-WIRL VR/SR Flowmeter Primary

10.3.1 Interconnection Diagram TRIO-WIRL VR 4A and SR 4A Ex-Design

The converter is connected as described in Sect. 10.2 .



Note

Terminals 81–84 are only to be used in instruments which have a temperature sensor installed (PT100) .

Note

The fieldbus cable shield is connected to the Potential Equalization at the supply end or per FISCO.

Fig. 34:

10.4 Ex-Approval Specifications

Ambient Temperature(-40) -20 °C to 70 °C

VT4A/ST4A/VR4A/SR4A

Supply Current Circuit	Terminals 31, 32
Ignition Type	***II 2G EEx ia IIC T4*** Ui = 24 V Ii = 380 mA Pi = 9.12 Watt Ci and Li are negligibly small effective internal capacitances to earth: 24.4 nF

Contact Output	Terminals 41, 42
Ignition Type	***II 2G EEx ia IIC T4*** Ui = 15 V Ii = 30 mA Pi = 115 Watt Effective int. capacitance: 3.6 nF Effective int. capacitance to earth: 3.6 nF Effective int. inductance: 0.133 mH

Only VR4A/Sr4A

Ignition Type	***II 2G EEx ia IIC T4***
Piezo Sensor	U0 = 8.5 V
Terminals 85, 86, 86, 87	I0 = 1073 mA
PT100-circuit	P0 = 2280 mW
Terminals 81, 82, 83, 84	

Recommended Namur Switch Amplifiers	
ABB	V17131–51...53, V17131–54...56
Digitable	ci 1/941, ci 1/942
Apparatebau Hundsbach	AH TS920, AH 90 924
Pepperl + Fuchs	Various types

10.5 Fluid Temperatures/Temperature Classes

Cables suitable for T=110°C can be used for the supply power terminals 31, 32 and the contact output terminals 41, 42 without any reduction in the temperature range specifications. When using cables suitable only for temperatures T=80°C short circuiting between the cables during an error condition must be considered, otherwise the temperature range of the flowmeter is reduced as shown in the following table.

Ambient Temperature[2)] [°C]	Max. Allow. Temperature for the Cables Connected to Terminals 31, 32, 41, 42 [°C]	Max. Allow. Fluid Temperature [°C]
(-40) -20 to 70	110	280/400[1)]
(-40) -20 to 70	80	160
(-40) -20 to 60		240
(-40) -20 to 55		280
(-40) -20 to 50		320[1)]
(-40) -20 to 40		400[1)]

Maximum Fluid Temperature	Temperature Class
130 °C	T4
195 °C	T3
290 °C	T2
400 °C	T1

1) Fluidtemperature limits > 280°C only at VORTEX-Flowmeter TRIO-WIRL V
2) Lowest allowable limit of the ambient temperature depends on ordering code (standard -20°C)

10.6 Insulating the Flowmeter Primary

The pipeline can be insulated to a max. thickness of 100 mm.

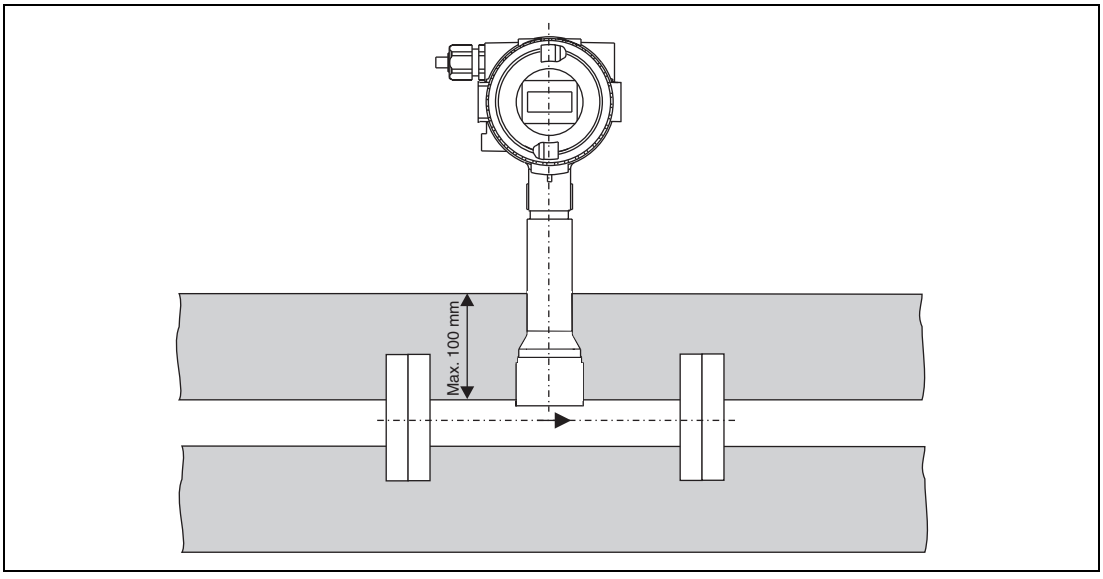


Fig. 35:

Translation from German original

TÜV CERT

EC Type Examination Certificate

(1)

(2) Equipment or Protective Systems intended for use in potentially hazardous atmospheres **- Directive 94/9/EC**

(3) **TÜV 01 ATEX 1771**

(4) Equipment:: Flow meter TRIO WIRL Types: V_4A/S_4A_ "Fieldbus"

(5) Manufacturer: ABB Automation Products GmbH

(6) Address: D-37079 Göttingen, Dransfelder Straße 2, Germany

(7) The equipment or protective system and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein to.

(8) The TÜV Hannover/Sachsen Anhalt e.V., TÜV Certification Body No. 0032 in accordance with the Article 9 of the Council Directive of 23 March 1994 (94/9/EC) certifies that this equipment or protective system 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 of the Directive.

The examination and test results are recorded in the confidential Report No. 139025.

(9) Compliance with the Essential Health and Safety Requirements has been assured by the compliance with

EN 50 014:1997 **EN 50 020:1994**

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

(11) This EC-Type Examination Certificate relates only to the design and construction of the specified equipment or protective system. If applicable, further requirements of this Directive apply to the manufacture and supply of this equipment or protective system.

(12) The markings for the equipment or protective system shall include the following:

II 2 G EEX ia IIC T4

TÜV Hannover/Sachsen-Anhalt e.V.
TÜV CERT- Certification Body
Am TÜV 1
D-30519 Hannover, Germany

Hanover, 14.11.2001

Stürwold

Head of the Certification Body

Translation from German original

(13) **SCHEDULE**

(14) **EC Type Examination Certificate No. TÜV 01 ATEX 1771**

(15) Description of Equipment

The flowmeter TRIO-WIRL type V_4A/S_4A_ "Fieldbus" is applicable for measuring the flow or operating volume of vapors, gases or fluids.

Correlation of temperature category, ambient temperature and material temperature has to be taken from table 1:

Range of ambient temp.	Max. material temp.	Temp. category
-40°C...+70°C	130°C	T4
	195°C	T3
	290°C	T2
	400°C	T1

Table 1

Design	Ambient Temp.	Max. Material Temperature
Temp. 110°C at cable gland	-40°C....+70°C	400°C
Temp. 80°C at plug and cable gland	-40°C....+40°C	400°C
	-40°C....+50°C	320°C
	-40°C....+60°C	240°C
	-40°C....+70°C	160°C

Table 2

The respective temperature category for designs under table 2 depend on the material temperature in table 1. The temperatures stated are likewise valid for thermally isolated flow meters.

Electrical Data

Fieldbus connection (Terminals 31 and 32)

Ignition Class Intrinsically Safe EEx ia IIC
to be connected to certified intrinsically safe current circuits (in accordance with FISCO model) only
Peak values: UI = 24 V
Ii = 380 mA
Pi = 9.12 W
The effective inner capacity and inductor are of a negligible low level.

Translation from German original

Schedule to EC Type Examination Certificate No. TÜV 01 ATEX 1771

Contact Output (Terminals 41 and 42)	Ignition Class Intrinsically Safe EEx ia IIC to be connected to certified intrinsically safe current circuits with the following peak values only: Ui = 15V Ii = 30 mA Pi = 115 mW effective inner capacity Ci = 3.6 nF effective inner capacity ag. PA Ci = 3.6 nF effective inner inductor Ci = 0.133 mH

Types VR4_ and SR4_

Sensor current circuit / Piezo Sensor (Terminals 85, 86, 87) and PT100 circuit (Terminals 81, 82, 83, 84)	Ignition Class Intrinsically Safe EEx ia IIC peak values: Uo = 8.5 V Io = 1073 mA Po = 2280 mW The effective inner capacity and inductor are of a negligible low value.

Types VT4_ and ST4_

As to these types, the sensor current circuits are represented by inner intrinsically safe circuits.

The Fieldbus and contact output circuit are galvanically isolated among one another and against PA.

(16) Test documentation is listed in test report no.: YEX 139025

(17) Special Conditions

None

(18) Basic Safety and Health requirements

no additional

EG-Konformitätserklärung
EC-Certificate of Compliance

CE (Ex)

Hiermit bestätigen wir die Übereinstimmung der
Herewith we confirm that our

TRIO-WIRL Durchflußmesser
TRIO-WIRL Flowmeter

Modell V_4A.; S_4A. "Feldbus"
Model V_4A.; S_4A. "Fieldbus"

mit den grundlegenden Sicherheits- und Gesundheitsanforderungen gem. der Richtlinie 94/9/EG des Rates der Europäischen Gemeinschaft. Die Sicherheits- und Installationshinweise der Produktdokumentation sind zu beachten.
are in compliance with the Essential Health and Safety Requirements with refer to the council directives 94/9/EC of the European Community. The safety and installation requirements of the product documentation must be observed.

Die TRIO-WIRL Durchflußmesser dienen zur Messung des Durchflusses von Gasen, Dämpfen und Flüssigkeiten.
The TRIO-WIRL Flowmeters are utilized to meter the flowrate of gases, steam or liquids.

EG-Baumusterprüfbescheinigung: *EC-Type Examination Certificate:*	TÜV 01 ATEX 1771	
Benannte Stelle: *Notified Body:*	TÜV Hannover/Sachsen-Anhalt e.V., Kennummer 0032	
Geräte-Kennzeichnung: *Apparatus code:*	II 2G EEx ia IIC T4 *II 2G EEx ia IIC T4*	Feldbus PA/FF (FISCO) *Fieldbus PA/FF (FISCO)*
Sicherheitstechnische Daten: *Safety values:*	siehe EG-Baumusterprüfbescheinigung TÜV 01 ATEX 1771 *refer to EC-Type Examination Certificate TÜV 01 ATEX 1771*	
Angewandte Normen: *Standards:*	EN 50 014: 1997 EN 50 020: 1994	

Göttingen, 27. November 2001

i. V.

Unterschrift / *Signature*

BZ-13-8014, Rev.1, 4101

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Sitz der Gesellschaft: Eschborn
Registergericht: Amtsgericht Frankfurt/Main
Handelsregister: HRB 4965
Vorsitz des Aufsichtrates: Bengt Pihl
Geschäftsführung: Uwe Alvardt (Vorsitz) Burkhard Block Erik Huggare
Commerzbank AG Frankfurt
Konto: 589 635 200
BLZ: 500 400 00

EG-Konformitätserklärung
EC-Certificate of Compliance

CE

Hiermit bestätigen wir die Übereinstimmung der aufgeführten Geräte mit den Richtlinien des Rates der Europäischen Gemeinschaft. Die Sicherheits- und Installationshinweise der Produktdokumentation sind zu beachten.

Herewith we confirm that the listed instruments are in compliance with the council directives of the European Community. The safety and installation requirements of the product documentation must be observed.

Modell: *Model:*	VT4… VR4… ST4… SR4…	
Richtlinie: *Directive:*	EMV Richtlinie 89/336/EWG * EMC directive 89/336/EEC *	
Europäische Norm: *European Standard:*	EN 50081-1, 3/93 * EN 50082-1, 3/93 *	EN 50081-2, 3/94 * EN 50082-2, 2/96 *

* einschließlich Nachträge
including alterations

Göttingen, 28.01.2000

ppa

Unterschrift / Signature

BZ-13-5028, Rev.0, 917

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