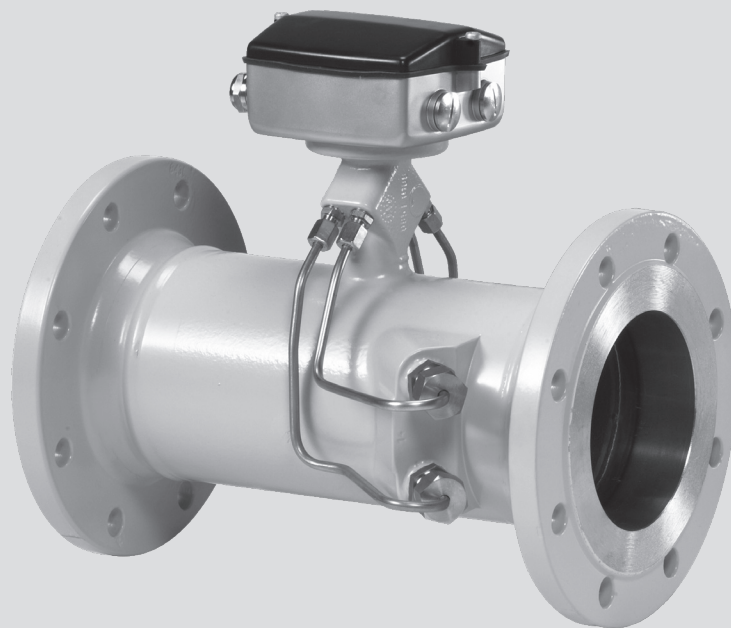


Ultrasonic Flowmeters

SITRANS F US SONO 3300

Operating instructions · 01/2010



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Flowmeters SITRANS F US SONO 3300

Operating Instructions

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Sensor type SONO 3300 DN 50 ... DN 300 for use
with transmitter type FUS060

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER
indicates that death or severe personal injury will result if proper precautions are not taken.
⚠ WARNING
indicates that death or severe personal injury may result if proper precautions are not taken.
⚠ CAUTION
with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.
CAUTION
without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.
NOTICE
indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation for the specific task, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠ WARNING
Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be adhered to. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of the Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Introduction

These instructions contain all the information you need for using the device.

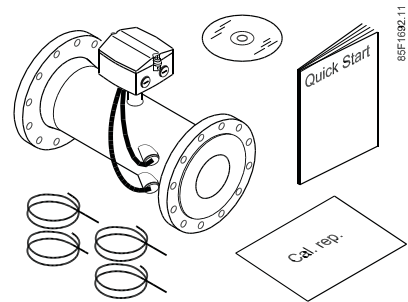
The instructions are aimed at persons mechanically installing the device, connecting it electronically, configuring the parameters and commissioning it as well as service and maintenance engineers.

Note

It is the responsibility of the customer that the instructions and directions provided in the manual are read, understood and followed by the relevant personnel before installing the device.

1.1 Items supplied

- SITRANS F US SONO 3300
- SITRANS F literature CD
- Quick Start guide
- Calibration report
- Transducer coaxial cable (4 pcs)
- Transmitter type FUS060 (not shown)



Note

Scope of delivery may vary, depending on version and add-ons.

Note

Handle with care!

Impact and shock can damage the piezoelectric crystal located in the transducers.

Do not stress or bend the tubes with transducer cables.

1.2 History

The contents of these instructions are regularly reviewed and corrections are included in subsequent editions. We welcome all suggestions for improvement.

The following table shows the most important changes in the documentation compared to each previous edition.

Edition	Remarks
01/2006	SITRANS F US Ultrasonic flowmeter Sensor type SONO 3300 DN 50 ... DN 300 for use with transmitter type FUS060 (Operating Instructions, replacing SITRANS F US SONOFLO Handbook)
03/2008	Version 2.
08/2009	Version 3. Contents restructured.

Note

A flowmeter system consists of a sensor (SONO 3300) and a transmitter (FUS060).

These Operating Instructions only cover the sensor part of the system. The transmitter FUS060 has a separate manual, which is available on the SITRANS F literature CD-ROM and on the flow documentation homepage (<http://www.siemens.com/flowdocumentation>)

1.3 Further Information

The contents of these Operating Instructions shall not become part of or modify any prior or existing agreement, commitment or legal relationship. All obligations on the part of Siemens AG are contained in the respective sales contract which also contains the complete and solely applicable warranty conditions. Any statements contained herein do not create new warranties or modify the existing warranty.

Product information on the Internet

The Operating Instructions are available on the CD-ROM shipped with the device, and on the Internet on the Siemens homepage, where further information on the range of SITRANS F flowmeters may also be found:

Product information on the internet (<http://www.siemens.com/flow>)

Worldwide contact person

If you need more information or have particular problems not covered sufficiently by the operating instructions, please get in touch with your contact person. You can find contact information for your local contact person on the Internet:

Local contact person (<http://www.automation.siemens.com/partner>)

Safety notes

 CAUTION
--

Correct, reliable operation of the product requires proper transport, storage, positioning and assembly as well as careful operation and maintenance. Only qualified personnel should install or operate this instrument.

Note

Alterations to the product, including opening or improper repairs of the product, are not permitted.

If this requirement is not observed, the CE mark and the manufacturer's warranty will expire.

2.1 Laws and directives

General requirements

Installation of the equipment must comply with national regulations. For example EN 60079-14 for the European Community.

Instrument safety standards

The device has been tested at the factory, based on the safety requirements. In order to maintain this condition over the expected life of the device the requirements described in these Operating Instructions must be observed.

CAUTION

Material compatibility

The meters have been designed according to EN 13480 with an additional corrosion layer of approx. 1 mm for steel sensors. Stainless steel transducer parts do not have an additional layer.


It is the responsibility of the customer to ensure that the medium is compatible with the sensor construction material. The full responsibility for the selection rests with the customer and Siemens Flow Instruments can take no responsibility for any failure due to material incompatibility.
--

CE marked equipment

The CE-mark symbolizes the compliance of the device with the following directives:

- EMC directive 2004/108/EC
- Low voltage directive 2006/95/EC
- Pressure equipment directive (PED/DGRL) 93/23/EC
- ATEX Directive 94/9/EC

2.2 Installation in hazardous area

 WARNING
Equipment used in hazardous areas must be Ex-approved and marked accordingly. It is required that the special conditions for safe use provided in the manual and in the Ex certificate are followed!


Hazardous area approvals

This flowmeter (SONO 3300 with FUS060) is approved for use in hazardous area and has the following approval:

- ATEX II 2G Ex dem [ia/ib] IIC T6/T4/T3

The sensor part of the flowmeter (SONO 3300) furthermore has the following approval:

- ATEX II 2G Ex ib IIC T6/T4/T3 (only approved for use with FUS060)

 WARNING
Make sure the hazardous area approval is suitable for the environment in which the device will be installed.

Temperature specifications for use in hazardous area

Table 2- 1 Hazardous area temperature specifications

Temperature class	Max. surface temperature	Media temperature	Ambient temperature
T3	+200°C	+135 ... 200°C ¹⁾	-20 ... +60°C
T4	+135°C	+100 ... 135°C	-20 ... +60°C
T5	+100°C	+85 ... 100°C	-20 ... +60°C
T6	+85°C	-10 ... 85°C	-20 ... +60°C

¹⁾ Maximum media temperature technically limited to +160°C

 **WARNING****Media temperature specifications**

Make sure that media temperature specifications indicated on the device type plate / label will not be exceeded.

Hazardous area safety requirements **WARNING**

It is required that:

- Electrical connections are in accordance with EN60079-14 (Installing Electrical Systems in Explosion Hazardous Areas).
- Appropriate cable connectors are used for the output circuits:
 - Intrinsically safe: blue and / or metal (nickle plated brass)
 - Non-intrinsically safe: gray or black
- Protective earth terminals (PE) on both sensor and transmitter are connected (min. 4mm²).

Description

SITRANS F US ultrasonic flowmeters measure flow in standard volumetric units. Measurement is independent of changes in liquid temperature, density, pressure and conductivity. A time of flight flowmeter is designed for use on single phase liquids.

They are designed for measurement of:

- Volume flow rate
- Limit monitoring
- Total volume
- Sound velocity in the media

3.1 Measuring principle

Physical principle

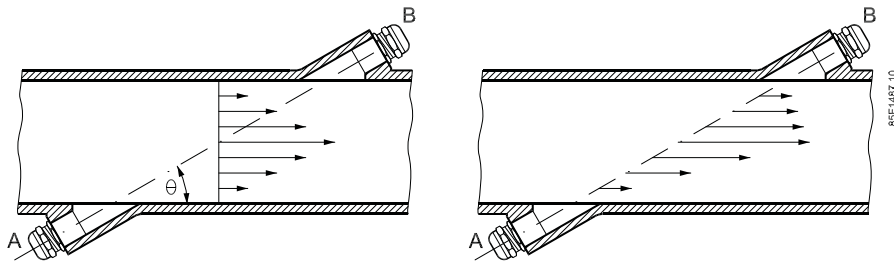


Figure 3-1 Velocity distribution along sound path

A sound wave travelling in the same direction as the liquid flow arrives at point B from point A in a shorter time than the sound wave travelling against the direction of flow (from point B to A).

The difference in sound transit time indicates the flow velocity in the pipe.

Since delay time is measured at short intervals both in and against flow direction, temperature has no influence on measurement accuracy.

SITRANS F US flowmeters

In SITRANS F US flowmeters the ultrasonic transducers are placed at an angle θ in relation to the pipe axis. The transducers function as transmitters and receivers of the ultrasonic signals. Measurement is performed by determining the time the ultrasonic signal takes to travel with and against the flow. The principle can be expressed as follows:

$$v = K \times (t_{B,A} - t_{A,B}) / (t_{A,B} \times t_{B,A}) = K \times \Delta t / t^2$$

v = Average flow velocity

t = Transit time

K = Proportional flow factor

This measuring principle offers the advantage that it is independent of variations in the actual sound velocity of the liquid, i.e. independent of the temperature.

The Proportional factor K is determined by wet calibration or calculated by "Auto" in case of manual programming of geometrical pipe data (SONOKIT only). The transducer angle (θ), distance between sensors (L) and pipe dimension (D_i) are shown in the figure below.

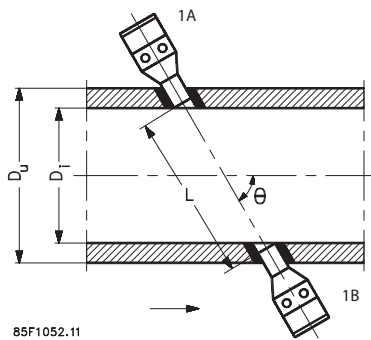


Figure 3-2 Measuring principle

The ultrasonic signal is sent directly between the transducers. The advantage gained sending signals from point to point is an extremely good signal strength.

3.2 Design

SITRANS F US SONO 3300 with FUS060 is designed for measuring the flow velocity of liquids in full pipes. Satisfactory function of the ultrasonic flowmeter depends on a low sound attenuation of the medium and a well-defined and stable flow profile.

The sensor SONO 3300 with transmitter FUS060 remote mounted measures with a high accuracy (better than $\pm 0,5\%$ of reading over a wide measuring range).



Figure 3-3 SITRANS F US SONO 3300 (shown without transmitter type FUS060)

The following table shows the properties of the ultrasonic flowmeter system SITRANS F US SONO 3300 with the transmitter type FUS060

Table 3- 1 System overview SONO 3300 with FUS060

Sensor	Transmitter	Outputs	Measurement
SONO 3300 DN 50 - DN 300 (2" - 12")	FUS060	<ul style="list-style-type: none"> • Analog with HART • Frequency-/pulse • Relay or <ul style="list-style-type: none"> • Profibus PA • Frequency-/pulse 	<ul style="list-style-type: none"> • Volume flow rate • Total volume • Mass flow rate • Total mass • Sound velocity • Error indication • Limit monitoring • Ultrasonic Amplitude

Description

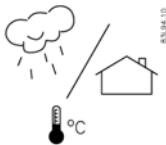
3.2 Design

Installing/Mounting

The installation of the sensor has 3 steps:

1. Selecting the measuring site (Page 16)
2. Orienting the sensor (Page 18)
3. Mounting the sensor (Page 19)

Ambient conditions



SITRANS F flowmeters are suitable for in- and outdoor installations.

- The SONO 3300 has the following temperature specifications:
 - Media/surface temperature: -10 to 160 °C (14 to 320 °F)
 - Ambient temperature: -20 to $+60$ °C (-4 ... $+140$ °F)
 - Storage -40 °C to 85 °C (14 to 185 °F).
- The enclosure rating is IP67 (NEMA 4X/6) or better.

CAUTION

Make sure that pressure and temperature specifications indicated on the device type plate / label will not be exceeded.

Note

In case of large temperature differences between medium and environment, the sensor must be isolated to avoid 2-phase flow which will result in inaccurate measuring results

WARNING

Installation in hazardous location

Special requirements apply to the location and interconnection of sensor and transmitter. See "Installation in hazardous area" (Page 8)

4.1 Installation safety precautions

WARNING

In applications with working pressures/media that can be dangerous to people, surroundings, equipment or others in case of pipe fracture, we recommend that special precautions such as special placement, shielding or installation of a security guard or a security valve are taken when the sensor is mounted.

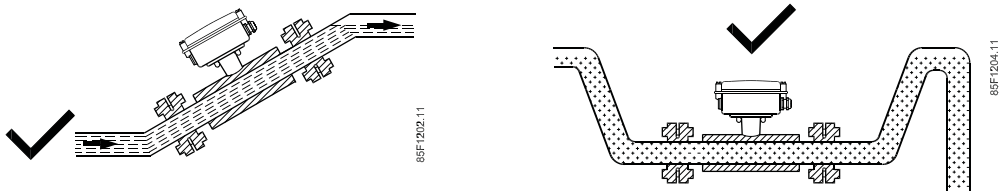
- Ensure that stresses and loading caused by earthquakes, traffic, high winds and fire damage if appropriate are taken into account during installation.
- Ensure that the flowmeter is installed such that it does not act as a focus for pipeline stresses. External loadings are not taken into account during flowmeter design.
- Provide adequate protection to minimise any risk of contact with hot surfaces.

⚠ WARNING
Prevent personal injuries by assuring that operation below pressure guards cannot take place, if working with vacuum or fluids boiling readily.

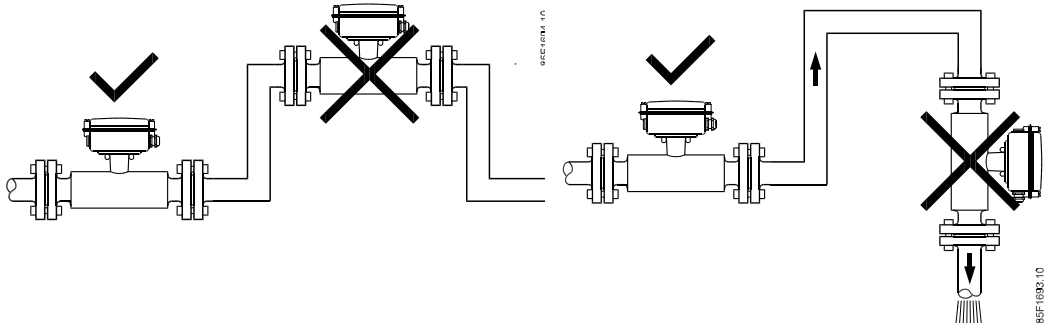
4.2 Determining a location

CAUTION
The sensor must always be completely filled with liquid.

- Locate the flowmeter in U-shaped pipes if pipes are only partially filled or have free outlet.



- Avoid the following installations:
 - Installation at the highest point of the pipe system
 - Installation in vertical pipes with free outlet or downwards flow



Inlet / outlet conditions

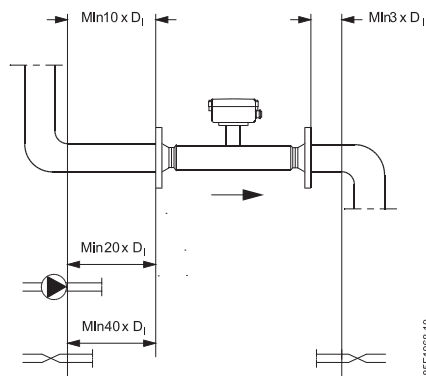


Figure 4-1 Inlet and outlet conditions

- Ensure that inlet and outlet are straight
- Ensure sufficient distance between meter and bends, pump and valves (see the table below).
- Install valves influencing the flow profile after the flowmeter. The only exception is installation of the sensor in a vertical pipe (upwards flow direction). In installations in a vertical pipe a valve below the sensor is required to allow zero-point adjustment

Note

Select a valve not altering flow when fully opened.

Table 4- 1 Recommended inlet conditions

Recommended inlet	
Fully open valve, ie no flow restriction	Min. 10 × pipe diameter
Partially open valve	Min. 40 × pipe diameter
Pumps	Min. 20 × pipe diameter
Single bends	Min. 10 × pipe diameter
Recommended outlet	3 × pipe diameter

Note

By more than one bend, the optimal inlet is min. 40 × pipe diameter.

4.3 Orienting the sensor

Flow direction

The flow direction is indicated with the "+" on the double arrow on the sensor.

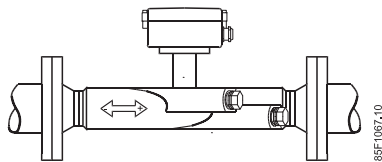


Figure 4-2 Flow direction

Orienting the sensor

SITRANS F US SONO 3300 operates in any orientation, but Siemens Flow Instruments recommends orienting the sensor in one of the following ways

1. Vertical orientation with an upwards flow in order to minimize the effect of gas / air bubbles in the media

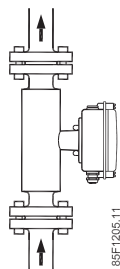
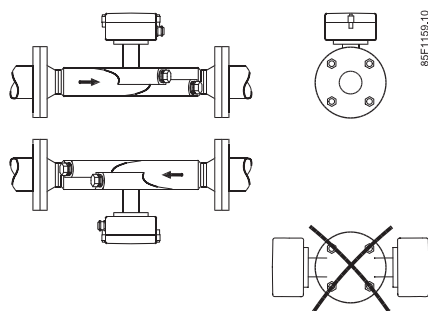


Figure 4-3 Vertical installation with an upwards flow

2. Horizontal orientation, terminal box upwards or downwards



CAUTION

Measurement of liquids containing abrasive or other particles

In order to minimize wear, a vertical installation with an upwards flow is recommended.

4.4 Mounting the sensor

- Install the sensor in rigid pipelines in order to support the weight of the meter.
- Centre the connecting pipelines axially in order to assure a stress-free installation.
- Centre the flowmeter in relation to pipe flanges and gaskets.
- Install two supports or hangers symmetrically and stress-free in close proximity to the process connections.

⚠ CAUTION
Gas / air bubbles in the liquid
Avoid the accumulation of large quantities of air in the sensor as these will affect measurement. When air is present, installation of an air separator upstream of the meter is recommended.

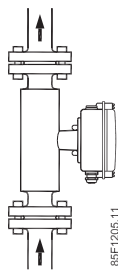


Figure 4-4 Gas / air bubbles

Electrical connection

The following contains a short description of how to connect the sensor to the transmitter SITRANS FUS060. For more information, please refer to the relevant Operating Instructions of the transmitter.

 **WARNING**

Only qualified personnel may carry out work on the electrical connections.

 **WARNING**

Use in hazardous locations

Before opening the terminal box check that:

- No explosion hazard exists
- A fire department permission certificate has been issued
- All connection leads are potential free

Special requirements apply to the location and interconnection of sensor and transmitter. See "Installation in hazardous area" (Page 8)

5.1 Wiring

Wire transducer cables and transmitter as follows:

1. Remove and keep the lid of the terminal box from the sensor.

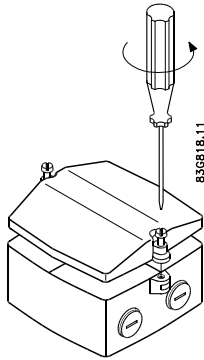


Figure 5-1 Remove terminal box lid

2. Connect the 4 coaxial cables to the terminals 1B, 1A, 2B and 2A and the shields of the coaxial cables

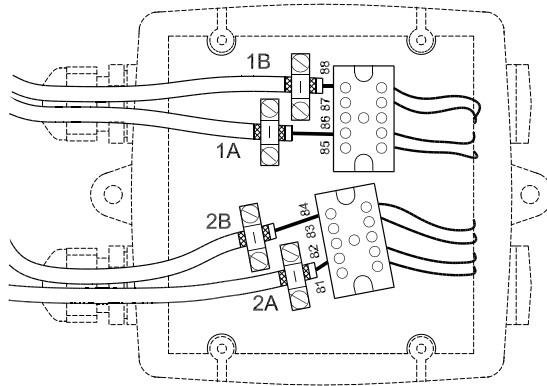
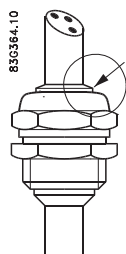


Figure 5-2 Electrical connection, SONO 3300

3. Tighten the cable glands to obtain optimum sealing. The gaskets must protrude along the cable



Cable sealing, correct



Cable sealing, incorrect

4. Mount the terminal box lid.

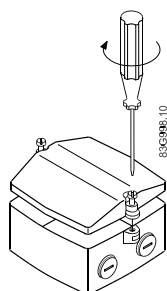


Figure 5-3 Mount terminal box lid

5. Connect the 4 transducers cables at the FUS060 transmitter as shown below (terminal plug 1B, 1A, 2B and 2A):
Push the SMB-plug cable ends carefully through the cable glands, plug them in and fix them by using the glands.

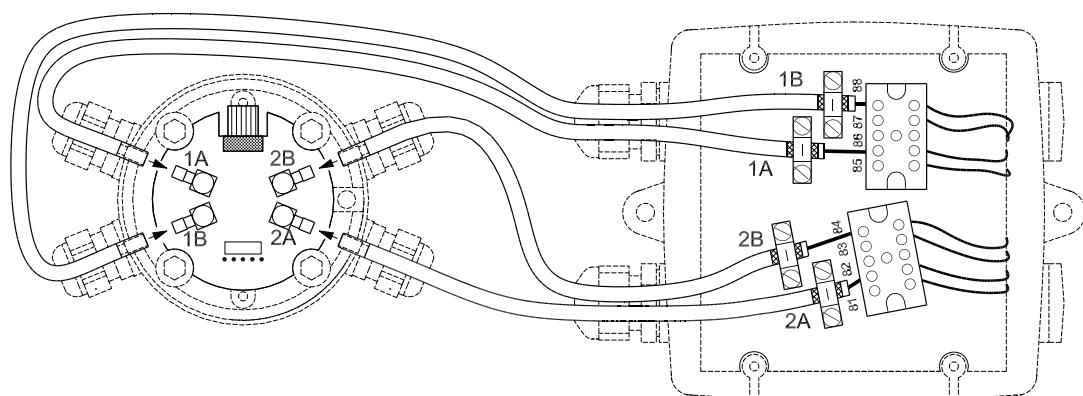


Figure 5-4 Electrical connection FUS060 and SONO 3300

- 6. Ensure that transducer cables are not overbent. Minimum cable bend radius is 50 mm

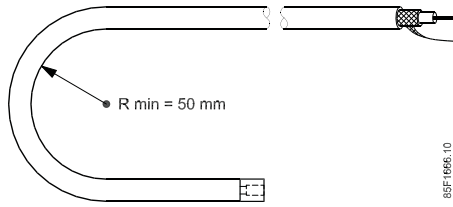


Figure 5-5 Minimum cable bend radius

- 7. Ground transmitter and sensor for optimal performance. A direct ground connection of transmitter and sensor is recommended.

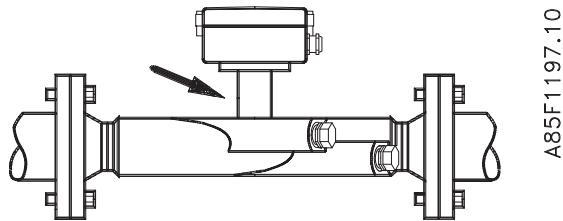



Figure 5-6 Sensor earth terminal located on sensor pedestal

 WARNING
Use in hazardous area
Connect protective earth terminals (PE) on both sensor and transmitter (min. 4mm ²)

Maintenance and service

6.1 Maintenance

The device is maintenance-free, however, a periodic inspection according pertinent directives and regulations must be carried out.

An inspection can include check of:

- Ambient conditions
- Seal integrity of the process connections, cable entries, and cover screws
- Reliability of power supply, lightning protection, and grounds

6.2 Recalibration

Siemens Flow Instruments offers to recalibrate the sensor. The following calibrations are offered as standard:

- Standard matched pair calibration
- Accredited matched pair calibration

Note

For recalibration the transmitter must always be returned with the sensor

6.3 Technical support

CAUTION
Repair and service must be carried out by approved Siemens Flow Instruments personnel only.

Note

Siemens Flow Instrument defines sensors as non-repairable products.

Technical Support

If you have any technical questions about the device described in these Operating Instructions and do not find the right answers, you can contact Technical Support:

- Via the Internet using the **Support Request:**
Support request (<http://www.siemens.com/automation/support-request>)
- Phone: +49 (0) 180 5050 222

Further information about our technical support is available in the Internet at
Technical support (<http://support.automation.siemens.com/WW/view/en/16604318>)

Service & Support on the Internet

In addition to our documentation, we offer a comprehensive knowledge base online on the Internet at:

Service and support (<http://www.siemens.com/automation/service&support>)

There you will find:

- The latest product information, FAQs, downloads, tips and tricks.
- Our newsletter, providing you with the latest information about your products.
- A Knowledge Manager to find the right documents for you.
- Our bulletin board, where users and specialists share their knowledge worldwide.
- You can find your local contact partner for Industry Automation and Drives Technologies in our partner database.
- Information about field service, repairs, spare parts and lots more under "Services."

Additional Support

Please contact your local Siemens representative and offices if you have additional questions about the device

Find your contact partner at:

Local contact person (<http://www.automation.siemens.com/partner>)

6.4 Application information guide

In case the device needs service, the factory will typically request information about application and flowmeter.

The following tables can be used as a preparation guide before taking contact to Siemens.

Note

Sketch

It is recommended to prepare a sketch of the installation / application.

Table 6- 1 Application data

Liquid	Chemical formula
	Name of liquid
	Concentration
	Density
	Viscosity at 20°C [cSt]
	Viscosity at process temperature [cSt]
Measurement range	
Nominal size [mm]	
Process temperature [°C]	
Ambient temperature (transmitter) [°C]	
Pressure [PN]	
Gas/solid content [%]	
Explosion protection	

Table 6- 2 Sensor data

Serial-No. (See system label)	
Order.No. (See system label)	
Flow (Menu 1.2)	
Sound velocity [600 [m/s] ≤ Medium ≤ 2000 [m/s]] (Menu 1.5)	
Ultrasonic amplitude [%](Menu 1.6)	
Frequency output [Hz] (Menu 1.7)	
Device status, error message, frequency, ... (Menu 2.1)	
Upper range value for flow (Menu 3.1.2)	
Low flow cut-off [%] (Menu 3.1.6)	
Software version (Menu 5.2.3)	
Gain (Menu 6.5.1)	
Amplitude (Menu 6.5.2)	
Trigger level [0....128] (Menu 6.5.3)	
Error count [0....100%] (Menu 6.5.4)	
Time of flight up [ns] (Menu 6.5.5)	
Time of flight down (Menu 6.5.6)	
Delta TOF (Menu 6.5.7)	

See also

Return procedures (Page 28)

6.5 Return procedures

Enclose the delivery note, the cover note for return delivery together with the declaration of decontamination form on the outside of the package in a well-fastened clear document pouch.

Required forms

- **Delivery Note**

- **Cover Note for Return Delivery** with the following information

Return delivery form (<http://support.automation.siemens.com/WW/view/en/16604370>)

- product (ordering number)
- number of devices or spare parts returned
- reason for the return

- **Declaration of Decontamination**

Decontamination declaration

(http://pia.khe.siemens.com/efiles/feldg/files/Service/declaration_of_decontamination_en.pdf)

With this declaration you certify *that the returned products/spare parts have been carefully cleaned and are free from any residues.*

If the device has been operated together with toxic, caustic, flammable or water-damaging products, clean the device before return by rinsing or neutralizing. Ensure that all cavities are free from dangerous substances. Then, double-check the device to ensure the cleaning is completed.

We will not service a device or spare part unless the declaration of decontamination confirms proper decontamination of the device or spare part. Shipments without a declaration of decontamination will be cleaned professionally at your expense before further proceeding.

You can find the forms on the Internet and on the CD delivered with the device.

Technical data

7.1 Sensor SONO 3300

Table 7- 1 Technical data SONO 3300

Description	2-track sensor with flanges and integrated transducers
Nominal size	DN 50 ... DN 300 (2" to 12")
Media/surface temperature	Separate version: -10 ... + 160 °C (14 ... 320 °F)
Ambient temperature (sensor)	Separate version: - 20 ... 60 °C (-4 ... +140 °F) Storage: - 40 ... +85 °C (-40 ... +185 °F)
Enclosure	Standard: IP67 (NEMA 4X/ NEMA 6)
Process connections	
PN designated	
EN 1092-1	<ul style="list-style-type: none"> • PN 10: DN 200...DN 300 (8" ... 12")
Pipe material: carbon steel	<ul style="list-style-type: none"> • PN 16: DN 80 ... DN 300 (4" ... 12") • PN 40: DN 50 ... DN 300 (2" ... 12")
Class designated	
EN 1759-1	<ul style="list-style-type: none"> • Class 150: DN 50 ... DN 300 (2" ... 12")
Pipe material: carbon steel	<ul style="list-style-type: none"> • Class 300: DN 50 ... DN 300 (2" ... 12")
Transducer	Integrated transducers welded into pipe
Materials	
Pipe	<ul style="list-style-type: none"> • Cast steel EN 1.7131-16Mn5, painted or • Carbon steel EN 1.0345-P235GH, painted
Flange (PN)	EN 1.0025-S235JRG2
Flange (Class)	ASTM A105
Transducer	Stainless steel EN 1.4404 (AISI 316) or similar
Certificates and approvals	
Declaration of conformity	CE declaration available on the internet and on the Sitrans F literature CD (supplied with the device).
Material certificate	Material certificate according to EN 10204-3.1 is available as option.
NDT examination report	Non Destructive Test (e.g. ultrasonic or penetrant test) available as option.
Pressure certificate	Pressure test according to EN 1024-2.3 is available as option.
Calibration report	<ul style="list-style-type: none"> • A standard calibration report is supplied with the sensor. • An extended accredited ISO/IEC 17025 calibration is available as option.

Technical data

7.2 Coaxial cable specifications

Ex approval	<ul style="list-style-type: none"> • System ATEX approval (SONO 3300 with FUS060 Ex): ATEX II 2G Ex dem [ia/ib] IIC T6/T4/T3 • SONO 3300 approval (only approved for use with FUS060): Ex ib IIC T6/T4/T3
Max. flow velocity	10 m/s (32 ft/s)

7.2 Coaxial cable specifications

Table 7- 2 Technical data, Standard coaxial cable

Standard Coaxial cable (75 Ω)	Coaxial cable with SMB straight plug on one end for the FUS060 connector
Outside diameter	Ø 5.8 mm
Length	3, 15, 30, 60, 90, 120 m (9.84, 49.21, 98.43, 196.85, 295.28, 393.70 ft) between sensor and transmitter.
Material (outside jacket)	Black PE
Ambient temperature	-10 ... +70 °C (14 ... 158 °F)

Table 7- 3 Technical data, HT coaxial cable

High temperature Coaxial cable (75 Ω)	Coaxial cable with SMB straight plug on one end for the FUS060 connector
Outside diameter	<ul style="list-style-type: none"> • Ø 5.13 mm (first 0.3 m (0.98 ft) of cable) • Ø 5.8 mm (remaining cable) - with plug hot melt junction on the end) Between the two parts a mounted black hot melt junction Ø 16 mm (length 70 mm)
Length	3, 15, 30, 60, 90, 120 m (9.84, 49.21, 98.43, 196.85, 295.28, 393.70 ft) between sensor and transmitter
Material (outside jacket)	<ul style="list-style-type: none"> • Brown PTFE (first 0.3 m (0.98 ft) of cable) • Black PE (remaining cable)
Ambient temperature	<ul style="list-style-type: none"> • -200 ... +200 °C (-328 ... +392 °F) (first 0.3 m (0.98 ft)) • -10 ... +70 °C (14 ... 158 °F) (remaining cable)

7.3 Permissible pressure and temperature

The maximum permissible pressure and temperature for Siemens Flow Instruments ultrasonic flowmeters are indicated on the sensor label.

Flanges according to PN

Flanges and joints as well as related pressure/temperature (p/t) classification are described in EN 1092.

- For steel group 1E1: Table 15

Flanges according to ANSI Class

Flanges and joints as well as related pressure/temperature (p/t) classification are described in EN 1759-1.

- For steel group 1.1 ASTM A105, class 150: Table 16
- For steel group 1.1 ASTM A105, class 300: Table 1

No flange bolts or gaskets are supplied. Bolts must comply with EN 1515-2 and gaskets with EN 1591-1.

 WARNING
--

<p>Exposing the sensors to pressures or temperatures above the limits stated may cause damage.</p>

<p>The sensor construction does not allow external action other than what is normal during common mounting in the pipeline. Make allowance for earthquakes, action of the air etc.</p>
--

7.4 Reference conditions

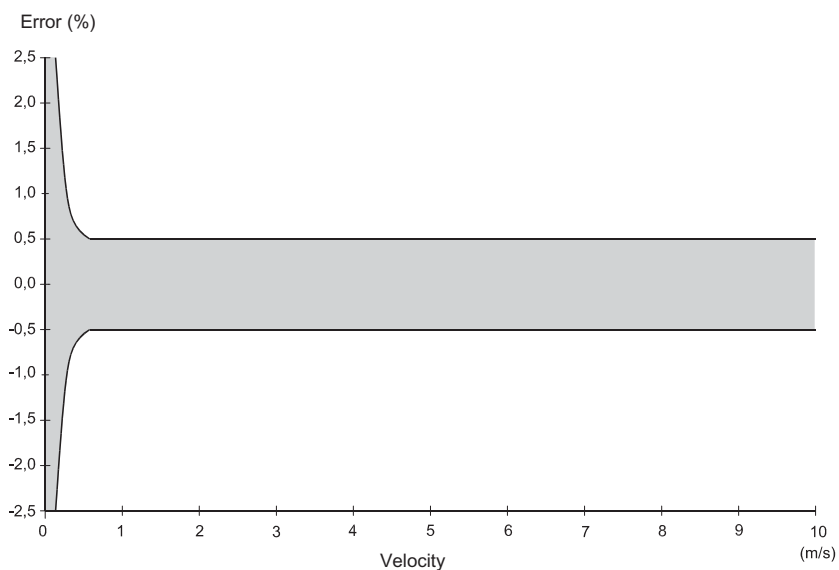


Figure 7-1 Reference condions

Table 7- 4 Reference conditions

Fluid:	Water
Fluid temperature:	25 °C ± 5 °K (77 °F ± 9 °F)
Ambient temperature:	25 °C ± 5 °K (77 °F ± 9 °F)
Supply voltage (FUS060):	<ul style="list-style-type: none"> • 120...230 V AC ± 15% (50/60 Hz) • 19...30 V DC/ 21...26 V AC
Installation conditions:	Upstream section > 20x DN and downstream section > 5x DN
Rangeability:	0-1 m/s to 0-10 m/s
Repeatabily:	Better than 0.25% in the range from 0.5 m/s to 10 m/s

Table 7- 5 Additional effects of deviations from reference conditions

Current output:	As pulse/frequency output plus ± 0.1% ± 20 µ A
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7.5 Dimensions and weight

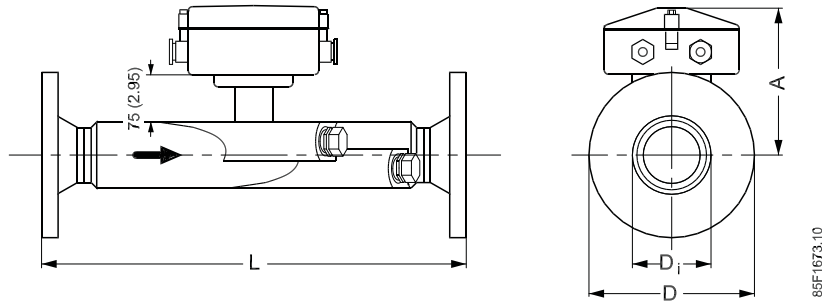


Table 7- 6 Flange type EN 1092-1

PN	Size	L ¹⁾		D		Di		A	
	[DN / inch]	mm	inch	mm	inch	mm	inch	mm	inch
10	200 [8]	400	15.75	340	13,39	207.30	8.16	256	10.08
	250 [10]	400	15.75	395	15.55	260.40	10.25	283	11.14
	300 [12]	400	15.75	445	17.52	309.70	12.19	309	12.17
16	80 [3]	380	14.92	200	7.87	78.00	3.07	193	7.60
	100 [4]	355	14.72	220	8.66	102.40	4.00	205	8.07
	125 [5]	375	14.72	250	9.84	128.30	5.05	218	8.58
	150 [6]	360	14.17	285	11.22	154.20	6.07	232	9.13
	200 [8]	400	15.75	340	13,39	207.30	8.16	256	10.08
	250 [10]	400	15.75	395	15.55	260.40	10.25	283	11.14
	300 [12]	420	16.54	445	17.52	309.70	12.19	309	12.17
40	50 [2]	475	18.70	165	6.50	52.60	2.07	180	7.09
	65 [2½]	475	18.70	185	7.28	62.70	2.47	186	7.32
	80 [3]	400	15.75	200	7.87	78.00	3.07	193	7.60
	100 [4]	400	15.75	235	9.25	102.40	4.00	205	8.07
	125 [5]	400	15.75	270	10.63	128.30	5.05	218	8.58
	150 [6]	400	15.75	300	11.81	154.20	6.07	232	9.13
	200 [8]	450	17.72	375	14.76	206.50	8.13	256	10.08
	250 [10]	500	19.69	450	17.72	258.80	10.19	283	11.14
	300 [12]	500	19.69	515	20.28	307.90	12.12	309	12.17

1) Length tolerance (mm): DN50 ... 100: +2/-3, DN125 ... 200: +3/-4, DN250... 300: +4/-5.

Table 7- 7 Flange type ANSI

lb	Size	L ¹⁾		D		Di		A	
	[DN / inch]	mm	inch	mm	inch	mm	inch	mm	inch
150	50 [2]	510	20.08	152	5.98	52.6	2.07	180	7.09
	65 [2½]	510	20.08	178	7.01	62.7	2.47	186	7.32
	80 [3]	420	16.54	191	7.52	78.0	3.07	193	7.60
	100 [4]	420	16.54	229	9.01	102.4	4.03	205	8.07

7.5 Dimensions and weight

lb	Size	L ¹⁾		D		Di		A	
	[DN /inch]	mm	inch	mm	inch	mm	inch	mm	inch
	125 [5]	440	17.32	254	10.00	128.3	5.05	218	8.58
	150 [6]	430	16.93	279	10.98	154.2	6.07	232	9.13
	200 [8]	480	18.90	343	13.50	202.7	7.98	256	10.08
	250 [10]	490	19.29	406	15.98	254.5	10.02	283	11.14
	300 [12]	550	21.65	483	19.02	306.3	12.06	309	12.17
300	50 [2]	520	20.47	165	6.50	52.6	2.07	180	7.09
	65 [2½]	520	20.47	190	7.48	62.7	2.47	186	7.32
	80 [3]	440	17.32	210	8.27	78.0	3.07	193	7.60
	100 [4]	440	17.32	254	10	102.4	4.03	205	8.07
	125 [5]	460	18.11	279	10.98	128.3	5.05	218	8.58
	150 [6]	450	17.71	318	12.52	154.2	6.07	232	9.13
	200 [8]	500	19.69	381	15	202.7	7.98	256	10.08
	250 [10]	520	20.47	444	17.48	254.5	10.02	283	11.14
	300 [12]	580	22.83	521	20.51	306.3	12.06	309	12.17

1) Length tolerance (mm): DN50 ... 100: +2/-3, DN125 ... 200: +3/-4, DN250... 300: +4/-5.

Table 7- 8 Weight

Size	EN (PN 40)		ANSI CL 300	
	[DN /inch]	kg	lbs	kg
50 [2]	14	30.9	17	37.5
65 [2½]	16	35.3	20	44
80 [3]	19	42	23	51
100 [4]	25	55	35	78
125 [5]	29	64	40	89
150 [6]	35	78	50	111
200 [8]	54	119	72	160
250 [10]	85	189	98	217
300 [12]	115	256	142	322

Weight without FUS060.

Appendix

A.1 Sizing table DN 50 to DN 300 (2" to 12")

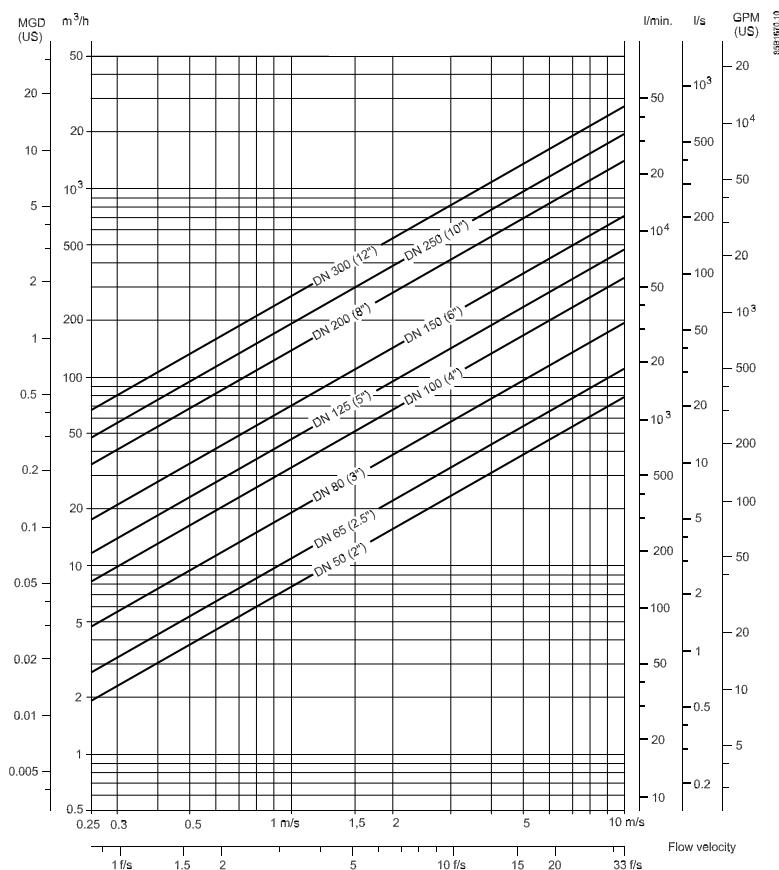


Figure A-1 Relationship between flow velocity (V), flow quantity (Q) and sensor dimension (DN)

Guidelines for sensor selection

- Min. measuring range: 0-1 m/s
- Max. measuring range: 0-10 m/s

Typically the sensor is selected so that V lies within the measuring range 1-3 m/s.

Flow velocity calculation formula

$$V = \frac{1273.24 \times Q \text{ [l/s]}}{Di^2[\text{mm}]} \text{ [m/s]} \text{ or } V = \frac{353.68 \times Q \text{ [m}^3\text{/h]}}{Di^2[\text{mm}]} \text{ [m/s]}$$

A.2 Dimension dependent settings for SONO 3300 (2-track)

Table A- 1 Dimension dependent settings

Nominal size DN	Max. vol. flow [m ³ /h]	Lo alarm limit	Hi alarm limit	Hysteresis [m ³ /h] ¹⁾	Low-flow cut [m ³ /h] ¹⁾	Pipe Diameter ^{2), 4)}	Displacement ²⁾	Angle [m ³ /h] ²⁾	Length [m ³ /h] ²⁾	Cal factor ³⁾
	Menu 3.1.2	Menu 3.1.3.1	Menu 3.1.3.2	Menu 3.1.3.3	Menu 3.1.6	Menu 7.1.3.1	Menu 7.1.4.x.3	Menu 7.1.4.x.2	Menu 7.1.4.x.1	Menu 7.1.4.x.6
50	10	-12	12	0.1	0.02	0.0526	0.0129	21.2	0.1915	0.0003317
	26	-31.2	31.2	0.26	0.052	0.0526	0.0129	21.2	0.1915	0.0003317
	60	-72	72	0.6	0.12	0.0526	0.0129	21.2	0.1915	0.0003317
65	15	-18	18	0.15	0.03	0.0627	0.0154	24	0.1912	0.0004530
	42	-50.4	50.4	0.42	0.084	0.0627	0.0154	24	0.1912	0.0004530
	100	-120	120	1	0.2	0.0627	0.0154	24	0.1912	0.0004530
80	20	-24	24	0.2	0.04	0.0780	0.0191	30	0.1808	0.0006531
	60	-72	72	0.6	0.12	0.0780	0.0191	30	0.1808	0.0006531
	150	-180	180	1.5	0.3	0.0780	0.0191	30	0.1808	0.0006531
100	36	-43.2	43.2	0.36	0.072	0.1024	0.0251	39	0.1749	0.0011267
	100	-120	120	1	0.2	0.1024	0.0251	39	0.1749	0.0011267
	230	-276	276	2.3	0.46	0.1024	0.0251	39	0.1749	0.0011267
125	50	-60	60	0.5	0.1	0.1283	0.0314	45	0.1857	0.0019660
	150	-180	180	1.5	0.3	0.1283	0.0314	45	0.1857	0.0019660
	360	-432	432	3.6	0.72	0.1283	0.0314	45	0.1857	0.0019660
150	80	-96	96	0.8	0.16	0.1542	0.0378	50	0.1992	0.0032419
	220	-264	264	2.2	0.44	0.1542	0.0378	50	0.1992	0.0032419
	500	-600	600	5	1	0.1542	0.0378	50	0.1992	0.0032419
200	120	-144	144	1.2	0.24	0.2079	0.0509	60	0.2269	0.0082412
	380	-456	456	3.8	0.76	0.2079	0.0509	60	0.2269	0.0082412
	900	-1080	1080	9	1.8	0.2079	0.0509	60	0.2269	0.0082412
250	200	-240	240	2	0.4	0.2604	0.0638	60	0.2797	0.0156976
	600	-720	720	6	1.2	0.2604	0.0638	60	0.2797	0.0156976
	1400	-1680	1680	14	2.8	0.2604	0.0638	60	0.2797	0.0156976

Nominal size DN	Max. vol. flow [m ³ /h]	Lo alarm limit	Hi alarm limit	Hysteresis [m ³ /h] ¹⁾	Low-flow cut [m ³ /h] ¹⁾	Pipe Diameter ^{2), 4)}	Displacement ²⁾	Angle [m ³ /h] ²⁾	Length [m ³ /h] ²⁾	Cal factor ³⁾
300	300	-360	360	3	0.6	0.3097	0.0759	60	0.3293	0.0258892
	850	-1020	1020	8.5	1.7	0.3097	0.0759	60	0.3293	0.0258892
	2200	-2640	2640	22	4.4	0.3097	0.0759	60	0.3293	0.0258892

X: The x can be 1 or 2 (for track 1 or track 2).

1) Only for FUS060 Profibus PA versions.

2) Nominal values

3) The menu 7.1.4.x.6 is not shown on the local display, but only in the PDM-software (HART- / Profibus-communication).

4) Diameter is based on standard pressure-rating for DN 50 to DN 300.

Note

All values are nominal. The pipe data can differ a little depending on the calibration results. These sensor specific data are predefined by Siemens and stored in the FUS060 transmitter. It is not allowed to change these values.

A.3 Certificates

All certificates are posted on the Internet. Additionally, the CE Declaration of Conformity as well as EX approvals are available on the Sitrans F literature CD-ROM

See also

SITRANS F US SONO 3300 Certificates
(<http://support.automation.siemens.com/WW/view/en/20806220/134200>)

A.4 Accessories and spare parts

In order to ensure that the ordering data you are using is not outdated, the latest ordering data is always available on the Internet: SITRANS F US catalog
(https://pia.khe.siemens.com/efiles/instrumentation/catalogs/fi01/fi01_en_extract/Sitrans%20FUS_systeminformation_2009.pdf)

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For more information...

www.siemens.com/flow

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Subject to change without prior notice
Order No.: A5E01365400
Lit. No.: SFIDK.PS.029.J4.02
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