

**SIEMENS**



# SITRANS F

Electromagnetic Flowmeters

SITRANS F M MAG 3100 sensor

Operating Instructions

Edition

09/2012

Answers for industry.



# SIEMENS

## SITRANS F

### Electromagnetic Flowmeters SITRANS F M MAG 3100 sensor

#### Operating Instructions




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Electromagnetic flow sensor for use with transmitter types SITRANS F M MAG 5000 / 6000 and MAG 6000 I

## 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.

 <b>DANGER</b>
indicates that death or severe personal injury <b>will</b> result if proper precautions are not taken.
 <b>WARNING</b>
indicates that death or severe personal injury <b>may</b> result if proper precautions are not taken.
 <b>CAUTION</b>
indicates that minor personal injury can result if proper precautions are not taken.
<b>NOTICE</b>
indicates that property damage can result if proper precautions are not taken.


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, 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:

 <b>WARNING</b>
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 complied with. The information in the relevant documentation must be observed.

### Trademarks

All names identified by ® are registered trademarks of 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 electrically, configuring the parameters and commissioning it, as well as service and maintenance engineers.

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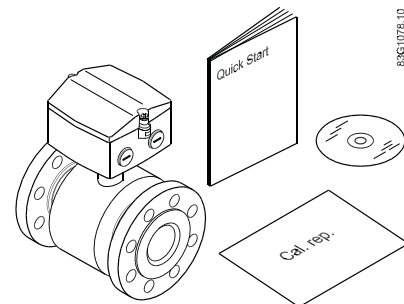
## Note

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

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## 1.1 Items supplied

- SITRANS F M MAG 3100
- Calibration report
- SITRANS F literature CD
- Quick Start guide



## Inspection

1. Check for mechanical damage due to possible improper handling during shipment. All claims for damage are to be made promptly to the shipper.
2. Make sure the scope of delivery, and the information on the type plate corresponds to the ordering information





Edition	Remarks
01 06/2010	First edition The Operating Instructions replaces: <ul style="list-style-type: none"> <li>• MAG 3100 part of SITRANS F M HANDBOOK (A5E02435647)</li> <li>• MAG 3100 part of SITRANS F M MAG 6000 I Ex d Operating Instructions</li> <li>• MAG 3100 part of SITRANS F M MAG 6000 19" &amp; Safety Barrier Operating Instructions</li> <li>• MAG 3100 Instructions</li> <li>• MAG 3100 with PTFE and PFA liners Instructions</li> </ul>
01.1 12/2011	General update Updated ATEX approval
02 09/2012	Updated temperature specifications Updated coil resistance table

## 1.3 Further Information

### 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 these Operating Instructions, 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>)



 <b>CAUTION</b>
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.

### 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.

<b>NOTICE</b>
<b>Material compatibility</b>
Siemens Flow Instruments can provide assistance with the selection of wetted sensor parts. However, 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 guidelines:

- EMC Directive 2004/108/EC
- Low Voltage Directive (LVD) 2006/95/EC
- Pressure Equipment Directive (PED/DGRL) 93/23/EG

*Safety notes*

*2.1 Laws and directives*

- ATEX Directive 94/9/EC
- MID Directive 2004/22/EC

**Compliance with PED directive**

"Pressure Equipment Directive" (PED) is mandatory for all pressure equipment sold within the EU and EFTA.


Siemens Flow Instruments products complies to PED as stated in the following table.

Table 2- 1 MAG 3100 PED Compliance


Flange mm	PN 6	PN 10	PN 16	PN25	PN 40	PN 63	PN 100	150 lb	300 lb	AWWA
15	N/A	N/A	N/A	N/A	SEP	N/A	N/A	N/A	N/A	N/A
25	N/A	N/A	N/A	N/A	SEP	N/A	SEP	N/A	N/A	N/A
40	N/A	N/A	N/A	N/A	SEP	N/A	PED	N/A	N/A	N/A
50	N/A	N/A	N/A	N/A	SEP	PED	PED	N/A	N/A	N/A
65	SEP	N/A	SEP	N/A	PED	PED	PED	N/A	N/A	N/A
80	SEP	N/A	SEP	N/A	PED	PED	PED	N/A	N/A	N/A
100	SEP	N/A	SEP	N/A	PED	PED	PED	N/A	N/A	N/A
125	SEP	N/A	SEP	N/A	PED	PED	PED	N/A	N/A	N/A
150	SEP	N/A	PED	N/A	PED	PED	PED	N/A	N/A	N/A
200	SEP	SEP	PED	PED	PED	PED	PED	N/A	N/A	N/A
250	SEP	SEP	PED	PED	PED	PED	PED	N/A	N/A	N/A
300	SEP	SEP	PED	PED	PED	PED	PED	N/A	N/A	N/A
350	SEP	SEP	PED	PED	PED	N/A	N/A	N/A	N/A	N/A
400	SEP	SEP	PED	PED	PED	N/A	N/A	N/A	N/A	N/A
450	SEP	SEP	PED	PED	PED	N/A	N/A	N/A	N/A	N/A
500	SEP	SEP	PED	PED	PED	N/A	N/A	N/A	N/A	N/A
600	SEP	SEP	PED	PED	PED	N/A	N/A	N/A	N/A	N/A
700	SEP	SEP	PED*	N/A	N/A	N/A	N/A	N/A	N/A	N/A
750	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
800	SEP	SEP	PED*	N/A	N/A	N/A	N/A	N/A	N/A	N/A
900	SEP	SEP	PED*	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1000	SEP	SEP	PED*	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1050	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1200	SEP	SEP	PED*	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1400	SEP	SEP	N/A*	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1500	SEP	SEP	N/A*	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1600	SEP	SEP	N/A*	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1800	SEP	SEP	N/A*	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2000	SEP	SEP	N/A*	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 2- 2 PED table key

SEP	Excluded from PED under SEP (Sound Engineering Practice)
PED	Product covered by PED and only available as fully PED-conforming
PED*	Product covered by PED but available as either conforming or non-conforming to PED
N/A	Size/pressure outside of PED scope or not available in the size range
N/A*	DN1400-2000 only available non conforming to PED

 <b>CAUTION</b>
<b>All products sold outside of EU and EFTA are excluded from the Pressure Equipment directive, also products sold into certain market sectors are excluded. These include</b>
<ol style="list-style-type: none"> <li>1. Meters used in networks for the supply, distribution and discharge of water.</li> <li>2. Meters used in pipelines for the conveyance of any fluid from offshore to onshore.</li> <li>3. Meters used in the extraction of petroleum or gas, including christmas tree and manifold equipment.</li> <li>4. Any meter mounted on a ship or mobile offshore platform.</li> </ol>

## 2.2 Installation in hazardous area

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

### Hazardous area approvals

The device is approved for use in hazardous area and has the following approvals:


MAG 3100 Ex DN 350-2000:


- Ex e ia IIC T3-T6 Gb Ex tD A21 IP67 T\*°C (\* pipe temperature +5 K) (remote mounted)
- Ex d e [ia] ia IIC T3-T6 Gb Ex tD A21 IP67 T\*\*°C (\*\* pipe temperature +5 K, but not less than 85°C) (compact mounted)

MAG 3100 Ex DN 15-300:

- Ex de ia IIC T3-T6 Gb Ex tD A21 IP67 T\*°C (\* pipe temperature +13 K) (remote mounted)
- Ex de\* [ia] [ib] ia ib\* IIC T3-T6 Gb Ex tD A21 IP67 T\*\*°C (\*\* pipe temperature +13 K, but not less than 85°C) (compact mounted)

\* The "e" and "ib" markings on the compact version are only applicable if the "Ex e" supply/data terminal chamber option is used.

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


 <b>WARNING</b>
All approvals are based on non-flammable processes only!


**Intrinsically safe data**

Table 2- 3 Intrinsically safe data for MAG 3100 Ex remote mounted

<b>Electrode circuit "ia" (Terminal 82,83)</b>	
Ui	30V
Li	2µH
li	50mA
Pi	0.5W
Ci	50nF

<b>Coil circuit "Ex e" (Terminal 85,86)</b>	
Ui	30 V (70 V peak)
li	130mA

 <b>WARNING</b>
<b>Compact mounted versions</b>
For intrinsically safe data for MAG 3100 Ex compact mounted with MAG 6000 I Ex d, refer to the Operating Instructions of MAG 6000 I or to certificate number Sira 11ATEX2124X, available here: Certificates ( <a href="http://www.siemens.com/processinstrumentation/certificates">http://www.siemens.com/processinstrumentation/certificates</a> ).

 <b>WARNING</b>
<b>With intrinsically safe circuits, use only certified meters appropriate for the transmitter.</b>
If a non-conforming supply unit is used, the "fail-safe" type of protection will no longer be effective and the approval certification will be invalid.

## Temperature specifications for Ex use

Table 2- 4 Temperature classifications for MAG 3100 Ex (remote or compact with MAG 6000 I)






Maximum process fluid temperature [°C]	Temperature class	Ambient temperature [°C]
75	T6 (85 °C)	-25 ... +60
90	T5 (100 °C)	-25 ... +60
125	T4 (135 °C)	-25 ... +60
180 (Remote configuration)	T3 (200 °C)	-25 ... +60
150 (Compact configuration)	T3 (200 °C)	-25 ... +50

For dust protection, the surface temperature is equal to the process fluid temperature plus 5 °C

## Special conditions for safe use

It is required that:

- Electrical connections are in accordance with national requirements.
- Appropriate cable connectors are used for the output circuits:
  - Intrinsically safe: blue
  - Non-intrinsically safe: black
- Minimum 4 mm<sup>2</sup> cable is to be used for potential equalization
- Cable glands for coil circuit must be Ex e approved (increased safety) and fit the application by being approved for the cable used as regards size and temperature.
- Sensor insulation thickness is max. 100mm (only insulated sensors).
- IEC/EN 61241-14 and 61241-17 are considered for installation in areas with combustible dust.

 <b>WARNING</b>
<b>Potential equalization</b> In operation, the output is earthed through the conductive medium being measured and therefore potential equalisation is necessary throughout the hazardous area. The apparatus housing shall be connected to the potential equalising conductor in the hazardous area.
 <b>WARNING</b>
<b>External connections to Ex e terminals</b> The external connections to the Ex 'e' Terminals of the Remote version shall comply with the following: <ul style="list-style-type: none"><li>• The wire conductors shall have a cross-sectional area between 0.5 mm<sup>2</sup> and 2.5 mm<sup>2</sup>.</li><li>• No more than one single or multiple strand wire conductor shall normally be connected to each of the terminals. If multiple conductors are required, these shall be joined in a suitable manner, e.g. two conductors into a single insulated crimped boot lace ferrule.</li><li>• The insulation on the wire conductors shall extend to within 1mm of the metal of the terminal throat.</li><li>• The terminal screws shall be tightened down with a torque between 0.5 Nm and 0.7 Nm.</li><li>• The terminals shall never be exposed to temperatures outside of the range -50°C to + 130°C; in addition, they shall only be installed and wired with cable in an ambient temperature of -10 to +80°C. Furthermore, in the event of there being a process temperatures of + 180°C in conjunction with an upper ambient temperature of +50°C the terminal strips should not be installed or wired with cable.</li></ul>
 <b>WARNING</b>
<b>Explosive gas or dust</b> The terminal box shall not be opened when an explosive gas or dust atmosphere may be present.
 <b>WARNING</b>
Do <b>NOT</b> open the device while energized; otherwise there is a risk of explosion.
 <b>WARNING</b>
<b>Laying of cables</b> Cable for use in zone 1 and 2 or 21 and 22 must satisfy the requirements for having a proof voltage < AC 500 V applied between the conductor/ground, conductor/shield and shield/ground. Connect the devices that are operated in hazardous areas as per the stipulations applicable in the country of operation, e.g. for Ex "d" and "nA", permanent cables must be laid.



## 2.3 Certificates

Certificates are posted on the Internet and on the documentation CD-ROM shipped with the device.

### See also

Certificates (<http://www.siemens.com/processinstrumentation/certificates>)



## Description

The main applications of the SITRANS F M electromagnetic flow sensors can be found in the following fields:

- Process industry
- Chemical industry
- Steel industry
- Mining
- Utility
- Power generation & distribution
- Oil & gas / HPI
- Water & waste water
- Pulp & paper

### 3.1 System components

The SITRANS F M flowmeter system includes:

- Transmitter (types: SITRANS F M MAG 5000/6000 or MAG 6000 I)
- Sensor (types: SITRANS F M MAG 1100/1100 F, MAG 3100/3100 P or MAG 5100 W)
- Communication module (optional) (types: HART, PROFIBUS PA/DP, MODBUS RTU RS 485, Foundation Fieldbus H1, Devicenet)
- SENSORPROM memory unit

#### Communication solutions

The SITRANS F M range of add on modules, presently including HART, Foundation Fieldbus, MODBUS RTU RS 485, PROFIBUS PA / DP and Devicenet, are all applicable with the SITRANS F M MAG 6000 transmitter.

## 3.2 Design

SITRANS F M MAG 3100 is available in a wide range of sizes (DN 15 to DN 2000 (½" to 78")) and pressure ratings (PN 6 to PN 100 / ANSI Class 150 / 300, AS 2129 / AS 4087. On request up to 690 bar (10 000 psi)) The fully welded construction provides a ruggedness that suits the toughest applications and environments.



Sensor housing and flanges are designed in carbon steel (ASTM A 105) and terminal box in fibre glass reinforced polyamide or optionally in stainless steel (AISI 316). Measuring pipe is made of stainless steel (AISI 304) while liners and electrodes are available in various material, which makes the sensor highly resistant to a wide range of chemicals.

The present range of liner types includes:

- PTFE
- PFA
- Soft rubber
- EPDM
- Linatex
- Ebonite Hard Rubber

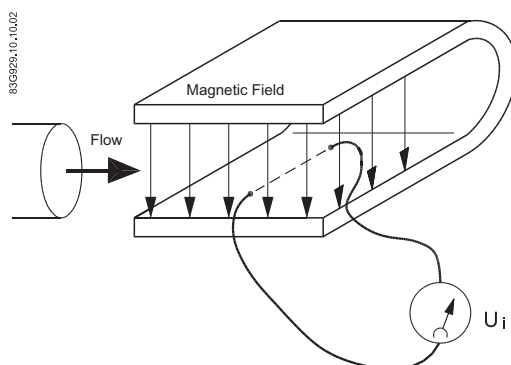
Electrodes are available in:

- Hastelloy C276 or C22
- AISI 316Ti (1.4571)
- Platinum / Iridium
- Titanium
- Tantalum

The sensors carry a wide range of approvals, see Technical data (Page 47).

### 3.3 Theory of operation

The flow measuring principle is based on Faraday's law of electromagnetic induction.



$U_i$  = When an electrical conductor of length  $L$  is moved at velocity  $v$ , perpendicular to the lines of flux through a magnetic field of strength  $B$ , the voltage  $U_i$  is induced at the ends of the conductor

$$U_i = L \times B \times v$$

- $U_i$  = Induced voltage
- $L$  = Conductor length = Inner pipe diameter =  $k_1$
- $B$  = Magnetic field strength =  $k_2$
- $v$  = Velocity of conductor (media)
- $k = k_1 \times k_2$

$U_i = k \times v$ , the electrode signal is directly proportional to the fluid velocity

#### Operating principle

The coil current module generates a pulsating magnetizing current that drives the coils in the sensor. The current is permanently monitored and corrected. Errors or cable faults are registered by the self-monitoring circuit.

The input circuit amplifies the flow-proportional induced voltage signal from the electrodes. The input impedance is extremely high:  $>10^{14} \Omega$  which allows flow measurements on fluids with conductivities as low as  $5 \mu\text{S/cm}$ . Measuring errors due to cable capacitance are eliminated due to active cable screening.

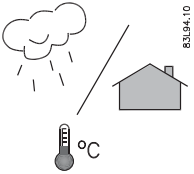
The digital signal processor converts the analog flow signal to a digital signal and suppresses electrode noise through a digital filter. Inaccuracies in the transmitter as a result of long-term drift and temperature drift are monitored and continuously compensated for via the self-monitoring circuit. The analog to digital conversion takes place in an ultra low noise ASIC with 23 bit signal resolution. This has eliminated the need for range switching. The dynamic range of the transmitter is therefore unsurpassed with a turn down ratio of minimum 3000:1.

*Description*

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*3.3 Theory of operation*

## Installing/Mounting



SITRANS F flowmeters with minimum IP65/NEMA 4X enclosure rating are suitable for indoor and outdoor installations.

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

### **⚠ WARNING**

#### **Installation in hazardous location**

Special requirements apply to the location and interconnection of sensor and transmitter. See "Installation in hazardous area" (Page 11)

### 4.1 Installation safety precautions

### **⚠ WARNING**

#### **High pressure hazard**

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 pressure guard or a safety valve are taken when the sensor is mounted.

### 4.2 Determining a location

#### **Note**

The sensor must always be completely filled with liquid.

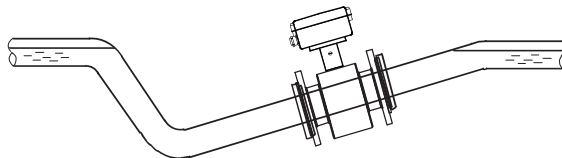
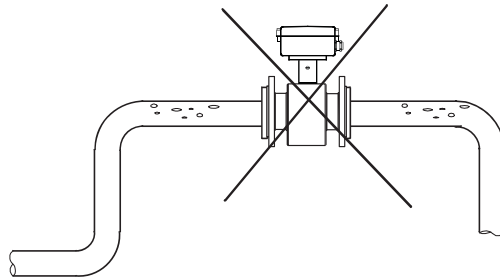


Figure 4-1 Correct installation with filled pipes

- Avoid the following installations
  - Installation at the highest point in the pipe system
  - Installation in vertical pipes with free outlet



- Wrong installation at high point

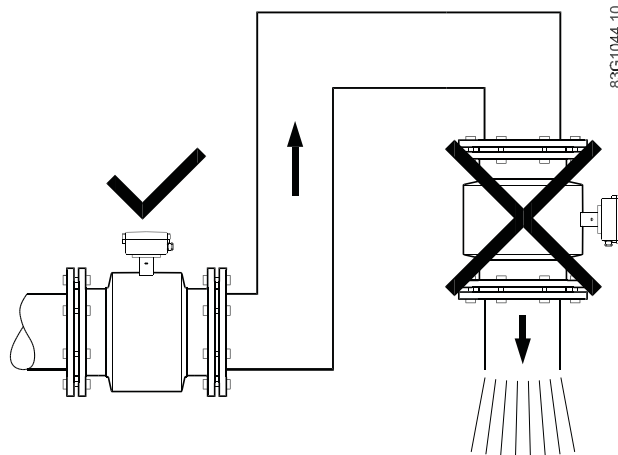


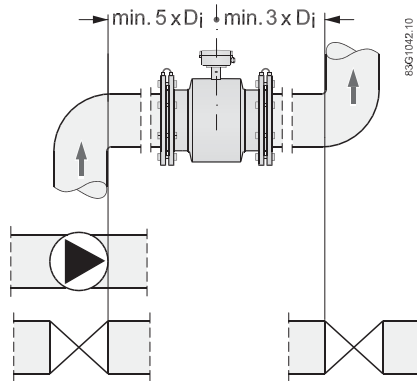
Figure 4-2 Correct installation at low point before outlet

### Inlet and outlet conditions

To achieve accurate flow measurement it is essential to have straight lengths of inlet and outlet pipes and a certain distance to pumps and valves.

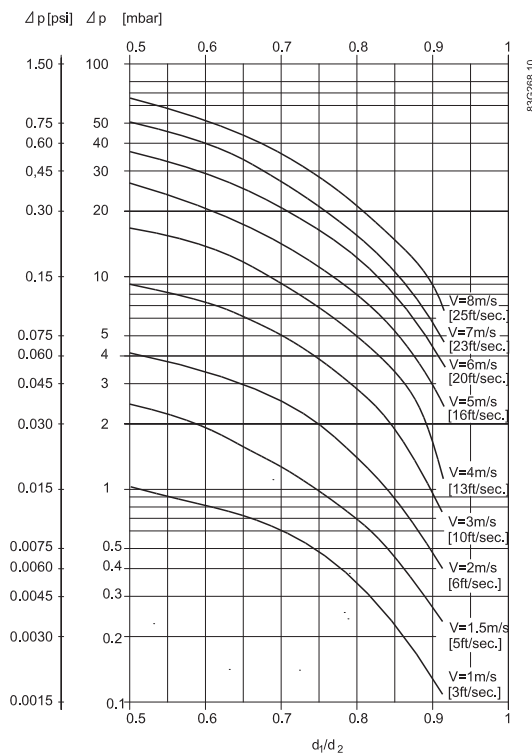
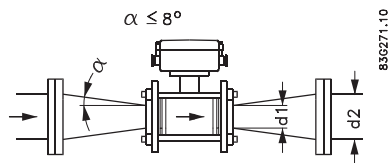
It is also important to centre the flowmeter in relation to pipe flanges and gaskets.





### Installation in large pipes

The flowmeter can be installed between two reducers (e.g. DIN 28545). At  $8^\circ$  the following pressure drop curves apply. The curves are applicable to water.



Example:

A flow of 3 m/s (V) in a sensor with a diameter reduction from DN 100 to DN 80 ( $d_1/d_2 = 0.8$ ) gives a pressure drop of 2.9 mbar.

### 4.3 Orienting the sensor

The sensor operates in all orientations, but Siemens has the following recommendations:

- Vertical installation with an upwards flow

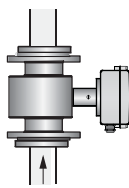


Figure 4-3 Vertical orientation, upwards flow

<b>NOTICE</b>
<b>Abrasive liquids / liquids containing solid particles</b>
A vertical installation minimizes wear and deposits in the sensor

**Note**

**Gas/air bubbles in the liquid**

A vertical installation minimizes any negative effect of gas/air bubbles in the liquid

- Horizontal installation, terminal box upwards

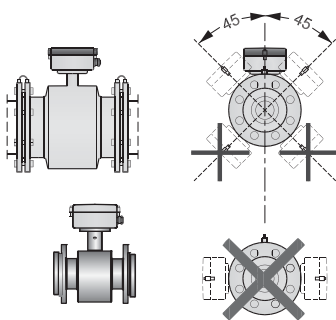


Figure 4-4 Horizontal installation, various terminal box positions

**NOTICE**

**Do NOT mount the sensor with the terminal box sideways**

This will position the electrodes at the top where there is possibility for air bubbles and at the bottom where there is possibility for mud, sludge, sand etc.

**Note**

**Empty pipe detection**

For applications with empty pipe detection, the sensor can be tilted up to 45°, as shown above.

## 4.4 Removing the liner protectors

**NOTICE**

**Sensors with PTFE or PFA liners only!**

The following information is only relevant for sensor types with PTFE or PFA liners!

### Sensors with PTFE liner

At delivery the sensor is mounted with wooden blanks to hold the liner in place during transportation and storage. After only a few hours without the blanks, the liner will creep back towards its original shape and installation will be more difficult to carry out.

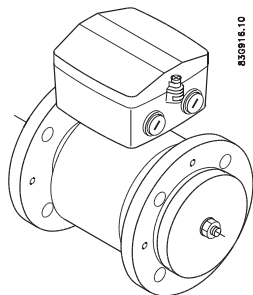


Figure 4-5 Sensor with wooden blanks

4.4 Removing the liner protectors

- Remove the blanks immediately before mounting the sensor

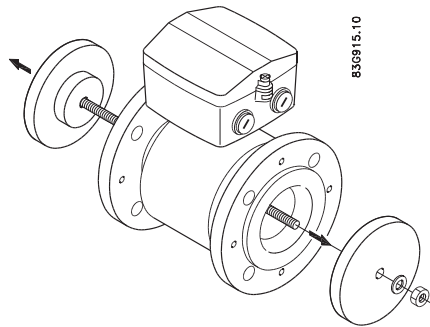


Figure 4-6 Removing wooden blanks

Sensors with PFA liner

At delivery the sensor is mounted with blanks to protect the liner during transportation and storage.

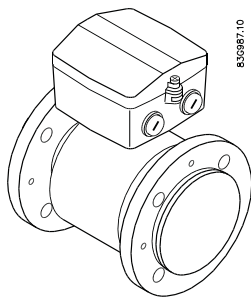


Figure 4-7 Sensor with blanks

- Remove the blanks immediately before mounting the sensor

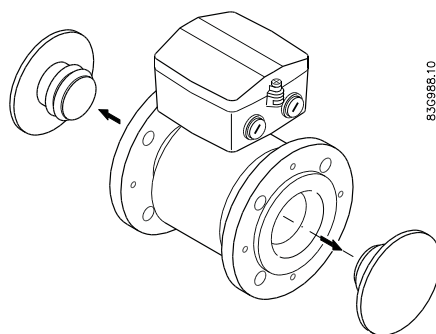


Figure 4-8 Removing blanks

**NOTICE**

Do not use sharp objects to remove the blanks as this can damage the liner!

## 4.5 Mounting

- Install the sensor in rigid pipelines in order to support the weight of the meter.
- Center the connecting pipelines axially in order to avoid turbulent flow profiles.
- Use proper gaskets according to liner type

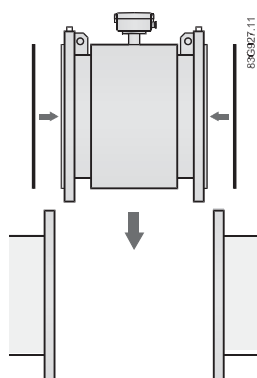


Figure 4-9 Correct installation with gaskets

## Vibrations

Avoid strong vibrations.

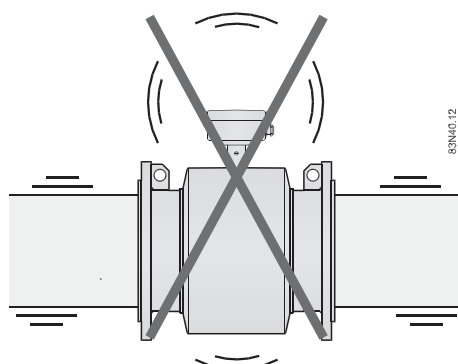


Figure 4-10 Avoid vibrations

### CAUTION

In applications with strong vibrations, Siemens recommend remote mounting of the transmitter!

**Mounting**

Fasten screws according to the torques values below

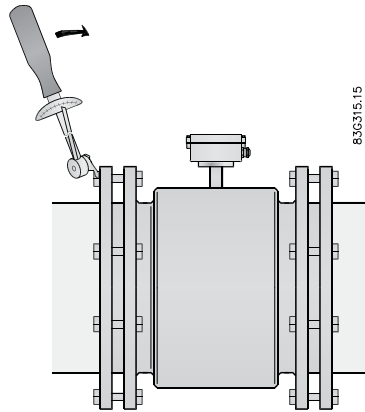


Figure 4-11 Mounting

**Note**

Torque values are calculated on the basis of use of gaskets.

Table 4- 1 Maximum allowable torques

DN		PN 6		PN 10		PN 16		PN25		PN 40		PN 63		ANSI CI 150		AWWA	
mm	Inch	Nm	F/lb s	Nm	F/lb s	Nm	F/lb s	Nm	F/lb s	Nm	F/lb s	Nm	F/lb s	Nm	F/lb s	Nm	F/lb s
15	½	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10	7	N/A	N/A	N/A	N/A	N/A	N/A
25	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	16	12	N/A	N/A	25	18	N/A	N/A
40	1½	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	34	25	N/A	N/A	52	38	N/A	N/A
50	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	46	34	45	33	83	61	N/A	N/A
65	2½	10	7	N/A	N/A	25	18	N/A	N/A	34	25	32	23	60	44	N/A	N/A
80	3	25	18	N/A	N/A	25	18	N/A	N/A	42	31	41	30	76	56	N/A	N/A
100	4	25	18	N/A	N/A	25	18	N/A	N/A	72	53	68	50	118	87	N/A	N/A
125	5	25	18	N/A	N/A	32	24	N/A	N/A	114	84	102	75	177	130	N/A	N/A
150	6	25	18	N/A	N/A	50	37	N/A	N/A	144	106	153	112	159	117	N/A	N/A
200	8	25	18	50	37	52	38	105	77	185	137	189	139	294	216	N/A	N/A
250	10	25	18	50	37	88	65	160	118	300	221	276	203	472	348	N/A	N/A
300	12	50	37	60	44	117	86	170	125	320	236	293	216	541	399	N/A	N/A
350	14	50	37	60	44	120	89	240	177	450	322	413	304	800	590	N/A	N/A
400	16	50	37	88	65	170	125	330	244	650	480	588	431	N/A	N/A	N/A	N/A
450	18	56	41	92	68	170	125	320	236	570	421	N/A	N/A	N/A	N/A	N/A	N/A
500	20	53	39	103	76	230	170	390	288	740	546	N/A	N/A	N/A	N/A	N/A	N/A

DN		PN 6		PN 10		PN 16		PN25		PN 40		PN 63		ANSI CI 150		AWWA	
600	24	81	60	161	119	350	258	560	413	1220	900	1200	N/A	N/A	N/A	N/A	N/A
700	28	48	35	96	71	183	135	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	250	184
800	32	70	52	137	101	257	190	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	329	242
900	36	86	63	144	106	272	201	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	339	250
1000	40	90	66	191	141	364	268	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	393	290
1050	42	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	366	270
1100	44	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	471	347
1200	48	126	93	263	194	522	385	522	385	N/A	N/A	N/A	N/A	N/A	N/A	436	322
1400	54	165	122	335	247	613	452	613	452	N/A	N/A	N/A	N/A	N/A	N/A	528	389
1600	66	190	140	456	336	830	612	830	612	N/A	N/A	N/A	N/A	N/A	N/A	698	515
1800	72	239	176	514	379	937	692	937	692	N/A	N/A	N/A	N/A	N/A	N/A	700	516
2000	78	288	212	578	426	1128	832	1128	832	N/A	N/A	N/A	N/A	N/A	N/A	890	656

## 4.6 Potential equalization

To obtain optimum results from the measuring system, the sensor must have the same electrical potential as the liquid being measured.

This is achieved by means of built-in grounding electrodes.

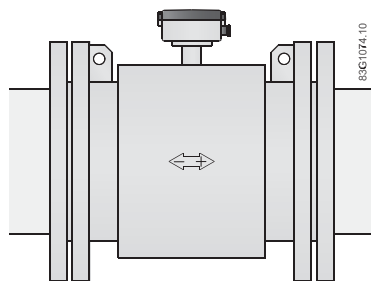



Figure 4-12 Potential equalization with earthing electrodes

### Cathodic protected piping

Special attention must be paid to systems with cathodic protection

 <b>WARNING</b>
<b>Use in hazardous area!</b>
Cathodic pipe protection is not allowed in hazardous areas

4.7 Installation with earthing flanges

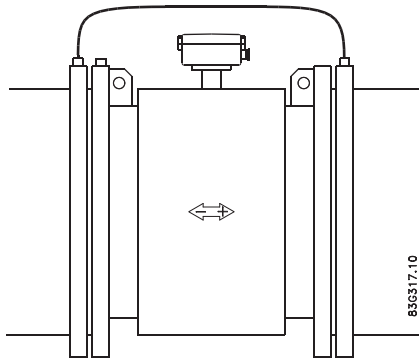


Figure 4-13 Cathodic protection

- Isolate the sensor from cathodic protected pipes using insulated bolts.
- Use bypass cable between the mating flanges

**Note**

**Remote mounted sensor versions**

If the above is not acceptable, remote mounted sensors can alternatively be connected as follows:

- Connect coil current cable shield at sensor end via a 1.5  $\mu$ F condensator
- Make sure that electrode cable shield is not connected at both ends

## 4.7 Installation with earthing flanges

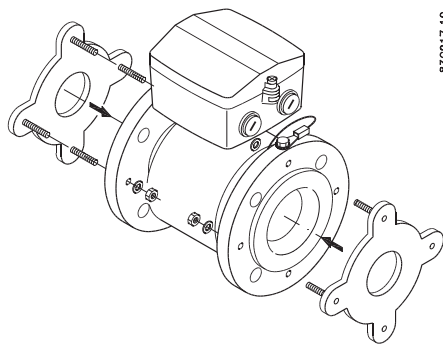
**NOTICE**

**Only sensors with PTFE or PFA liners**

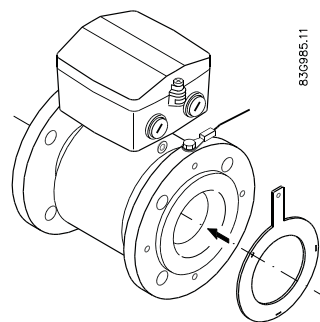
Installation with earthing flanges is only relevant for sensors with PTFE or PFA liners

- Mount earthing flanges where necessary on non conductive pipes.





Installation with earthing flanges on sensors with PTFE liner



Installation with flat earthing ring on sensors with PFA liner

---

**Note**

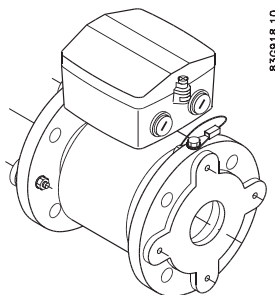
**Potential equalization**

For potential equalization one earthing flange is sufficient.

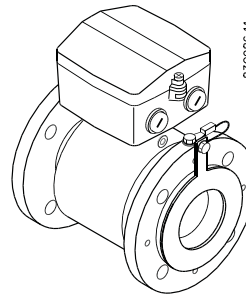
By unidirectional flow it is recommended to mount the earthing flange on the inlet side.

---

- Connect the earthing flanges to the sensor with the enclosed earthing straps.



Earthing strap connection on type E earthing rings



Earthing strap connection on flat earthing rings

---

**Note**

**Abrasive liquids**

In special cases the earthing flanges can work as inlet protection.

---

<b>NOTICE</b>
<b>High temperature sensors</b> High temperature sensors are delivered with two factory mounted earthing flanges. No further action need to be taken for potential equalisation.

## Connecting

The following contains a short description of how to connect a remote mounted sensor to transmitter types:

- SITRANS F M MAG 5000 / 6000 (standard versions)
- SITRANS F M MAG 6000 19" with Safety barrier
- SITRANS F M MAG 6000 I Ex de

For more information, e.g. about wiring of power supply and outputs, refer to the operating instructions for the respective transmitters.

### Before connecting

- Check that the serial numbers on the sensor and the SENSORPROM® unit are identical.

## 5.1 General safety requirements

### WARNING

**The pertinent regulations must be observed for electrical installation.**

- Never install the device with the mains voltage switched on!
- Danger of electric shock!
- The electrodes and magnetic current line may only be connected when the device is not connected to the power supply.
- If the housing is under voltage (power supply), the cover may be unscrewed by qualified personnel only.

### WARNING




**Mains supply from building installation Class II**

A switch or circuit breaker (max. 15 A) must be installed in close proximity to the equipment and within easy reach of the operator. It must be marked as the disconnecting device for the equipment.

### Note

#### Hazardous area applications

Special requirements apply to the location and interconnection of sensor and transmitter. See "Installation in hazardous locations".

 <b>WARNING</b>
<b>Terminal box</b> Before opening the terminal box check that: <ul style="list-style-type: none"><li>• No explosion hazard exists</li><li>• All connection leads are potential free</li></ul>
 <b>WARNING</b>
<b>Grounding</b> The mains protective earth wire must be connected to the PE terminal in accordance with the diagram (class 1 power supply) <b>Mechanical counters</b> When mounting a mechanical counter to terminals 57 and 58 (active output), a 1000 µF capacitor must be connected to terminals 56 and 58. Capacitor + is connected to terminal 56 and capacitor - to terminal 58. <b>Output cables</b> If long cables are used in electrically noisy environments, it is recommended to use screened cables. <b>Electrode cables</b> Dotted connections are only to be made when using special electrode cables.
 <b>WARNING</b>
<b>National requirements</b> Observe country-specific installation directives for field wiring.

**See also**

Installation in hazardous area (Page 11)

**Cable specifications**

- Only use cables with at least the same degree of protection as the sensor to install the sensor.
- The line length from the cable gland to the terminals must be kept as short as possible. Line loops in the terminal box must be avoided.
- To guarantee the IP 67 degree of protection, use cables with the required specifications.

<b>⚠ WARNING</b>
<b>Protective conductor terminal</b> The required cable is min. AGW16 or 1.5 Cu.
<b>⚠ WARNING</b>
<b>Wire insulation</b> For field wiring installation: Ensure that the national requirements of the country in which the flowmeters are installed is met.

**See also**

Cable data (Page 54)

## 5.2 Remote installation

---

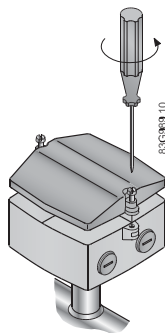
**Note**

**Remote installation only**

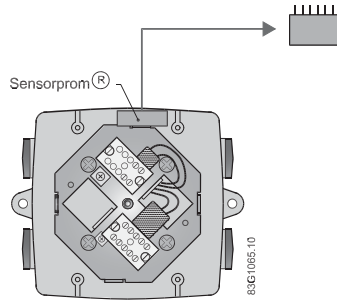
The following applies to remote installation of MAG 5000 / 6000 or MAG 6000 I.

---

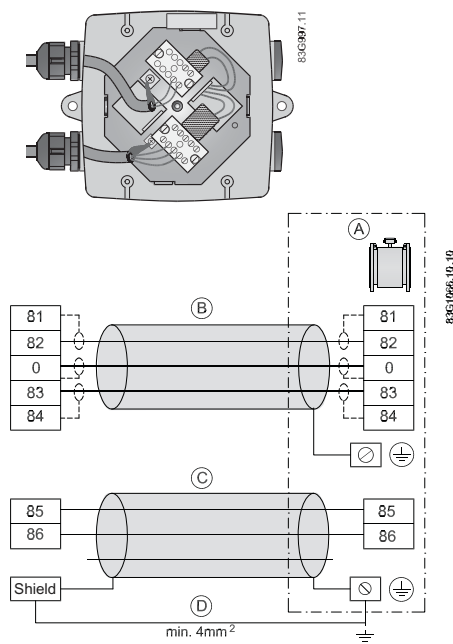
1. Unscrew and remove terminal box lid.



- Remove SENSORPROM® unit from sensor and mount it on connection plate in transmitter, see relevant transmitter operating instructions.



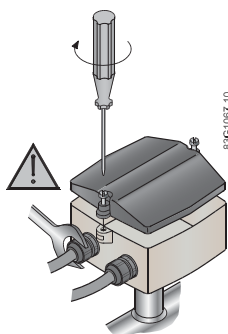
- Fit the ½" NPT or M20 cable glands for supply and output cables.
- Fit and connect electrode and coil cables as shown below.



- A Sensor
- B Electrode cable
- C Coil cable
- D Only required for ATEX applications

<b>⚠ CAUTION</b>
<b>Unscreened cable ends</b> Keep unscreened cable ends as short as possible.
<b>⚠ CAUTION</b>
<b>Prevent interference</b> Separate electrode and coil cables to prevent interference.
<b>⚠ WARNING</b>
<b>Use in hazardous area</b> Connect mains protective earth to the PE terminal in accordance with the above diagram in order to obtain potential equalization.

5. Tighten cable glands well to obtain optimum sealing.



<b>⚠ WARNING</b>
Mount terminal box lid before power up.

## 5.3 Installation check

The meter is now ready to go into normal operation - for commissioning and setting of parameters refer to the relevant transmitter manual.

Before commissioning it must be checked that:

- The device has been installed and connected in accordance with the guidelines provided previous in this chapter and in chapter 4 Installing/mounting .

### See also

Connecting (Page 33)

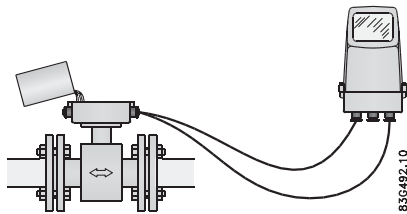
## 5.4 Potting

If sensor is buried or permanently submerged, terminal box must be encapsulated with silicon dielectric gel (non-toxic, transparent and self-healing gel)

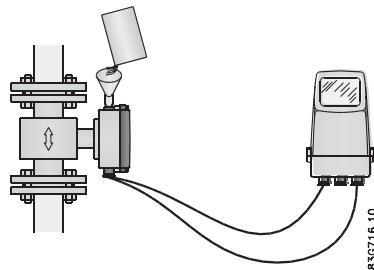
### NOTICE

Do **not** pot meter before electrical connections have been made.

- Mix the two components of the potting kit well and pour into terminal box.
- Let cure for approximately 24 hours at approximately 25°C (77°F). Curing time increases by 100% per -10°C (-18°F).



Horizontal orientation



Vertical orientation

### Note

Gel can be penetrated with test instruments or be removed in case of cable replacement.



## Service and maintenance

### 6.1 Maintenance

The device is maintenance-free. However, a periodic inspection according to 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

<b>NOTICE</b>
Repair and service must be carried out by Siemens authorized personnel only.

**Note**

Siemens defines flow sensors as non-repairable products.

### 6.2 Recalibration

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

- Standard matched pair calibration

**Note**

For recalibration the memory unit must always be returned with the sensor.

### 6.3 Transportation/storage

The sensor is a fragile piece of equipment. Impact and shock can cause measuring inaccuracy. Therefore during transportation it must be placed in the transportation box delivered by Siemens Flow Instruments. If this is not possible, the alternative sensor packaging must be able to withstand the hazards from transportation.



### Handling

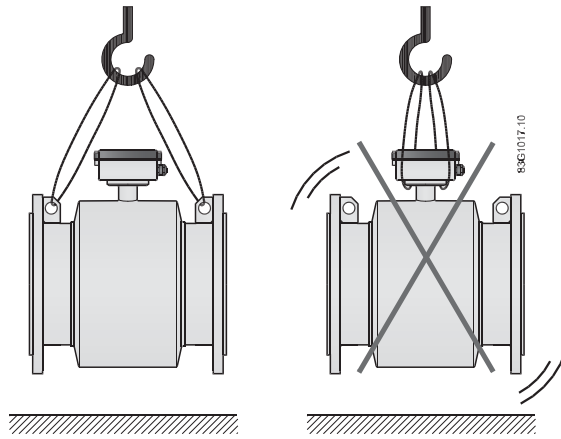


Figure 6-1 Handling of sensor

## 6.4 Unit repair

### NOTICE

Repair and service must be carried out by Siemens authorized personnel only.

### Note

Siemens defines flow sensors as non-repairable products.

## 6.5 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 Customer Support:

- Via the Internet using the **Support Request:**  
Support request (<http://www.siemens.com/automation/support-request>)
- Via Phone:
  - Europe: +49 (0)911 895 7222
  - America: +1 423 262 5710
  - Asia-Pacific: +86 10 6475 7575

Further information about our technical support is available on 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.
- 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 local contact partner at: <http://www.automation.siemens.com/partner>

## See also

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

## 6.6 Return procedures

Enclose the delivery note, the cover note for return delivery and 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  
Cover note (<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**

Declaration of Decontamination

([http://pia.khe.siemens.com/efiles/feldg/files/Service/declaration\\_of\\_decontamination\\_en.pdf](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 shall 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 shall 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.

## Troubleshooting/FAQs

### 7.1 Sensor check

#### Requirement

To check the SITRANS F M sensors the following test instruments will be required:

- Digital Meter/Multimeter
- Megger
- (Moving Coil Meter)

#### Sensor check

Remove the transmitter from the sensor or remote position before making the following checks.

#### Coil resistance check

- Measure the coil resistance between connection numbers 85 and 86 using a digital meter.  
Resistance should be within range stated in Coil resistance table.

A low reading may indicate moisture within the coil housing or shorted coil turns.

A high reading would indicate an open circuit coil.


---

#### Note

In case of deviation from nominal coil values, the sensor is damaged and must be replaced

---

#### Coil insulation check

 <b>WARNING</b>
<b>Potential hazard!</b> Only carry out a coil insulation check in non-hazardous area!

- Megger between connection number 85 and the sensor body.  
The resistance should be above 20 MΩ.
- A low megger reading would indicate the coil insulation is braking down. This is normally due to fluid ingress into the coil housing.
- Sensors with an insulation resistance down to 1 MΩ may still work satisfactorily but this is not guaranteed.

### Electrode resistance check

- Measure the electrode resistance between connections 82 and 0 with a moving coil meter.  
With a sensor full of fluid the resistance should be between 5 K $\Omega$  and 50 K $\Omega$ .  
If the sensor is empty the resistance will be infinite.
- Repeat the resistance measurements between connections 83 and 0.  
The results should be the same.

If the resistance is low there may be a short on the electrodes or wiring (in the case of a remote mounted transmitter). Alternatively there may be water ingress or moisture in the terminal box.

If the resistance is high and the pipe is completely full of fluid check the following:

1. Fluid is electrically conductive.
2. Electrodes are not coated with grease or any deposit.
3. Electrode circuit is not open.
4. Remote mounted transmitter has a 3 core cable with an overall shield continuously from sensor to transmitter, including junction boxes and terminal rails inside panels.
5. Shield is connected to 0 or to earth terminal (PE) on sensor.

---

#### Note

##### Sensors removed from line

For sensors removed from line with dry bore, use megger between terminal 82 and compression plate, and 83 and compression plate to show any water ingress behind electrodes or within enclosure.

---

## 7.2 Fluctuating process values

### Question

Why do the displayed process values fluctuate when the electrode cable is moved?

### Answer

There are several causes of the fluctuating process values:

- Deposits on electrodes
  - Clean the electrodes.
- Defect electrode cable
  - Replace the cable
- Incorrect cable connection
  - Connect the electrode cable (82, 83, 0 and shield) according to the instructions in chapter Connecting (Page 33)

---

#### **Note**

##### **Vibrating environments**

It is recommended to use special low noise cables for sensor sizes DN 2 and 3 installed in vibrating environments.

---





## Technical data

Table 8- 1

Version	MAG 3100 P	MAG 3100	MAG 3100 HT
Product characteristic	Process and chemical (Short lead time)	Flexible product program	Process temperature above 150°C (300°F)
Nominal size	DN 15 ... DN 300 (½" ... 12")	DN 15 ... DN 2000 (½" ... 78")	DN 15 ... DN 300 (½" ... 12")
Measuring principle	Electromagnetic induction		
Excitation frequency (Mains supply: 50 Hz/60 Hz)	<ul style="list-style-type: none"> <li>• DN 15 ... 65 (½" ... 2½"): 12.5 Hz/15 Hz</li> <li>• DN 80 ... 150 (3" ... 6"): 6.25 Hz/7.5 Hz</li> <li>• DN 200 ... 300 (8" ... 12"): 3.125 Hz/3.75 Hz</li> </ul>	<ul style="list-style-type: none"> <li>• DN 15 ... 65 (½" ... 2½"): 12.5 Hz/15 Hz</li> <li>• DN 80 ... 150 (3" ... 6"): 6.25 Hz/7.5 Hz</li> <li>• DN 200 ... 1200 (8" ... 48"): 3.125 Hz/3.75 Hz</li> <li>• DN 1400 ... 2000 (54" ... 78"): 1.5625 Hz/1.875 Hz</li> </ul>	<ul style="list-style-type: none"> <li>• DN 15 ... 65 (½" ... 2½"): 12.5 Hz/15 Hz</li> <li>• DN 80 ... 150 (3" ... 6"): 6.25 Hz/7.5 Hz</li> <li>• DN 200 ... 300 (8" ... 12"): 3.125 Hz/3.75 Hz</li> </ul>
Enclosure rating	IP67 (EN/IEC 60529) / NEMA 4X/6, 1 mH2O for 30 min Option: IP68 (EN/IEC 60529) / NEMA 6P, 10 mH2O cont. (not for Ex)	IP67 (EN/IEC 60529) / NEMA 4X/6, 1 mH2O for 30 min Option: IP68 (EN/IEC 60529) / NEMA 6P, 10 mH2O cont. (not for Ex)	IP67 (EN/IEC 60529) / NEMA 4X/6, 1 mH2O for 30 min Option: IP68 (EN/IEC 60529) / NEMA 6P, 10 mH2O cont. (not for Ex)
Test pressure	1.5 x PN (where applicable)	1.5 x PN (where applicable)	1.5 x PN (where applicable)
Pressure drop at 3 m/s	-	As straight pipe	-
EMC	According to 2004/108/EC		

Table 8- 2 Process connections

Version	MAG 3100 P	MAG 3100	MAG 3100 HT
EN 1092-1, raised face (EN 1092-1, DIN 2501 & BS 4504 have the same mating dimensions)	<ul style="list-style-type: none"> <li>• DN 15 ... 50 (½" ... 2"): PN 40 (580 psi)</li> <li>• DN 65 ... 300 (2½" ... 12"): PN 16 (232 psi)</li> <li>• DN 200 ... 300 (8" ... 12"): PN 10 (145 psi)</li> </ul>	<ul style="list-style-type: none"> <li>• DN 65 ... 2000 (2½" ... 78"): PN 6 (87 psi)</li> <li>• DN 200 ... 2000 (8" ... 78"): PN 10 (145 psi)</li> <li>• DN 65 ... 2000 (2½" ... 78"): PN 16 (232 psi)</li> <li>• DN 200 ... 600 (8" ... 24"): PN 25 (362 psi)</li> <li>• DN 15 ... 600 (½" ... 24"): PN 40 (580 psi)</li> <li>• DN 50 ... 300 (2" ... 12"): PN 63 (913 psi)</li> <li>• DN 25 ... 300 (1" ... 12"): PN 100 (1450 psi)</li> </ul>	<ul style="list-style-type: none"> <li>• DN 15 ... 300 (½" ... 12"): PN 40 (580 psi)</li> <li>• DN 65 ... 300 (2½" ... 12"): PN 16 (232 psi)</li> <li>• DN 200 ... 300 (8" ... 12"): PN 10 (145 psi)</li> <li>• DN 200 ... 300 (8" ... 12"): PN 25 (362 psi)</li> </ul>
ANSI B16.5 (~BS 1560), raised face	<ul style="list-style-type: none"> <li>• ½" ... 12": Class 150 (20 bar (290 psi))</li> </ul>	<ul style="list-style-type: none"> <li>• ½" ... 24": Class 150 (20 bar (290 psi))</li> <li>• ½" ... 24": Class 300 (50 bar (725 psi))</li> </ul>	<ul style="list-style-type: none"> <li>• ½" ... 12": Class 150 (20 bar (290 psi))</li> <li>• ½" ... 12": Class 300 (50 bar (725 psi))</li> </ul>
AWWA C-207, flat face	-	28" ... 78": Class D (10 bar)	-
AS 2129, raised face	-	½" ... 48": Table E	½" ... 12": Table E
AS 4087, raised face	-	<ul style="list-style-type: none"> <li>• PN 16 (DN 50 ... 1200, 16 bar (232 psi))</li> <li>• PN 21 (DN 50 ... 600, 21 bar (304 psi))</li> <li>• PN 35 (DN 50 ... 600, 35 bar (508 psi))</li> </ul>	-
JIS B 2220:2004	-	<ul style="list-style-type: none"> <li>• K10 (½" ... 24")</li> <li>• K20 (½" ... 24")</li> </ul>	-
Other flanges and pressure ratings	-	On request	On request

Table 8- 3 Rated operating conditions (Ambient temperatures)<sup>1</sup>

Version	MAG 3100 P	MAG 3100	MAG 3100 HT
Sensor	-40 ... +100 °C (-40 ... +212 °F)	-40 ... +100 °C (-40 ... +212 °F)	-40 ... +100 °C (-40 ... +212 °F)
Ex Sensor	-25 ... +60 °C (-13 ... +140 °F)	-25 ... +60 °C (-13 ... +140 °F)	For up to 150 °C (302 °F) media temperature: <ul style="list-style-type: none"> <li>-25 ... +60 °C (-13 ... +140 °F)</li> </ul> For media temperature 150 ... 180 °C (302 ... 356 °F): <ul style="list-style-type: none"> <li>-25 ... +50 °C (-13 ... +122 °F)</li> </ul>
With compact transmitter			
MAG 5000/6000	-20 ... +60 °C (-4 ... +140 °F)	-20 ... +60 °C (-4 ... +140 °F)	-20 ... +60 °C (-4 ... +140 °F)
MAG 6000 I	-25 ... +60 °C (-13 ... +140 °F)	-25 ... +60 °C (-13 ... +140 °F)	-25 ... +60 °C (-13 ... +140 °F)
MAG 6000 I Ex de	-25 ... +60 °C (-13 ... 140 °F)	-25 ... +60 °C (-13 ... 140 °F)	-25 ... +60 °C (-13 ... 140 °F)

<sup>1</sup> Conditions also dependent on liner characteristics

Table 8- 4 Operating pressure [abs.bar]<sup>1</sup>

Version	MAG 3100 P	MAG 3100	MAG 3100 HT
PTFE Teflon	<ul style="list-style-type: none"> <li>DN 15 ... 300 (½" ... 12"): 0.3 ... 40 bar (4 ... 580 psi)</li> </ul>	<ul style="list-style-type: none"> <li>DN ≤ 300 (≤ 12"): 0.3 ... 50 bar (4 ... 725 psi)</li> <li>350 ≤ DN ≤ 600 (14" ≤ DN ≤ 24"): 0.3 ... 40 bar (4 ... 580 psi)</li> </ul>	<ul style="list-style-type: none"> <li>DN 15 ... 300 (½" ... 12") (130/180 °C (266/356°F)): 0.3/0.6 ... 50 bar (4/8 ... 725 psi) 180 °C (356 °F)</li> </ul> PTFE has factory-mounted grounding SS rings type E & SS terminal box
PFA	DN 15 ... 150 (½" ... 6"): Vacuum 0.02 ... 50 bar (0.29 ... 725 psi)	DN 15 ... 150 (½" ... 6"): Vacuum 0.02 ... 50 bar (0.29 ... 725 psi)	DN 15 ... 150 (½" ... 6"): Vacuum 0.02 ... 50 bar (0.29 ... 725 psi)
Soft rubber		0.01 ... 100 bar (0.15 ... 1450 psi)	
EPDM		0.01 ... 40 bar (0.15 ... 580 psi)	
Linatex®		0.01 ... 40 bar (0.15 ... 580 psi)	
Ebonite		0.01 ... 100 bar (0.15 ... 1450 psi)	

<sup>1</sup> Maximum operating pressure decreases with increasing operating temperature and with stainless steel flanges

Technical data

Table 8- 5 Mechanical load/Vibration

Version	MAG 3100 P	MAG 3100	MAG 3100 HT
Description	18 ... 1000 Hz random in x, y, z, directions for 2 hours according to EN 60068-2-36		
Sensor		3.17 grms	
Sensor with compact MAG 5000/6000 mounted transmitter		3.17 grms	
MAG 6000 I/6000 I Ex mounted transmitter:		1.14 grms	

Table 8- 6 Media temperature

Version	MAG 3100 P	MAG 3100	MAG 3100 HT
PTFE Teflon	-20 ... +130 °C (-4 ... +266 °F)	-20 ... +100 °C (-4 ... +212 °F)	<ul style="list-style-type: none"> <li>• -20 ... +130 °C (-4 ... +266 °F)</li> <li>• -20 ... +180 °C (-4 ... +356 °F)</li> </ul> Factory mounted grounding rings type E and SS terminal box. Can only be used with remote transmitter.
PFA	-20 ... +150 °C (-4 ... +300 °F)	-20 ... +100 °C (-4 ... +212 °F)	-20 ... +150 °C (-4 ... +300 °F)
Soft rubber		0 ... +70 °C (32 ... 158 °F)	
EPDM		-10 ... +70 °C (14 ... 158 °F)	
Linatex®		-40 ... +70 °C (-40 ... +158 °F) For temperatures below -20 °C (-4 °F) AISI 304 or 316 flanges must be used	
Ebonite		0 ... 95 °C (32 ... 203 °F)	

Table 8- 7 Design

Version	MAG 3100 P	MAG 3100	MAG 3100 HT
Weight	See dimensional drawings		
Flange and housing material	<ul style="list-style-type: none"> <li>Carbon steel ASTM A 105, with corrosion resistant two component epoxy coating (min. 150 µm)</li> </ul>	<ul style="list-style-type: none"> <li>Carbon steel ASTM A 105, with corrosion resistant two component epoxy coating (min. 150 µm)</li> <li>AISI 304 (1.4301) flanges and carbon steel housing, with corrosion resistant two component epoxy coating (min. 150 µm)</li> <li>AISI 316 L (1.4404) flanges and housing, polished</li> </ul>	<ul style="list-style-type: none"> <li>Carbon steel ASTM A 105, with corrosion resistant two component epoxy coating (min. 150 µm)</li> <li>AISI 304 (1.4301) flanges and carbon steel housing, with corrosion resistant two component epoxy coating (min. 150 µm)</li> <li>AISI 316 L (1.4404) flanges and housing, polished</li> </ul>
Measuring pipe material	AISI 304 (1.4301)		
Electrode material	<ul style="list-style-type: none"> <li>Hastelloy C276 (PFA: Hastelloy C22)</li> </ul>	<ul style="list-style-type: none"> <li>AISI 316 Ti (1.4571)</li> <li>Hastelloy C276 (PFA: Hastelloy C22)</li> <li>Platinum/Iridium,</li> <li>Titanium</li> <li>Tantalum</li> </ul>	<ul style="list-style-type: none"> <li>AISI 316 Ti (1.4571)</li> <li>Hastelloy C276 (PFA: Hastelloy C22)</li> <li>Platinum/Iridium,</li> <li>Titanium</li> <li>Tantalum</li> </ul>
Grounding Electrode material	<ul style="list-style-type: none"> <li>PTFE: None</li> <li>PFA: Hastelloy</li> </ul>	Material as measuring electrodes Exceptions - see ordering data	No grounding electrodes
Terminal box (remote version only)	<ul style="list-style-type: none"> <li>Standard fibre glass reinforced polyamide</li> <li>Stainless steel AISI 316 (1.4436)</li> </ul>	<ul style="list-style-type: none"> <li>Standard fibre glass reinforced polyamide</li> <li>Stainless steel AISI 316 (1.4436)</li> </ul>	<ul style="list-style-type: none"> <li>Stainless steel AISI 316 (1.4436)</li> </ul>
Cable entries			

Version	MAG 3100 P	MAG 3100	MAG 3100 HT
Remote installation	<ul style="list-style-type: none"> <li>• 2 x M20</li> <li>• 2 x ½" NPT</li> </ul>	<ul style="list-style-type: none"> <li>• 2 x M20</li> <li>• 2 x ½" NPT</li> </ul>	<ul style="list-style-type: none"> <li>• 2 x M20</li> <li>• 2 x ½" NPT</li> </ul>
Compact installation	MAG 5000/MAG 6000: <ul style="list-style-type: none"> <li>• 4 x M20</li> <li>• 4 x ½" NPT</li> </ul> MAG 6000 I: <ul style="list-style-type: none"> <li>• 2 x M20 (for supply/output)</li> <li>• 2 x ½" NPT</li> </ul> MAG 6000 I Ex de: <ul style="list-style-type: none"> <li>• 2 x M20 (for supply/output)</li> <li>• 2 x ½" NPT</li> </ul>	MAG 5000/MAG 6000: <ul style="list-style-type: none"> <li>• 4 x M20</li> <li>• 4 x ½" NPT</li> </ul> MAG 6000 I: <ul style="list-style-type: none"> <li>• 2 x M20 (for supply/output)</li> <li>• 2 x ½" NPT</li> </ul> MAG 6000 I Ex de: <ul style="list-style-type: none"> <li>• 2 x M20 (for supply/output)</li> <li>• 2 x ½" NPT</li> </ul>	-

Table 8- 8 Certificates and approvals




Version	MAG 3100 P	MAG 3100	MAG 3100 HT
Calibration Standard production calibration, calibration report shipped with sensor	Zero-point, 2 x 25 % and 2 x 90 %	Zero-point, 2 x 25 % and 2 x 90 %	Zero-point, 2 x 25 % and 2 x 90 %
Conforms to	PED (All EN1092-1 flanges conforms to PED) – 97/23 EC1) CRN	PED (All EN1092-1 flanges conforms to PED) – 97/23 EC1) CRN	PED (All EN1092-1 flanges conforms to PED) – 97/23 EC1) CRN
Material certificate EN 10204 3.1	On request	On request	On request

Version	MAG 3100 P	MAG 3100	MAG 3100 HT
Ex approvals	<p>Ex sensor DN 15 ... 300:</p> <ul style="list-style-type: none"> <li>• ATEX 2GD Ex de ia IIC T3 - T6</li> <li>• IEC Ex de e ia IIC T3 - T6</li> <li>• FM Class 1 Div 1(Only compact mounted)</li> <li>• FM Class 1 Zone 1</li> <li>• CSA Class 1 Zone 1</li> </ul> <p>Standard sensors:</p> <ul style="list-style-type: none"> <li>• FM Class 1 Div 2</li> <li>• CSA Class 1, Div 2</li> </ul>	<p>Ex sensor DN 15 ... 300:</p> <ul style="list-style-type: none"> <li>• ATEX 2GD Ex de ia IIC T3 - T6</li> <li>• IEC Ex e ia IIC T3 - T6</li> <li>• FM Class 1 Div 1 (Only compact mounted)</li> <li>• FM Class 1 Zone 1</li> <li>• CSA Class 1 Zone 1</li> </ul> <p>DN 350 ... 2000:</p> <ul style="list-style-type: none"> <li>• Ex e ia IIC T4 - T6</li> <li>• FM Class 1 zone 1</li> <li>• CSA Class 1 zone 1</li> <li>• IEC Ex de ia IIC T3-T6</li> <li>• Ex tD A21 IP67</li> </ul> <p>Standard sensors:</p> <ul style="list-style-type: none"> <li>• FM Class 1 Div 2</li> <li>• CSA Class 1, Div 2</li> </ul>	<p>Ex sensor DN 15 ... 300:</p> <ul style="list-style-type: none"> <li>• ATEX 2GD Ex de ia IIC T3 - T6</li> <li>• IEC Ex de ia IIC T3-T6</li> <li>• FM Class 1 zone 1</li> <li>• CSA Class 1 zone 1</li> </ul> <p>Standard sensors:</p> <ul style="list-style-type: none"> <li>• FM Class 1 Div 2</li> <li>• CSA Class 1, Div 2</li> </ul>
Drinking water approvals		<p>EPDM lining:</p> <ul style="list-style-type: none"> <li>• WRAS (WRc, BS6920 cold water, GB)</li> <li>• NSF/ANSI Standard 61 (Cold water, US)</li> <li>• ACS listed (F)</li> <li>• DVGW W270 (D)</li> <li>• Belgaqua (B)</li> <li>• MCERTS (GB) (EPDM or PTFE lining with AISI 316 or Hastelloy electrodes)</li> </ul>	
Custody transfer (CT) (≤ DN2000) (only with MAG 5000/6000 CT)	<p>Heat meter pattern approval:</p> <ul style="list-style-type: none"> <li>• OIML R 75 (Denmark)</li> </ul> <p>Hot water pattern approval:</p> <ul style="list-style-type: none"> <li>• PTB (Germany)</li> </ul> <p>Other media than water:</p> <ul style="list-style-type: none"> <li>• OIML R 117 (Denmark)</li> </ul>	<p>Cold water pattern approval:</p> <ul style="list-style-type: none"> <li>• DANAK</li> <li>• TS 22.36.001, PTB (Denmark and Germany)</li> </ul> <p>Heat meter pattern approval:</p> <ul style="list-style-type: none"> <li>• OIML R 75 (Denmark)</li> </ul> <p>Hot water pattern approval:</p> <ul style="list-style-type: none"> <li>• PTB (Germany)</li> </ul> <p>Other media than water</p> <ul style="list-style-type: none"> <li>• OIML R 117 (Denmark)</li> </ul>	<p>Heat meter pattern approval</p> <ul style="list-style-type: none"> <li>• OIML R 75 (Denmark)</li> </ul> <p>Hot water pattern approval</p> <ul style="list-style-type: none"> <li>• PTB (Germany)</li> </ul>

1) For sizes larger than 600 mm (24") in PN 16 PED conformity is available as a cost-added option. The basic unit will carry the LVD (Low Voltage Directive) and EMC approval.

## 8.1 Cable data

### Description

Cable for standard electrode or coil	
Electrode cable, double shielded	
Cable kit with standard coil cable and electrode cable double shielded (also available as low noise cable for MAG 1100 sensor )	

### Standard applications

Table 8- 9 Technical data, standard application cables

		Coil cable	Standard electrode cable
<b>Basic data</b>	No. of conductors	2	3
	Min. sqr. area	0.5 mm <sup>2</sup>	0.2 mm <sup>2</sup>
	Shield	Yes	Yes
	Max. capacitance	N/A	350 pF/m
<b>Max. cable loop resistance</b>	Media temperature:		
	< 100 °C	40 Ω	N/A
	> 200 °C	6 Ω	N/A
<b>Cable glands on sensor and transmitter</b>	M20x1.5 gland - Cable ø 5 ... 13 mm (0.20 ... 0.51 inches)		
	½ NPT gland - cable ø 5 ... 9 mm (0.20 ... 0.35 inches)		

### Special applications, e.g. low conductivity or electrical noise

Table 8- 10 Technical data, special application cables

		Coil cable	Special electrode cable
<b>Basic data</b>	No. of conductors	3	3
	Sqr. area	1.5 mm <sup>2</sup>	0.25 mm <sup>2</sup>
	Shield	Yes	Double
	Color code	Brown, blue, black	Brown, blue, black
	Outside color	Grey	Grey
	Ext. diameter	7.8 mm	8.1 mm
	Conductor	Flexible CU	Flexible CU
	Isolation material	PVC	PVC



		Coil cable	Special electrode cable
Ambient temperature	Flexible installation	-5 ... +70°C (23 ... 158°F)	-5 ... +70°C (23 ... 158°F)
	Non-flexible installation	-30 ... +70°C (-22 ... 158°F)	-30 ... +70°C (-22 ... 158°F)
Cable parameter	Capacity	161.50 pF/m	N/A
	Inductance	0.583 μH/m	N/A
	L/R	43.83 pH/Ω	N/A

## 8.2 Pressure / temperature range

The following diagrams and tables show the maximum allowable working pressure at various working temperatures. For maximum allowable working pressure (MAWP) at 20 °C and at maximum working temperature, see the nameplate on the device.

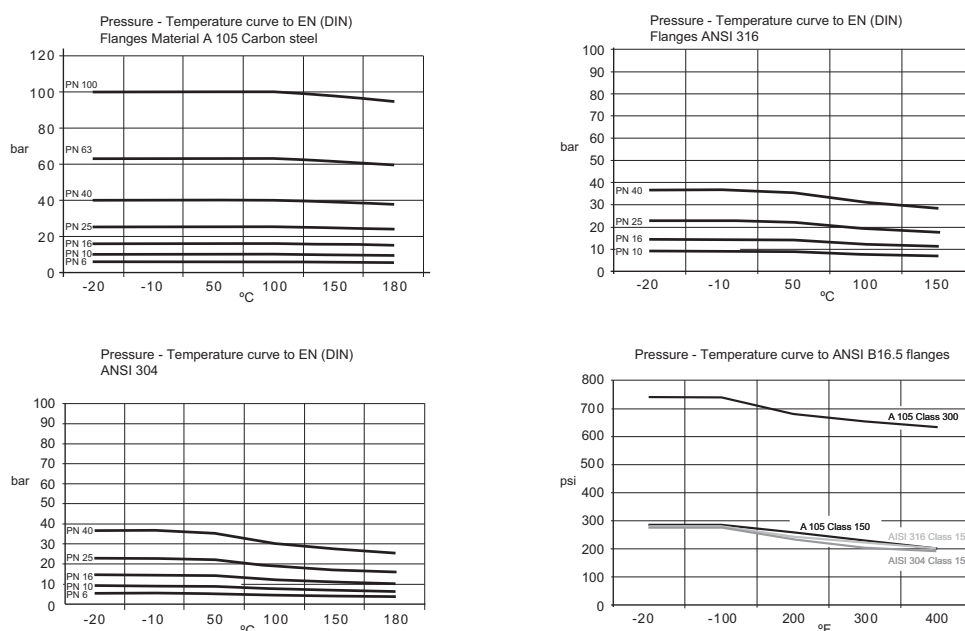


Table 8- 11 Metric measures (pressure in bar) - Sizes 25 mm, 40 mm and >300 mm

Flange specifications	Flange rating	Temperature (°C)			
		-5	10	50	90
EN 1092-1	PN 10	10.0	10.0	9.7	9.4
	PN 16	16.0	16.0	15.5	15.1
	PN 40	40.0	40.0	38.7	37.7

8.3 Process fluid conductivity

Flange specifications	Flange rating	Temperature (°C)			
		-5	10	50	90
ANSI B16.5	150 lb	19.7	19.7	19.3	18.0
AWWA C-207	Class D	10.3	10.3	10.3	10.3

Table 8- 12 Imperial measures (pressure in psi) - Sizes 1", 1½" and >12"

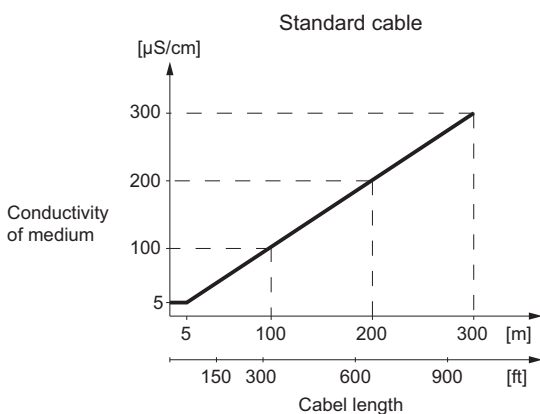
Flange specifications	Flange rating	Temperature (°F)			
		23	50	120	200
EN 1092-1	PN 10	145	145	141	136
	PN 16	232	232	225	219
	PN 40	580	580	561	547
ANSI B16.5	150 lb	286	286	280	261
AWWA C-207	Class D	150	150	150	150

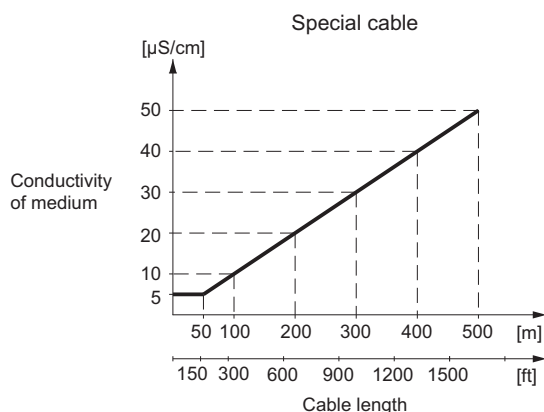
### 8.3 Process fluid conductivity

#### Compact installation

Liquids with an electrical conductivity  $\geq 5 \mu\text{S/cm}$ .

#### Remote installation





**⚠ WARNING**

For detection of empty sensor the min. conductivity must always be  $>50 \mu\text{S/cm}$  and the max. length of the electrode cable when remote mounted is 50 meters (164 ft). Special cable must be used!

For 19" Ex applications with safety barriers special cable cannot be used and the empty pipe function can therefore not be used. For these applications 25 meters (82 ft) of cable can be used in order to obtain 0.2% and 50 meters (164 ft) to obtain 0.4%.

For remote MID installations the max. cable length is 3 meters (9.8 ft). For other CT application standard requirements are applicable.

## 8.4 Liner selection

Table 8- 13

Liner	Applications
EPDM	Drinking Water, Low abrasive media, Food & Beverage
Ebonite	Drinking Water, Wastewater, Fine low abrasive media
PTFE	Drinking Water, Wastewater, Chemicals, Food & Beverage, Pulp & Paper
PFA	Drinking Water, Wastewater, Chemicals, Food & Beverage, Pulp & Paper
Linatex	Abrasive media
Soft rubber	Drinking Water, Wastewater, Abrasive media, Chemicals

## 8.5 Electrode selection

Table 8- 14

Electrodes	Applications	Chemical Resistance
Stainless Steel	Drinking Water, Wastewater, Chemicals, Food & Beverage, Pulp & Paper	Reducing acids, Oxidizing acids, Organic acids, Alkalis, Diluted salts
Hastelloy C22	Drinking Water, Wastewater, Abrasive Liquids, Chemicals, Food & Beverage, Pulp & Paper	Reducing acids, Oxidizing acids, Organic acids, Alkalis, Diluted salts
Hastelloy C267	Drinking Water, Wastewater, Abrasive Liquids, Chemicals, Food & Beverage, Pulp & Paper	Reducing acids, Oxidizing acids, Organic acids, Alkalis, Diluted salts
Titanium	Drinking Water, Wastewater, Chemicals, Food & Beverage, Pulp & Paper	Reducing acids, Oxidizing acids, Organic acids, Alkalis, Diluted salts
Tantalum	Drinking Water, Wastewater, Chemicals, Food & Beverage, Pulp & Paper	Reducing acids, Oxidizing acids, Organic acids, Alkalis, Diluted salts
Platinum	Drinking Water, Wastewater, Chemicals, Food & Beverage, Pulp & Paper	Reducing acids, Oxidizing acids, Organic acids, Alkalis, Diluted salts

## 8.6 Dimensions and weight

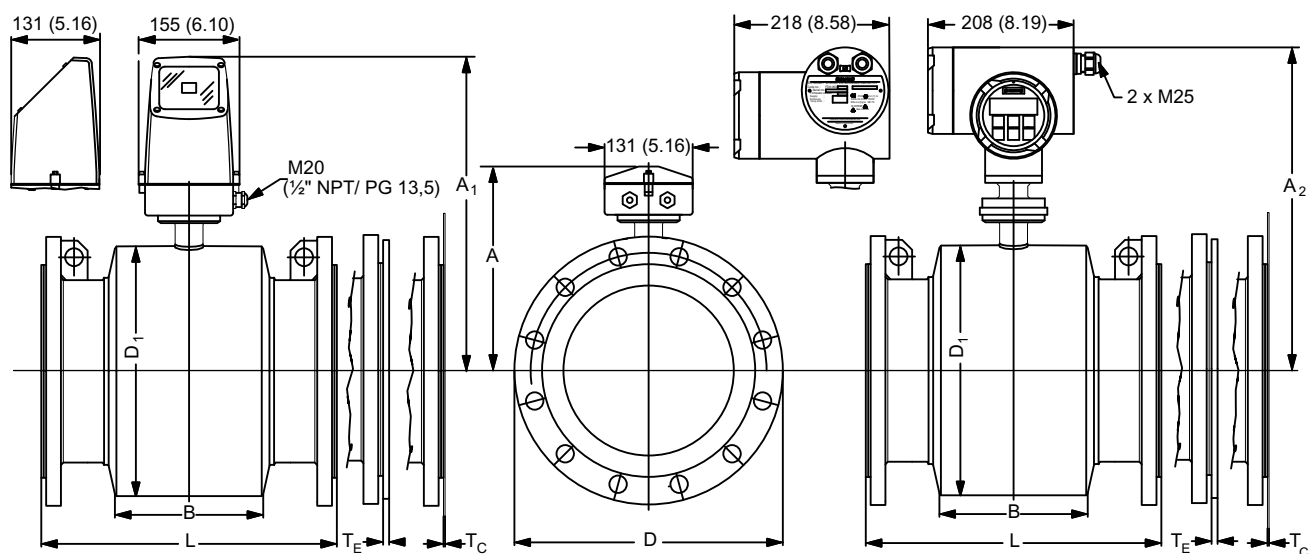


Table 8- 15 Dimensions

Nominal size		A <sup>1)</sup>		A <sub>1</sub> /A <sub>2</sub> <sup>8)</sup>		B		D <sub>1</sub>	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
15	1/2	187	7.4	338	13.4	59	2.4	104	4.1
25	1	187	7.4	338	13.4	59	2.4	104	4.1
40	1 1/2	197	7.8	348	13.7	82	3.3	124	4.9
50	2	205	8.1	356	14.1	72	2.9	139	5.5
65	2 1/2	212	8.3	363	14.3	72	2.9	154	6.1
80	3	222	8.7	373	14.7	72	2.9	174	6.9
100	4	242	9.5	393	15.5	85	3.4	214	8.5
125	5	255	10.0	406	16	85	3.4	239	9.5
150	6	276	10.9	427	16.9	85	5.4	282	11.1
200	8	304	12.0	455	18	137	5.4	338	13.4
250	10	332	13.1	483	19.1	157	6.2	393	15.5
300	12	357	14.1	508	20.0	157	6.2	444	17.5
350	14	362	14.3	513	20.2	270	10.7	451	17.8
400	16	387	15.2	538	21.2	270	10.7	502	19.8
450	18	418	16.5	569	22.4	310	12.2	563	22.2
500	20	443	17.4	594	23.4	350	13.8	614	24.2
600	24	494	19.4	645	25.4	320	12.6	715	28.2
700	28	544	21.4	695	27.4	450	17.8	816	32.2
750	30	571	22.5	722	28.5	556	21.9	869	34.3
800	32	606	23.9	757	30.0	560	22.1	927	36.5
900	36	653	25.7	804	31.7	630	24.9	1032	40.7
1000	40	704	27.7	906	35.7	670	26.4	1136	44.8

8.6 Dimensions and weight

Nominal size		A <sup>1)</sup>		A <sub>1</sub> /A <sub>2</sub> <sup>8)</sup>		B		D <sub>1</sub>	
1050	42	704	27.7	906	35.7	670	26.4	1136	44.8
1100	44	755	29.7	906	35.7	770	30.4	1238	48.8
1200	48	810	31.9	961	37.9	792	31.2	1348	53.1
1400	54	925	36.4	1076	42.4	1000	39.4	1675	66.0
1500	60	972	38.2	1123	44.3	1020	40.2	1672	65.9
1600	66	1025	40.4	1176	46.3	1130	44.5	1915	75.4
1800	72	1123	44.2	1274	50.2	1250	49.3	1974	77.8
2000	78	1223	48.1	1374	55.0	1375	54.2	2174	85.6

<sup>1)</sup>:14.5 mm shorter with AISI terminal box (Ex and high temperature version)

<sup>8)</sup>:A<sub>2</sub> is 3 mm shorter than A<sub>1</sub>

Table 8- 16 Built-in lengths

Nominal size		L <sup>2)</sup>											
		EN 1092-1-201											
		PN 6 / 10		PN 16 / PN 16 non-PED		PN 25		PN 40		PN 63		PN 100	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
15	1	-	-	-	-	-	-	200	7.9	-	-	-	-
25	1	-	-	-	-	-	-	200	7.9	-	-	260	10.3
40	1½	-	-	-	-	-	-	200	7.9	-	-	280	11.1
50	2	-	-	-	-	-	-	200	7.9	276	10.9	300	11.9
65	2½	200	7.9	200 / -	7.9 / -	-	-	200	7.9	320	12.6	350	13.8
80	3	200	7.9	200 / -	7.9 / -	-	-	272	10.8	323	12.8	340	13.4
100	4	250	9.8	250 / -	9.8 / -	-	-	250	9.9	380	15.0	400	-
125	5	250	9.8	250 / -	9.8 / -	-	-	250	9.9	420	16.6	450	-
150	6	300	11.8	300 / -	11.8 / -	-	-	300	11.9	415	16.4	450	-
200	8	350	13.8	350 / -	13.8 / -	350	13.8	350	13.8	480	18.9	530	-
250	10	450	17.7	450 / -	17.7 / -	450	17.7	450	17.8	550	-	620	-
300	12	500	19.7	500 / -	19.7 / -	500	19.7	500	19.7	600	-	680	-
350	14	550	21.7	550 / -	21.7 / -	550	21.7	550	21.7	-	-	-	-
400	16	600	23.6	600 / -	23.6 / -	600	23.6	600	23.7	-	-	-	-
450	18	600	23.6	600 / -	23.6 / -	600	23.6	600	23.7	-	-	-	-
500	20	600	23.6	600 / -	23.6 / -	625	-	680	26.8	-	-	-	-
600	24	600	23.6	600 / -	23.6 / -	750	30	800	31.5	-	-	-	-
700	28	700	27.6	875 / 700	31.5 / 27.6	-	-	-	-	-	-	-	-
750	30	-	-	-	-	-	-	-	-	-	-	-	-
800	32	800	31.5	1000 / 800	39.4 / 31.5	-	-	-	-	-	-	-	-
900	36	900	35.4	1125 / 900	49.2 / 35.4	-	-	-	-	-	-	-	-

Nominal size		L <sup>2)</sup>											
		EN 1092-1-201											
		PN 6 / 10		PN 16 / PN 16 non-PED		PN 25		PN 40		PN 63		PN 100	
1000	40	1000	39.4	1250 / 1000	49.2 / 39.4	-	-	-	-	-	-	-	-
1050	42	-	-	-	-	-	-	-	-	-	-	-	-
1100	44	-	-	-	-	-	-	-	-	-	-	-	-
1200	48	1200	47.2	1500 / 1200	59.1 / 47.2	-	-	-	-	-	-	-	-
1400	54	1400	55.1	- / 1400	- / 55.1	-	-	-	-	-	-	-	-
1500	60	1500	59.1	- / 1500	- / 59.1	-	-	-	-	-	-	-	-
1600	66	1600	63.0	- / 1600	- / 63.0	-	-	-	-	-	-	-	-
1800	72	1800	70.9	- / 1800	- / 70.9	-	-	-	-	-	-	-	-
2000	78	2000	78.7	- / 2000	- / 78.7	-	-	-	-	-	-	-	-

<sup>2)</sup>:When earthing flanges are used, the thickness of the earthing flange must be added to the built-in length

Table 8- 17 Built-in lengths

Nominal size		L <sup>2)</sup>											
		ANSI 16.5 Class 150		ANSI 16.5 Class 300		AS 2129 E AS 4087 PN 16, 21,35		AWWA C-207 Class D		JIS K10		JIS K20	
		mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
15	1	200	7.9	200	7.9	200	7.9	-	-	200	7.9	200	7.9
25	1	200	7.9	200	7.9	200	7.9	-	-	200	7.9	200	7.9
40	1½	200	7.9	200	7.9	200	7.9	-	-	200	7.9	240	9.5
50	2	200	7.9	200	7.9	200	7.9	-	-	200	7.9	240	9.5
65	2½	200	7.9	272	10.8	200	7.9	-	-	200	7.9	272	10.7
80	3	272	10.8	272	10.8	200 <sup>5)</sup>	7.9	-	-	200	7.9	272	10.7
100	4	250	9.9	310	12.2	250	9.9	-	-	250	9.9	310	12.2
125	5	250	9.9	335	13.1	250	9.9	-	-	250	9.9	335	13.2
150	6	300	11.8	300	11.9	300	11.9	-	-	300	11.9	300	11.9
200	8	350	13.8	350	13.8	350	13.8	-	-	350	13.8	350	13.8
250	10	450	17.7	450	17.8	450	17.8	-	-	450	17.8	450	17.8
300	12	500	19.7	500	19.7	500	19.7	-	-	500	19.7	500	19.7
350	14	550	21.7	550	21.7	550	21.7	-	-	550	21.7	550	21.7
400	16	600	23.7	600	23.7	600	23.7	-	-	600	23.7	600	23.7
450	18	600	23.7	640	23.7	600	23.7	-	-	600	23.7	640	25.2

8.6 Dimensions and weight

Nominal size		L <sup>2)</sup>											
		ANSI 16.5 Class 150		ANSI 16.5 Class 300		AS 2129 E AS 4087 PN 16, 21,35		AWWA C-207 Class D		JIS K10		JIS K20	
500	20	600	23.7	730	28.7	600 <sup>6)</sup>	23.7	-	-	600	23.7	680	26.8
600	24	600	23.7	860	33.8	600 <sup>7)</sup>	23.7	-	-	600	23.7	800	31.5
700	28	-	-	-	-	700 <sup>9)</sup>	-27.6	700	27.6	-	-	-	-
750	30	-	-	-	-	750 <sup>9)</sup>	-	750	29.6	-	-	-	-
800	32	-	-	-	-	800 <sup>9)</sup>	31.5	800	31.5	-	-	-	-
900	36	-	-	-	-	900 <sup>9)</sup>	35.5	900	35.5	-	-	-	-
1000	40	-	-	-	-	1000 <sup>9)</sup>	39.4	1000	39.4	-	-	-	-
1050	42	-	-	-	-	-	-	1050	39.4	-	-	-	-
1100	44	-	-	-	-	1100 <sup>9)</sup>	43.4	1100	43.4	-	-	-	-
1200	48	-	-	-	-	1200 <sup>9)</sup>	47.3	1200	47.3	-	-	-	-
1400	54	-	-	-	-	-	-	1400	55.2	-	-	-	-
1500	60	-	-	-	-	-	-	1500	59.1	-	-	-	-
1600	66	-	-	-	-	-	-	1600	63.0	-	-	-	-
1800	72	-	-	-	-	-	-	1800	70.9	-	-	-	-
2000	78	-	-	-	-	-	-	2000	78.8	-	-	-	-

2):When earthing flanges are used, the thickness of the earthing flange must be added to the built-in length

5):PN 35 DN 80 = 272 mm

6):PN 35 DN 500 = 680 mm

7):PN 35 DN 600 = 750 mm

9):Not AS 4087 PN 21 or PN 35

Table 8- 18 Grounding rings

Nominal size		T <sub>c</sub> <sup>3)</sup>		T <sub>E</sub> <sup>3)</sup>		T <sub>F</sub> <sup>3)</sup>		Wgt. <sup>4)</sup>	
mm	inch	mm	inch	mm	inch	mm	inch	kg	lbs
15	1	--	0.1	6	0.3	2	0.1	4	9
25	1	1.2	0.1	6	0.3	2	0.1	5	11
40	1½	1.2	0.1	6	0.3	2	0.1	8	17
50	2	1.2	0.1	6	0.3	2	0.1	9	20
65	2½	1.2	0.1	6	0.3	2	0.1	11	24
80	3	1.2	0.1	6	0.3	2	0.1	12	26
100	4	1.2	0.1	6	0.3	2	0.1	16	35
125	5	1.2	0.1	6	0.3	2	0.1	19	42
150	6	1.2	0.1	6	0.3	2	0.1	27	60
200	8	1.2	0.1	8	0.3	2	0.1	40	88
250	10	1.2	0.1	8	0.4	2	0.1	60	132
300	12	1.6	0.1	8	0.4	2	0.1	80	176



Nominal size		T <sub>C</sub> <sup>3)</sup>		T <sub>E</sub> <sup>3)</sup>		T <sub>F</sub> <sup>3)</sup>		Wgt. <sup>4)</sup>	
350	14	1.6	0.1	8	0.4	-	-	110	242
400	16	1.6	0.1	10	0.4	-	-	125	275
450	18	1.6	0.1	10	0.4	-	-	175	385
500	20	1.6	0.1	10	0.4	-	-	200	440
600	24	1.6	0.1	10	0.4	-	-	287	633
700	28	2.0	0.1	-	-	-	-	330	728
750	30	2.0	0.1	-	-	-	-	360	794
800	32	2.0	0.1	-	-	-	-	450	992
900	36	2.0	0.1	-	-	-	-	530	1168
1000	40	2.0	0.1	-	-	-	-	660	1455
1050	42	2.0	0.1	-	-	-	-	660	1455
1100	44	2.0	0.1	-	-	-	-	1140	2513
1200	48	2.0	0.1	-	-	-	-	1180	2601
1400	54	2.0	0.1	-	-	-	-	1600	3528
1500	60	3.0	0.1	-	-	-	-	2460	5423
1600	66	3.0	0.1	-	-	-	-	2525	5566
1800	72	3.0	0.1	-	-	-	-	2930	6460
2000	78	3.0	0.1	-	-	-	-	3665	8080

<sup>3)</sup>:T<sub>C</sub> = Type C grounding ring

T<sub>E</sub> = Type E grounding ring (included and factory-mounted on high-temperature 180 °C PTFE sensor)

T<sub>F</sub> = Flat type grounding rings

<sup>4)</sup>:Weights are approx. (for PN 16) without transmitter



## Spare parts/Accessories

### 9.1 Ordering

In order to ensure that the ordering data you are using is not outdated, the latest ordering data is always available on the Internet: Process instrumentation catalog (<http://www.siemens.com/processinstrumentation/catalogs>)



## Factory settings

### Dimension-dependent factory settings

Table A- 1 50 Hz version

DN		Qmax			Unit	Volume/ pulse	Pulse unit	Totalizer unit
mm	Inch	Fac. settings	Min.	Max.				
15	½	2000	159	636	l/h	1	l	l
25	1	5000	441	17671	l/h	10	l	l
40	1½	12	1.1	45	m³/h	10	l	l
50	2	20	1.7	70	m³/h	10	l	l
65	2½	30	2.9	119	m³/h	100	l	l
80	3	50	4.5	180	m³/h	100	l	l
100	4	120	7	282	m³/h	100	l	l
125	5	180	11	441	m³/h	100	l	m³
150	6	250	15.9	636	m³/h	100	l	m³
200	8	400	28.2	1130	m³/h	1	m³	m³
250	10	700	44.1	1767	m³/h	1	m³	m³
300	12	1000	63.6	2544	m³/h	1	m³	m³
350	14	1200	86.5	3463	m³/h	1	m³	m³
400	16	1800	113	4523	m³/h	1	m³	m³
450	18	2000	143.1	5725	m³/h	1	m³	m³
500	20	3000	176.7	7068	m³/h	1	m³	m³
600	24	4000	254.4	10178	m³/h	10	m³	m³
700	28	5000	346.3	13854	m³/h	10	m³	m³
750	30	6000	397.6	15904	m³/h	10	m³	m³
800	32	7000	452.3	18095	m³/h	10	m³	m³
900	36	9000	572.5	22902	m³/h	10	m³	m³
1000	40	12000	706.8	28274	m³/h	10	m³	m³
1050	42	12000	706.8	28274	m³/h	10	m³	m³
1100	44	14000	855.2	34211	m³/h	10	m³	m³
1200	48	15000	1017.8	40715	m³/h	10	m³	m³
1400	54	25000	1385.4	55417	m³/h	10	m³	m³
1500	60	30000	1590.4	63617	m³/h	10	m³	m³
1600	66	35000	1809.5	72382	m³/h	10	m³	m³
1800	72	40000	2290.2	91608	m³/h	10	m³	m³
2000	78	45000	2827.4	113097	m³/h	10	m³	m³

Table A-2 60 Hz version

DN		Qmax			Unit	Volume/ pulse	Pulse unit	Totalizer unit
mm	Inch	Fac. settings	Min.	Max.				
15	½	<b>8.8</b>	0.7	28.0	US GPM	1	US G	US G
25	1	<b>22</b>	1.9	77.8	US GPM	1	US G	US G
40	1½	<b>52</b>	4.9	199.1	US GPM	1	US G	US G
50	2	<b>88</b>	7.7	311.2	US GPM	1	US G	US G
65	2½	<b>132</b>	13.1	525.9	US GPM	1	US G	US G
80	3	<b>220</b>	19.9	796.7	US GPM	1	US G	US MG
100	4	<b>528</b>	31.1	1244.8	US GPM	1	US G	US MG
125	5	<b>793</b>	48.6	1945.1	US GPM	1	US G	US MG
150	6	<b>1101</b>	70	2800.9	US GPM	1	US G	US MG
200	8	<b>1761</b>	124.4	4979.5	US GPM	1	US G	US MG
250	10	<b>3082</b>	194.5	7780.5	US GPM	1	US G	US MG
300	12	<b>4402</b>	280	11203.9	US GPM	1	US G	US MG
350	14	<b>5283</b>	381.2	15249.7	US GPM	1	US G	US MG
400	16	<b>7925</b>	497.9	19918.1	US GPM	1	US G	US MG
450	18	<b>8806</b>	630.2	25208.8	US GPM	1	US G	US MG
500	20	<b>13209</b>	778	31122	US GPM	1	US G	US MG
600	24	<b>17611</b>	1120.3	44815.7	US GPM	10	US G	US MG
700	28	<b>19812</b>	1524.9	60999.1	US GPM	10	US G	US MG
750	30	<b>22014</b>	1750.6	70024.5	US GPM	10	US G	US MG
800	32	<b>30820</b>	1991.8	79672.4	US GPM	10	US G	US MG
900	36	<b>39626</b>	2522.8	100835.3	US GPM	10	US G	US MG
1000	40	<b>52834</b>	3112.2	124488.1	US GPM	10	US G	US MG
1050	42	<b>52834</b>	3431.2	137248.1	US GPM	10	US G	US MG
1100	44	<b>61640</b>	3765.7	150630.6	US GPM	10	US G	US MG
1200	48	<b>66043</b>	4481	179262.9	US GPM	10	US G	US MG
1400	54	<b>110072</b>	6099.9	243993.7	US GPM	1000	US G	US MG
1500	60	<b>132086</b>	7002.4	280098.3	US GPM	1000	US G	US MG
1600	66	<b>154100</b>	7967.2	318689.6	US GPM	1000	US G	US MG
1800	72	<b>176115</b>	10083.5	403341.5	US GPM	1000	US G	US MG
2000	78	<b>198129</b>	12448.8	497952.5	US GPM	1000	US G	US MG

## Flange mating dimensions (metric)

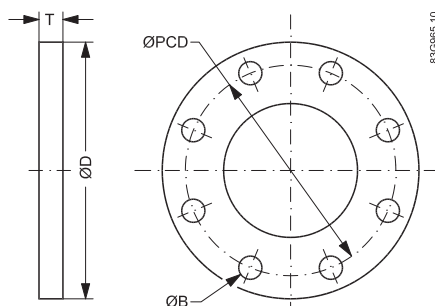


Figure B-1 Flange mating dimensions

Table B- 1 Flange mating dimensions (metric)

mm	Dimensions (mm)				Bolting	
	D	PCD	T	B	Holes	Bolts
<b>PN10</b>						
200	340	295	24	22	8	M20
250	395	350	26	22	12	M20
300	445	400	26	22	12	M20
350	505	460	28	22	16	M20
400	565	515	32	26	16	M24
450	615	565	36	26	20	M24
500	670	620	38	26	20	M24
600	780	725	42	3	20	M27
700	895	840	30	30	24	M27
800	1015	950	32	33	24	M30
900	1115	1050	34	33	28	M30
1000	1230	1160	34	36	28	M33
1200	1455	1380	38	39	32	M36
<b>PN16</b>						
50	165	125	19	18	4	M16
65	185	145	20	18	8	M16
80	200	160	20	18	8	M16
100	220	180	22	18	8	M16
125	250	210	22	18	8	M16
150	285	240	24	22	8	M20
200	340	295	26	22	12	M20
250	405	355	29	26	12	M24
300	460	410	32	26	12	M24

Flange mating dimensions (metric)

mm	Dimensions (mm)				Bolting	
	D	PCD	T	B	Holes	Bolts
350	520	470	35	26	16	M24
400	580	525	38	30	16	M27
450	640	585	42	30	20	M27
500	715	650	46	33	20	M30
600	840	770	52	36	20	M33
700	910	840	36	36	24	M33
800	1025	950	38	39	24	M36
900	1125	1050	40	39	28	M36
1000	1255	1170	42	42	28	M39
1200	1485	1390	48	48	32	M45
<b>PN40</b>						
15	95	65	14	14	4	M12
25	115	85	16	14	4	M16
40	150	110	18	18	4	M16
<b>150 lb</b>						
15	89	60	12	16	4	M12
25	108	79	16	16	4	M16
40	127	98	18	16	4	M16
50	152	121	19	19	4	M16
65	178	140	22	19	4	M16
80	190	152	24	19	4	M16
100	229	191	24	19	8	M16
125	254	216	24	22	8	M20
150	279	241	25	22	8	M20
200	343	298	29	22	8	M20
250	406	362	30	25	12	M24
300	483	432	32	25	12	M24
350	533	476	35	28	12	M27
400	597	540	36.5	28	16	M27
450	635	578	40	32	16	M30
500	699	635	43	32	20	M30
600	813	749	48	35	20	M33
<b>AWWA</b>						
700	927	864	33	35	28	M33
750	984	914	35	35	28	M33
800	1060	978	38	41	28	M39
900	1168	1068	41	41	32	M39
1000	1289	1200	41	41	36	M39
1050	1346	1257	44	41	36	M39
1200	1511	1422	48	41	44	M39



# Coil resistance



DN	Inch	MAG 3100 MAG 3100 P	
		Coil resistance $\Omega$	Tolerance $\Omega$
15	1/2"	100	-25/+60
25	1"	100	-25/+60
DN40	1 1/2"	100	-25/+60
DN50	2"	100	-25/+60
DN65	2 1/2"	100	-25/+60
DN80	3"	100	-25/+60
DN100	4"	100	-25/+60
DN125	5"	100	-25/+60
DN150	6"	100	-25/+60
DN200	8"	100	-25/+60
DN250	10"	100	-25/+60
DN300	12"	100	-25/+60
DN400	16"	100	-25/+60
DN450	18"	100	-25/+60
DN500	20"	100	-25/+60
DN600	24"	100	-25/+60
DN700	28"	100	-25/+60
DN800	32"	100	-25/+60
DN900	36"	100	-25/+60
DN1000	40"	100	-25/+60
DN1100	44"	100	-25/+60
DN1200	48"	100	-25/+60
DN1400	54"	100	-25/+60
DN1500	60"	100	-25/+60
DN1600	66"	100	-25/+60
DN1800	72"	100	-25/+60
DN2000	78"	100	-25/+60



# Glossary

## ASIC

Application-Specific Integrated Circuit is an integrated circuit (IC) customized for a particular use, rather than intended for general-purpose use.

## EMC

Electromagnetic compatibility (EMC) is the branch of electrical sciences which studies the unintentional generation, propagation and reception of electromagnetic energy with reference to the unwanted effects (Electromagnetic Interference, or EMI) that such energy may induce. The goal of EMC is the correct operation, in the same electromagnetic environment, of different equipment which use electromagnetic phenomena, and the avoidance of any interference effects.

## HART

HART Communication is a bi-directional industrial field communication protocol used to communicate between intelligent field instruments and host systems. HART is the global standard for smart process instrumentation and the majority of smart field devices installed in plants worldwide are HART-enabled. HART technology is easy to use and very reliable

## IP

An IP (Ingress Protection) number is used to specify the environmental protection of enclosures around electronic equipment. These ratings are determined by specific tests. The IP number is composed of two numbers, the first referring to the protection against solid objects and the second against liquids. The higher the number, the better the protection. For example, in IP67 the first Number (6) means that the device is totally protected against dust, and the second (7) that it is protected against the effect of immersion between 15cm and 1m

## MODBUS

MODBUS is a serial communications protocol intended for use with programmable logic controllers (PLCs). MODBUS allows for communication between many devices connected to the same network, for example a system that measures temperature and humidity and communicates the results to a computer. MODBUS is often used to connect a supervisory computer with a remote terminal unit (RTU) in supervisory control and data acquisition systems.

## NAMUR

Normenarbeitsgemeinschaft für Meß- und Regeltechnik in der Chemischen Industrie (NAMUR). NAMUR is a group representing the interests of the chemical industry which create standards for instrumentation and electrical devices used in industrial plants.

## **PED**

The Pressure Equipment Directive (97/23/EC) is the legislative framework on European level for equipment subject to a pressure hazard. It was adopted by the European Parliament and the European Council in May 1997 and has been obligatory throughout the European Union since May 2002.

## **PROFIBUS**

PROFIBUS (Process Field Bus) is a vendor-independent, open bus system standardized in the German DIN 19 245. It is a standard for field bus communication in automation technology and should not be confused with the PROFINET standard for industrial Ethernet. PROFIBUS-PA (Process Automation) is one of three PROFIBUS variants that are compatible with each other. PROFIBUS-DP (Decentralized Periphery)

## **SENSORPROM**

All sensor related settings/data saved on an EPROM. SENSORPROM technology automatically configures the transmitter at start up providing calibration data, pipe size, sensor type, and output settings. The SENSORPROM automatically stores values or settings changed by users, and automatically re-programs any new transmitter without loss of accuracy.

## **Turndown ratio**

'Turndown ratio' is a flow measurement term indicating the range a specific flow meter, or meter type, is able to measure with acceptable accuracy. It is also known as rangeability. If a gas flow to be measured is expected to vary between 100,000 m<sup>3</sup> per day and 1,000,000 m<sup>3</sup> per day, the specific application has a turndown ratio of at 10:1. Therefore the meter requires a turndown ratio of at least 10:1.

## **USM**

USM II is a Communication Platform. The Siemens USM II concept enables fitting of add-on bus modules without loss of functionality:

1. All modules can be fitted as true "plug & play"
2. Module and transmitter are automatically configured through the SENSORPROM

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## For more information

[www.siemens.com/flow](http://www.siemens.com/flow)

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