

# Electromagnetic flowmeters

MAG 1100, MAG 1100 F, MAG 3100, MAG 3100 P, MAG 5100 W  
MAG 5000, MAG 6000






Operating Instructions • 07/2010







SITRANS F

**SIEMENS**

Siemens Flow Instruments  
range of electromagnetic  
flowmeters


	MAG 1100 	MAG 1100 F 	MAG 3100 	MAG 3100 P 	MAG 5100 W 
<b>Size [mm/inch]</b>	DN 2 ... 100/ 1/12" ... 4"	DN 10 ... 100/ 3/8" ... 4"	DN 15 ... 2000/ 1/2" ... 78"	DN 15 ... 300/ 1/2" ... 12"	DN 25 ... 2000/ 1" ... 78"
<b>Connection</b>	Flangeless (Sandwich design)	Weld-in adapter, clamp adapter, thread adapter	Flange	Flange	Flange
<b>Pressure [bar/psi]</b>	Max. 40/600	Max. 40/600	Max. 100/1450	Max. 50/725	Max. 40/600
<b>Temperature [°C/°F]</b>	-30 ... +200/ -20 ... 400	-30 ... +150/ -20 ... 300	-40 ... +180/ -40 ... 350	-20 ... +150/ -4 ... 300	-10 ... +70/ -14 ... 160
<b>Liner</b>	Zirconium oxide (ZrO <sub>2</sub> ) Ceramic (Al <sub>2</sub> O <sub>3</sub> ), PFA	Ceramic (Al <sub>2</sub> O <sub>3</sub> ), PFA	Neoprene, EPDM, Teflon (PTFE), Ebonite, Linatex® PFA	PTFE, PFA	EPDM, NBR, Ebonite
<b>Electrodes</b>	Platinum Hastelloy C	Platinum Hastelloy C	AISI 316 Ti, Hastelloy C, Platinum/Iridium, Titanium, Tantalum, Grounding electrodes	Hastelloy C	Hastelloy C, Grounding electrodes
<b>Enclosure</b>	IP67/NEMA 4X	IP67/NEMA 4X	IP67/IP68 NEMA 4X/6 / NEMA 6P	IP67/IP68 NEMA 4X/6 / NEMA 6P	IP67/IP68 NEMA 4X/6 / NEMA 6P
<b>Ex-version</b>	ATEX 2G D FM Class 1, Div 2	ATEX 2G D FM Class 1, Div 2	ATEX 2G D FM/CSA Class 1, Div 2	ATEX 2G D FM/CSA Class 1, Div 2	FM Class 1, Div 2


	MAG 5000 	MAG 6000 
<b>Outputs</b>	1 current output 1 digital output 1 relay output	1 current output 1 digital output 1 relay output
<b>Flow direction</b>	Uni/bidirectional	Uni/bidirectional
<b>Communication</b>	Optional HART®	Add-on modules, HART, Profibus PA & DP, MODBUS RTU, DeviceNet, Foundation Fieldbus H1
<b>Display</b>	3 lines 20 characters (optional without display)	3 lines 20 characters (optional without display)
<b>Meter uncertainty</b>	±0.4% o.r.	±0.20% o.r.
<b>Enclosure</b>	IP67, IP20 NEMA 6 (NEMA 4X), NEMA 2	IP67, IP20 NEMA 6 (NEMA 4X), NEMA 2
<b>Custody transfer approval</b>	MI-001 PTB OIML R 49	MI-001 PTB (hot and cold water) OIML R 49 OIML R 75 OIML R 117
<b>Approvals</b>	ATEX 2G D FM/CSA Class 1, Div 2	ATEX 2G D FM/CSA Class 1, Div 2
<b>Power supply</b>	12 ... 24 V AC/DC 115 ... 230 V AC	12 ... 24 V AC/DC 115 ... 230 V AC
<b>Batch</b>	No	Yes

	MAG 6000 Industry 	MAG 8000 
<b>Refer to</b>	Operating manual A5E02083319	Operating manual 083R9174

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**1. Introduction**

 For safety reasons it is important that the following points, especially the points marked with a warning sign, are read and understood before the system is being installed:

- Installation, connection, commissioning, and service must be carried out by personnel who are qualified and authorized to do so.
- It is very important that the same people have read and understood the instructions and directions provided in this manual and that they follow the instructions and directions before putting the equipment into use!
- People who are authorized and trained by the owner of the equipment may operate the equipment.
- The installer must ensure that the measuring system is correctly connected and is in accordance with the connection diagram. The transmitter has to be earthed by means of a 4 mm<sup>2</sup> potential equalising conductor.
- In applications where the operating pressure or media can be hazardous in the event of a pipe failure, we recommend that special precautions are taken during the installation of the sensor, such as sensor location, guarding or the use of a pressure relief valve.
- Siemens Flow Instruments can provide assistance with the selection of sensor parts in contact with the media. 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.
- Equipment used in hazardous areas must be Ex-approved and marked . It is required that the "Special Conditions for Safe Use" provided in the manual and in the Ex certificate are followed!
- Installation of the equipment must comply with national regulations. Example EN 60079-14 for the European Community.
- Repair and service can be done by approved Siemens Flow Instruments personnel only.

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**Manufacturer's design and safety statement**

1. Responsibility for the choice of lining and electrode materials with regard to their abrasion and corrosion resistance lies with the purchaser; the effect of any change in process medium during the operating life of the flowmeter should be taken into account. Incorrect selection of lining and/or electrode materials could lead to a failure of the flowmeter.
2. It is the responsibility of the user to ensure that stresses and loading caused by earthquakes, traffic, high winds and fire damage are taken into account during installation, when appropriate. These forces are not taken into account during flowmeter design.
3. It is the responsibility of the user to ensure that the flowmeter is installed such that it does not act as a focus for pipeline stresses. External loading are not taken into account during flowmeter design.
4. During operation do not exceed the pressure and/or temperature ratings indicated on the data label or in the installation instructions.
5. It is the responsibility of the user to ensure that all installations include over pressure protection, means for draining/venting, and that adequate protection is provided to minimize any risk of contact with hot surfaces.
6. Under the Pressure Equipment Directive this product is a pressure accessory, and not approved for use as a safety accessory, as defined by the Pressure Equipment Directive.
7. Removal of the terminal box except by Siemens Flow Instruments or their approved agents will invalidate the PED conformity of the product.

In accordance with the Pressure Equipment Directive (97/23/EC)



### 1.1 Product introduction

Electromagnetic flowmeters are suitable for measuring the flow of almost all electrically conducting liquids, pastes and slurries.

A prerequisite is that the medium must have a minimum conductivity of 5  $\mu\text{S}/\text{cm}$  and a solid content of maximum 40%. The temperature, pressure, density, and viscosity have no influence on the result. The main applications of the electromagnetic flowmeters can be found in the following sectors:

- Water and wastewater
- Chemical and pharmaceutical industries
- Food and beverage industry
- Mining, aggregates and cements industries
- Pulp and paper industry
- Steel industry
- Power; utility and chilled water industry

The wide variety of combinations and versions from the modular system means that ideal adaptation is possible to each measuring task.

SITRANS F M electromagnetic flowmeters are characterised by simplicity:

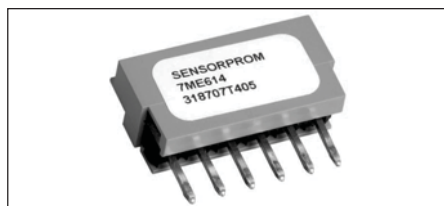
- ⇒ Simple to install
- ⇒ Simple to commission
- ⇒ Simple to operate
- ⇒ Simple to maintain

SITRANS F M electromagnetic flowmeters are manufactured by Siemens Flow Instruments A/S - one of the world's leading manufacturers of flowmeters.



All SITRANS F M electromagnetic flowmeters feature a unique SENSORPROM® memory unit which stores sensor calibration data and transmitter settings for the lifetime of the product. At commissioning the flowmeter commences measurement without any initial programming.

The factory settings matching the sensor are stored in the SENSORPROM® unit. Also customer-



specified settings are downloaded to the SENSORPROM® unit. Should the transmitter be replaced, the new transmitter will upload all previous settings and resume measurement without any need for re-programming.

Furthermore, the "fingerprint" used in connection with the Siemens Flow Instruments Verificator is stored during the sensor calibration.

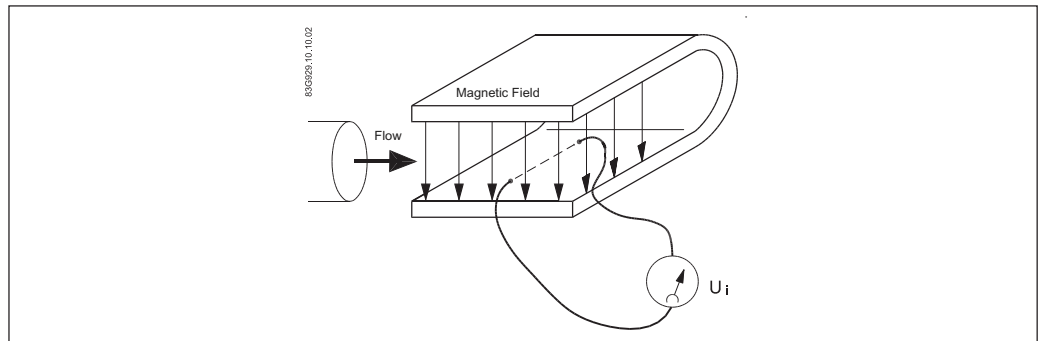


#### USM II "Plug & Play" add-on communication modules.

USM II - the Universal Signal Module with "Plug & Play" simplicity makes it easy to access and integrate the flow measurement with almost any system. It ensures the flowmeter will be easy to upgrade to new communication platforms in the future, too.

## 1.2 Mode 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**

A flowmeter consists of a sensor (MAG 1100, MAG 1100 F, MAG 3100, MAG 3100 P or MAG 5100 W) and a transmitter (MAG 5000 or 6000).

### SENSOR

The sensor converts the flow into an electrical voltage ( $U_i$ ) proportional to the velocity of the flow. The sensor is built up of a stainless steel pipe, 2 coils, electrodes, an isolating liner, housing and, where applicable, connecting flanges.

### TRANSMITTER

The transmitter consists of a number of function blocks which convert the sensor voltage into flow readings.

### Power supply

Two different types of power supply are available. A 12 ... 24 V AC/DC and a 115 ... 230 V AC switch mode type.

**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.

**Input circuit** amplifies the flow proportional 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.

**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.

### CAN communication

The transmitter operates internally via an internal CAN communication bus. Signals are transferred through a signal conditioner to the display module, and to/from internal/external option modules and the dialog module.

### Dialog module

The display unit consists of a 3-line display and a 6-key keypad. The display shows a flow rate or a totalizer value as primary reading.

**Output module** converts flow data to an analog, a digital and a relay output. The outputs are galvanically isolated and can be individually set to suit a particular application.

### 1.3 Pressure Equipment Directive 97/23EC

Since 30 May 2002 the "Pressure Equipment Directive" is mandatory for all pressure equipment sold within the EU and EFTA.

Siemens Flow Instruments products confirms to PED by following the tables below.

#### MAG 5100 W (7ME6580 only < DN600 (< 24"))

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

#### MAG 3100

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

**MAG 3100 high temperature and 3100 P**

Flange mm	PN 10	PN 16	PN 25	PN 40	CL 150	CL 300
15	N/A	N/A	N/A	EXC.PED	N/A	N/A
25	N/A	N/A	N/A	EXC.PED	N/A	N/A
40	N/A	N/A	N/A	PED	N/A	N/A
50	N/A	N/A	N/A	PED	N/A	N/A
65	N/A	PED	N/A	PED	N/A	N/A
80	N/A	PED	N/A	PED	N/A	N/A
100	N/A	PED	N/A	PED	N/A	N/A
125	N/A	PED	N/A	PED	N/A	N/A
150	N/A	PED	N/A	PED	N/A	N/A
200	PED	PED	PED	PED	N/A	N/A
250	PED	PED	PED	PED	N/A	N/A
300	PED	PED	PED	PED	N/A	N/A

**MAG 1100 and MAG 1100 F**

Flange mm	MAG 1100		MAG 1100 HT	MAG 1100 F	
	Ceramic	PFA	Ceramic	Ceramic	PFA
2	EXC.PED	N/A	N/A	N/A	N/A
3	EXC.PED	N/A	N/A	N/A	N/A
6	EXC.PED	N/A	N/A	N/A	N/A
10	EXC.PED	EXC.PED	N/A	EXC.PED	EXC.PED
15	EXC.PED	EXC.PED	EXC.PED	EXC.PED	EXC.PED
25	EXC.PED	EXC.PED	EXC.PED	EXC.PED	EXC.PED
40	PED	EXC.PED	PED	PED	EXC.PED
50	PED	PED	PED	PED	PED
65	PED	PED	PED	PED	PED
80	PED	PED	PED	PED	PED
100	PED	PED	PED	PED	PED

Siemens Flow Instruments products confirms to PED by following the tables below.

The key to the tables is as follows.

<b>EXC. PED</b>	Excluded from PED under SEP or LVD
<b>PED</b>	Product covered by PED
<b>PED*</b>	Product covered by PED but available conforming or non conforming to PED
<b>NA</b>	Size/pressure outside of PED scope or not available in the size range
<b>NA*</b>	DN1400-2000 only available non conforming to PED

### 1.3.1 Exclusions

All products sold outside of EU and EFTA are excluded from the directive, also products sold into certain market sectors are excluded. These include

- 1) Meters used in networks for the supply, distribution and discharge of water.
- 2) Meters used in pipelines for the conveyance of any fluid from offshore to onshore.
- 3) Meters used in the extraction of petroleum or gas, including christmas tree and manifold equipment.
- 4) Any meter mounted on a ship or mobile offshore platform.

### 1.3.2 Product marking example



All meters will now carry either a CE mark or a CE mark followed by for example 0086

CE0086: This indicates that the product conforms to PED 97/23/EC, LVD 2006/95/EC, & EMC 2004/108/EC

CE: This indicates that the product conforms to LVD 2006/95/EC & EMC 2004/108/EC

## 2. Technical data

## 2.1 Sensor MAG 1100 and MAG 1100 HT (High temperature)

		
<b>Type</b>	<b>MAG 1100</b>	<b>MAG 1100 HT (High temperature)</b>
<b>Measuring principle</b>	Electromagnetic induction	
Excitation frequency (Main supply: 50 Hz / 60 Hz)	DN 2 ... 65 (1/12" ... 2 1/2"): 12.5 Hz / 15 Hz DN 80, 100 (3", 4"): 6.25 Hz / 7.5 Hz	DN 15 ... 50 (1/2" ... 2"): 12.5 Hz / 15 Hz DN 80, 100 (3", 4"): 6.25 Hz / 7.5 Hz
<b>Process connection</b> Nominal size • MAG 1100 (Ceramic) • MAG 1100 (PFA) Mating flanges	DN 2 ... DN 100 (1/12" ... 4") DN 10 ... DN 100 (3/8" ... 4") EN 1092-1 (DIN 2501), ANSI B 16.5 class 150 and 300 or equivalent Option: DN 2 ... 10 (1/12" ... 3/8"): G 1/2" / NPT 1/2" pipe connection adapters	DN 15 ... DN 100 (1/2" ... 4") EN 1092-1 (DIN 2501), ANSI B 16.5 class 150 and 300 or equivalent
<b>Rated operating conditions</b> <u>Ambient conditions</u> Ambient temperature <sup>1)</sup> • Sensor • Sensor ATEX • Compact transmitter MAG 5000/6000	-40 ... +100 °C (-40 ... +212 °F) -20 ... +60 °C (-4 ... +140 °F) -20 ... +50 °C (-4 ... +122 °F)	-40 ... +100 °C (-40 ... +212 °F) -20 ... +50 °C (-4 ... +122 °F)
<u>Temperature of medium</u> • MAG 1100 (Ceramic) • MAG 1100 ATEX (Ceramic) • MAG 1100 (PFA)	-20 ... +150 °C (-4 ... +302 °F) -20 ... +150 °C (-4 ... +302 °F) -30 ... +130 °C (-20 ... +266 °F) Suitable for steam sterilization at 150 °C (302 °F)	-20 ... +200 °C (-4 ... +392 °F) -20 ... +180 °C (-4 ... +356 °F)
<u>Temperature shock</u> • MAG 1100 (Ceramic) - Duration ≤ 1 min, followed by 10 min rest • MAG 1100 (PFA)	• DN 2, 3 (1/12", 1/8") No limitations • DN 6, 10, 15, 25: Max. ΔT ≤ 80 °C/min (1/4", 3/8", 1/2", 1": Max. ΔT ≤ 80 K/min) • DN 40, 50: Max. ΔT ≤ 70 °C/min (1 1/2", 2", 2 1/2"): Max. ΔT ≤ 70 K/min) • DN 80, 100: Max. ΔT ≤ 60 °C/min (3", 4": Max. ΔT ≤ 60 K/min) Max. ±100 °C (210 °F) momentarily	• DN 15, 25: Max. ΔT ≤ 80 °C/min (1/2", 1": Max. ΔT ≤ 80 K/min) • DN 40, 50, 65: Max. ΔT ≤ 70 °C/min (1 1/2", 2": Max. ΔT ≤ 70 K/min) • DN 80, 100: Max. ΔT ≤ 60 °C/min (3", 4": Max. ΔT ≤ 60 K/min)
<u>Operating pressure</u> • MAG 1100 (Ceramic) • MAG 1100 (PFA)	• DN 2 ... 65: 40 bar (1/12" ... 2 1/2": 580 psi) • DN 80: 37.5 bar (3": 540 psi) • DN 100: 30 bar (4": 435 psi) Vacuum: 1 x 10 <sup>-6</sup> bar <sub>abs</sub> (1.5 x 10 <sup>-5</sup> psi <sub>abs</sub> ) 20 bar (290 psi) Vacuum: 0.02 bar <sub>abs</sub> (0.3 psi <sub>abs</sub> ) DN 80 ... DN 100: CO <sub>2</sub> pressure max. 7 bar (101.5 psi)	• DN 15 ... 50: 40 bar (1/2" ... 2": 580 psi) • DN 80: 37.5 bar (3": 540 psi) • DN 100: 30 bar (4": 435 psi) Vacuum: 1 x 10 <sup>-6</sup> bar <sub>abs</sub> (1.5 x 10 <sup>-5</sup> psi <sub>abs</sub> )
<u>Mechanical load</u>	• 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	• 18 ... 1000 Hz random in x, y, z, directions for 2 hours according to EN 60068-2-36 • Sensor: 3.17 grms


Type	MAG 1100	MAG 1100 HT (High temperature)
Enclosure rating	IP67 to EN 60529 (NEMA 4X), 1 mH <sub>2</sub> O for 30 min	
EMC	89/336 EEC	
<b>Design</b> Weight Material • Enclosure - MAG 1100 • Terminal box - Standard - Option • Fixing studs • Gaskets - Standard - Option • Pipe connection adapters: DN 2, 3, 6 and 10 (1/12", 1/8", 1/4" and 3/8")	See dimensional drawings  Stainless steel AISI 316L (1.4404)  Fibre glass reinforced polyamide (no ATEX) Stainless steel AISI 316 (1.4436) (ATEX)  Stainless steel AISI 304 (1.4301), Number and size to EN 1092-1:2001  EPDM (max. 150 °C, PN 40 (max. 300 °F, 600 psi)) • Graphite (max. 200 °C, PN 40 (max. 390 °F, 600 psi)) • PTFE (max. 130 °C, PN 25 (max. 270 °F, 300 psi))  • Stainless steel, AISI 316 • Hastelloy C22 • PVDF	See dimensional drawings  Stainless steel AISI 316L (1.4404)  Stainless steel AISI 316 (1.4436)  Stainless steel AISI 304 (1.4301), Number and size to EN 1092-1:2001  Graphite (max. 200 °C, PN 40 (max. 390 °F, 600 psi))
<b>Liner</b> • MAG 1100 (Ceramic)	• DN 2, 3 (1/12", 1/8"): Zirconium oxide (ZrO <sub>2</sub> ) • DN 6 ... 100 (1/4" ... 4"): Aluminium oxide Al <sub>2</sub> O <sub>3</sub> • Reinforced PFA (no ATEX)	DN 15 ... 100 (1/2" ... 4"): Aluminium oxide Al <sub>2</sub> O <sub>3</sub>
<b>Electrodes</b> • MAG 1100 (Ceramic)  • MAG 1100 (PFA)	• DN10 ... 100 (3/8" ... 4") : Platinum with gold / Titanium brazing alloy • DN 2 ... 6 (1/12" ... 1/4"): Platinum • DN 10 ... 15 (3/8" ... 1/2"): Hastelloy C276 • DN 25 ... 100 (1" ... 4"): Hastelloy C22	Platinum with gold / Titanium brazing alloy
<b>Cable entries</b>	• Remote installation 2 x M20 or 2 x 1/2" NPT • Compact installation - MAG 5000/MAG 6000: 4 x M20 or 4 x 1/2" NPT	Remote installation 2 x M20 or 2 x 1/2" NPT
<b>Certificates and approvals</b> Conforms to  <b>Custody Transfer (MAG 5000/6000 CT)</b>	PED – 97/23 EC and CRN (PFA)  Cold water pattern approval PTB (Germany) Heat meter pattern approval - OIML R 75 (Denmark) Hot water pattern approval - PTB (Germany) Other media than water pattern approval - OIML R 117 (Denmark)	PED – 97/23 EC and CRN (PFA)  Heat meter pattern approval - OIML R 75 (Denmark) Hot water pattern approval - PTB (Germany)
<b>Ex approvals</b> MAG 1100 (Ceramic) • ATEX sensor  • Sensor with/without MAG 5000/6000  MAG 1100 (PFA) • Sensor with/without MAG 5000/6000	ATEX 2G D sensor Ex d e ia IIB T3 - T6  FM Class 1 div 2  FM Class 1 div 2	ATEX 2G D sensor Ex d e ia IIB T3 - T6  FM Class 1 div 2

1) Conditions are also dependent on liner characteristics

For technical specifications for transmitter - please see transmitter pages.



## 2.2 Sensor MAG 1100 F

	
<b>Type</b>	<b>MAG 1100 F</b>
<b>Measuring principle</b>	Electromagnetic induction
Excitation frequency (Main supply: 50 Hz / 60 Hz)	DN 10 ... 65 (¼" ... 2½"): 12.5 Hz / 15 Hz DN 80 ... 100 (3", 4"): 6.25 Hz / 7.5 Hz
<b>Process connection</b> Nominal size Process connection	DN 10 ... DN 100 (¾" ... 4") Hygienic adapters available for: • Direct welding onto pipe • Clamp fitting • Threaded fitting
<b>Rated operating conditions</b> <u>Ambient conditions</u> Ambient temperature <sup>1)</sup> • Sensor • Sensor ATEX • Compact transmitter MAG 5000/6000	-40 ... +100 °C (-40 ... +212 °F) -20 ... +60 °C (-4 ... +140 °F) -20 ... +50 °C (-4 ... +122 °F)
Temperature of medium MAG 1100 F (Ceramic) MAG 1100 F (PFA)	-20 ... +150 °C (-4 ... +300 °F) Suitable for steam sterilization -30 ... +130 °C (-20 ... +270 °F) Suitable for steam sterilization at 150 °C (300 °F)
<u>Temperature shock</u> MAG 1100 F • Duration ≤ 1 min, followed by 10 min rest  MAG 1100 F (PFA)	• DN 10, 15, 25: Max. ΔT ≤ 80 °C/min (¾", ½", 1": Max. ΔT ≤ 80 °C/min) • DN 40, 50, 65: Max. ΔT ≤ 70 °C/min (1½", 2", 2½"): Max. ΔT ≤ 70 °C/min) • DN 80, 100: Max. ΔT ≤ 60 °C/min (3", 4": Max. ΔT ≤ 60 °C/min)  Max. ± 100 °C (210 °F) momentarily
<u>Operating pressure</u> MAG 1100 F (Ceramic)  MAG 1100 F (PFA)	DN 10 ... 65: 40 bar (¾" ... 2½": 580 psi) DN 80: 37.5 bar (3": 540 psi) DN 100: 30 bar (4": 435 psi) Vacuum: 1 x 10 <sup>-6</sup> bar <sub>abs</sub> (1.5 x 10 <sup>-5</sup> psi <sub>abs</sub> )  20 bar (290 psi) Vacuum: 0.02 bar <sub>abs</sub> (0.3 psi <sub>abs</sub> ) DN 80 ... 100: CO <sub>2</sub> pressure max. 7 bar (101.5 psi)
<u>Mechanical load</u>	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
<u>Enclosure rating</u>	IP67 to EN 60529 (NEMA 4X), 1 mH <sub>2</sub> O for 30 min
<b>EMC</b>	86/336 EEC
<b>Design</b> Weight	See dimensional drawings
<u>Material</u> Enclosure • MAG 1100 F Terminal box (remote version only) • Standard • Option • Ex ATEX (remote version only)	Stainless steel AISI 316L (1.4404)  Fibre glass reinforced polyamide Stainless steel AISI 316 (1.4436) Stainless steel AISI 316 (1.4436)




Type	MAG 1100 F
<b>Liner</b> MAG 1100 F (Ceramic) MAG 1100 F (PFA)	Aluminium oxide Al <sub>2</sub> O <sub>3</sub> (ceramics) Reinforced PFA (teflon) (no ATEX)
<b>Electrodes</b> MAG 1100 F (Ceramic) MAG 1100 F (PFA)	Platinum with gold / Titanium brazing alloy • DN 10 ... 15 (3/8" ... 1/2"): Hastelloy C276 • DN 25 ... 100 (1" ... 4"): Hastelloy C22
<b>Cable entries</b>	• Remote installation 2 x M20 or 2 x 1/2 NPT • Compact installation - MAG 5000/MAG 6000: 4 x M20 or 4 x 1/2"NPT
<b>Certificates and approvals</b> MAG 1100 F (Ceramic) • Ex ATEX approvals for sensor • Sensor with/without MAG 5000/6000 MAG 1100 F (PFA)  Conforms to  <b>Custody Transfer</b> <b>(MAG 5000/6000 CT)</b>	3A (sensor with Polyamid terminal box ), transmitter not part of the approval ATEX 2G D sensor EEx d e ia IIB T3 - T6  FM Class 1 div 2 3A (sensor with Polyamid terminal box ), transmitter not part of the approval FM Class 1 div 2 PED – 97/23/EC and CRN (PFA)  Cold water pattern approval PTB (Germany) Heat meter pattern approval - OIML R 75 (Denmark) Hot water pattern approval - PTB (Germany) Other media than water pattern approval - OIML R 117 (Denmark)
<b>Weld-in adapter</b> Adapter for welding onto dairy pipe Tri-Clover, ISO 2037, DIN 11850, SMS 3008, BS 4825-1 • DN 10, 15, 25, 40, 50, 65 and 80 (3/8", 1/2", 1", 1 1/2", 2", 2 1/2" and 3") • DN 100 (4")	PN 40 (600 psi) PN 25 (350 psi)
<b>Clamp adapter</b> Tri-Clamp, ISO 2852, DIN 32676, SMS 3016, BS 4825-3 • DN 10, 15, 25, 40 and 50 (3/8", 1/2", 1", 1 1/2", and 2") • DN 65, 80 and 100 (2 1/2", 3" and 4")	PN 16 (200 psi) PN 10 (150 psi)
<b>Thread adapter</b> DIN 11851 • DN 10, 15, 25, and 40 (3/8", 1/2", 1", and 1 1/2") • DN 50, 65, 80 and 100 (2", 2 1/2", 3" and 4") ISO 2853, BS 4825-4 • DN 10, 15, 25, 40, 50, 65 and 80 (3/8", 1/2", 1", 1 1/2", 2", 2 1/2" and 3") SMS 1145 • DN 25, 40, 50, 65 and 80 (1", 1 1/2", 2", 2 1/2" and 3")	PN 40 (600 psi)  PN 25 (350 psi)  PN 16 (200 psi)  PN 6 (80 psi)
<b>Design</b> <b>Material</b> Adapter Gasket • MAG 1100 F (Ceramic)  • MAG 1100 F (PFA)	Stainless steel AISI 316/Stainless steel AISI 304 (ISO 2852)  FKM/FPM with stainless steel insert (AISI 304) (-20 ... +150 °C (-4 ... +302 °F)) EPDM (-20 ... +150 °C (-4 ... +302 °F)) EPDM (-20 ... +150 °C (-4 ... +302 °F)) NBR (-20 ... +100 °C (-4 ... +212 °F))

**Note:**

When combined sensor and adapter, the operating pressure is the lower rated of the two.



## 2.3 Sensor MAG 3100, MAG 3100 HT and MAG 3100 P

			
<b>Type</b>	<b>MAG 3100</b>	<b>MAG 3100 HT (High Temperature)</b>	<b>MAG 3100 P</b>
Nominal size	DN 15 ... DN 2000 (½" ... 78")	DN 15 ... DN 300 (½" ... 12")	DN 15 ... DN 300 (½" ... 12")
Measuring principle	Electromagnetic induction		
Excitation frequency (Main 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 ... 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>	<ul style="list-style-type: none"> <li>• DN 15 ... 65 (½" ... 2½"): 12.5 Hz / 7.5 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>
<b>Process connection</b>			
Flanges	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 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> ANSI B16.5 (~BS 1560), raised face <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> AWWA C-207, flat face 28" ... 78": Class D (10 bar)           AS 2129, raised face ½" ... 48": 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> Other flanges and pressure ratings on request	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 ... 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> <li>• ½" ... 12": Class 300 (50 bar (725 psi))</li> </ul> AS 2129, raised face ½" ... 12": Table E           Other flanges and pressure ratings on request	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> ANSI B16.5 (~BS 1560), raised face <ul style="list-style-type: none"> <li>• ½" ... 12": Class 150 (20 bar (290 psi))</li> </ul>
<b>Rated operation conditions</b>			
Ambient temperature (conditions also dependent on liner characteristics)			
• Sensor	-40 ... +100 °C (-40 ... +212 °F)	-40 ... +100 °C (-40 ... +212 °F)	-40 ... +100 °C (-40 ... +212 °F)
• Sensor ATEX	-20 ... +60 °C (-4 ... +140 °F)	For medium temperature up to 150 °C (302 °F) -20 ... +60 °C (-4 ... +140 °F) For medium temperature 150 ... 180 °C (302 ... 356 °F): -20 ... +50 °C (-4 ... +122 °F)	
• Compact transmitter MAG 5000/6000	-20 ... +50 °C (-4 ... +122 °F)	-20 ... +50 °C (-4 ... +122 °F)	-20 ... +50 °C (-4 ... +122 °F)



## 2.3 Sensor MAG 3100, MAG 3100 HT and MAG 3100 P (continued)

Type	MAG 3100	MAG 3100 HT (High Temperature)	MAG 3100 P
<b>Operating pressure</b>			
<b>Operating pressure</b> [abs. bar] (maximum operating pressure decreases with increasing operating temperature and with stainless steel flanges)	<ul style="list-style-type: none"> <li>• Neoprene 0.01 ... 100 bar (0.15 ... 1450 psi)</li> <li>• EPDM 0.01 ... 40 bar (0.15 ... 580 psi)</li> <li>• Linatex® 0.01 ... 40 bar (0.15 ... 580 psi)</li> <li>• Ebonite 0.01 ... 100 bar (0.15 ... 1450 psi)</li> <li>• PTFE DN ≤ 300 (≤ 12"): 0.3 ... 50 bar (4 ... 725 psi) 350 ≤ DN ≤ 600 (14" ≤ DN ≤ 24"): 0.3 ... 40 bar (4 ... 580 psi)</li> <li>• PFA - DN 25 ... 100 (1" ... 4"): 0.01 ... 50 bar (0.15 ... 725 psi)</li> </ul>	<ul style="list-style-type: none"> <li>• PTFE Teflon - DN 15 ... 300 (½" ... 12") (130/180 °C (266/356°F)): 0.6 ... 50 bar (9 ... 725 psi) (180 °C (356 °F)) PTFE has factory-mounted grounding SS rings type E &amp; SS terminal box)</li> <li>• PFA - DN 25 ... 100 (1" ... 4"): 0.01 ... 50 bar (0.15 ... 725 psi)</li> </ul>	<ul style="list-style-type: none"> <li>• PTFE Teflon - DN 15 ... 300 (½" ... 12") : 0.3 ... 40 bar (4 ... 580 psi)</li> <li>• PFA - DN 25 ... 100 (1" ... 4"): 0.01 ... 50 bar (0.15 ... 725 psi)</li> </ul>
Enclosure rating	IP67/NEMA 4X/6 to EN 60529, 1 m H <sub>2</sub> O for 30 min Option: IP68/NEMA 6P to EN 60529, 10 mH <sub>2</sub> O cont. (no ATEX)		
Pressure drop at 3 m/s	As straight pipe		
Test pressure	1.5 x PN (where applicable)		
Mechanical load	<ul style="list-style-type: none"> <li>• 18 ... 1000 Hz random in x, y, z, directions for 2 hours according to EN 60068-2-36</li> <li>• Sensor: 3.17 grms</li> <li>• Sensor with compact MAG 5000/6000 mounted transmitter: 3.17 grms</li> </ul>		
Temperature of medium	<ul style="list-style-type: none"> <li>• Neoprene 0 ... +70 °C (32 ... 158 °F)</li> <li>• EPDM -10 ... +70 °C (14 ... 158 °F)</li> <li>• Linatex® (rubber) -40 ... +70 °C (-40 ... +158 °F) (for temperatures below -20 °C (-4 °F) AISI 304 or 316 flanges must be used)</li> <li>• Ebonite 0 ... 95 °C (32 ... 203 °F)</li> <li>• PTFE -20 ... +100 °C (-4 ... +212 °F)</li> <li>• PFA -20 ... +100 °C (-4 ... +212°F)</li> </ul>	<ul style="list-style-type: none"> <li>• PTFE -20 ... +130 °C (-4 ... +266 °F)</li> <li>• PTFE -20 ... +180 °C (-4 ... +356 °F)</li> <li>Factory-mounted grounding rings type E and SS terminal box. Can only be used with remote transmitter.</li> <li>• PFA -20 ... +150 °C (-4 ... +300 °F)</li> </ul>	<ul style="list-style-type: none"> <li>• PTFE -20 ... +130 °C (-4 ... +266 °F)</li> <li>• PFA -20 ... +150 °C (-4 ... +300 °F)</li> </ul>
EMC	89/336 ECC		
<b>Design</b>			
Weight	See dimensional drawings		
Flange and housing	Carbon steel ASTM A 105, with material corrosion-resistant two-component epoxycoating (min. 150 µm) <b>or</b> AISI 304 (1.4301) flanges and carbon steel housing, with corrosion-resistant two-component epoxy coating (min. 150 µm) <b>or</b> AISI 316 L (1.4404) flanges and housing, polished		
Measuring pipe material	AISI 304 (1.4301)		

## 2.3 Sensor MAG 3100, MAG 3100 HT and MAG 3100 P (continued)

Design (continued)			
Type	MAG 3100	MAG 3100 HT (High Temperature)	MAG 3100 P
Electrode material	<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>	Hastelloy C276 (PFA: Hastelloy C22)
Grounding electrode material	Material as measuring electrodes: Exceptions - see ordering data	No grounding electrodes	No grounding electrodes
Terminal box (remote version only)	<ul style="list-style-type: none"> <li>• Standard: Fibre glass reinforced polyamide</li> <li>• Option: Stainless steel AISI 316 (1.4436)</li> <li>• Ex ATEX (remote version only): Stainless steel AISI 316 (1.4436)</li> </ul>	<ul style="list-style-type: none"> <li>• Stainless steel AISI 316 (1.4436)</li> <li>• Ex ATEX (remote version only) Stainless steel AISI 316 (1.4436)</li> </ul>	<ul style="list-style-type: none"> <li>• Standard: Fibre glass reinforced polyamide</li> <li>• Option: Stainless steel AISI 316 (1.4436)</li> <li>• Ex ATEX (remote version only) Stainless steel AISI 316 (1.4436)</li> </ul>
Cable entries	<ul style="list-style-type: none"> <li>• Remote installation: 2 x M20 or 2 x ½ NPT</li> <li>• Compact installation - MAG 5000/MAG 6000: 4 x M20 or 4 x ½"NPT</li> </ul>		
Certificates and approvals			
Conforms to	PED – 97/23 EC, CRN		
Material certificate EN 10204 3.1	On request	On request	Pipe and flange certificate available as option
Ex approvals	ATEX 2G D sensor <ul style="list-style-type: none"> <li>• DN 15 ... 300/(½" ... 12"): EEx d e ia IIC T4 - T6</li> <li>• DN 350 ... 2000/(14" ... 78"): EEx e ia IIC T4 - T6 Non-ATEX sensors</li> <li>• FM Class 1, Div 2</li> <li>• CSA Class 1, Div 2</li> </ul>	ATEX 2G D sensor <ul style="list-style-type: none"> <li>• DN 15 ... 300/(½" ... 12"): EEx d e ia IIC T3 - T6 Non-ATEX sensors</li> <li>• FM Class 1, Div 2</li> <li>• CSA Class 1, Div 2</li> </ul>	ATEX 2G D sensor <ul style="list-style-type: none"> <li>• DN 15 ... 300/(½" ... 12"): EEx d e ia IIC T3 - T6 Non-ATEX sensors</li> <li>• FM Class 1, Div 2</li> <li>• CSA Class 1, Div 2</li> </ul>
Drinking water approvals	EPDM lining: <ul style="list-style-type: none"> <li>• WRAS (WRc, BS6920 cold water, UK)</li> <li>• ACS listed (F)</li> <li>• DVGW W270 (D) NSF/ANSI Standard 61 (Cold water, US)</li> <li>• Belgaqua (B)</li> </ul> Mcerts (EPDM or PTFE lining with AISI 316 Ti or Hastelloy C276 electrodes)		
Custody transfer (CT) (≤ DN2000) (MAG 5000/6000 CT)	Cold water - DANAK TS 22.36.001 Cold water pattern approval PTB (Germany) Heat meter pattern approval - OIML R 75 (Denmark) Hot water pattern approval - PTB (Germany) Other media than water pattern approval - OIML R 117 (Denmark)	Heat meter pattern approval - OIML R 75 (Denmark) Hot water pattern approval - PTB (Germany)	Cold water - DANAK TS 22.36.001 Cold water pattern approval PTB (Germany) Heat meter pattern approval - OIML R 75 (Denmark) Hot water pattern approval - PTB (Germany) Other media than water pattern approval - OIML R 117 (Denmark)

## 2.4 Sensor MAG 5100 W

		
<b>Technical specifications</b>	<b>EPDM or NBR lining (Order No. 7ME6520)</b>	<b>Ebonite lining (Order No. 7ME6580)</b>
<b>Product characteristic:</b>	<b>Targeted towards the EU water markets and low flow applications:</b>	<b>Targeted towards the Non EU water markets</b>
<b>Design and nominal size</b>	Full bore sensor: DN 25 ... 40 (1" ... 1½") Coned sensor: DN 50 ... 300 (2" ... 12") Full bore sensor: DN 350 ... 1200 (14" ... 48")	Full bore sensor: DN 25 ... 2000 (1" ... 78")
<b>Measuring principle</b>	Electromagnetic induction	Electromagnetic induction
Excitation frequency (Mains supply: 50 Hz/60 Hz)	DN 25 ... 65 (1" ... 2½"): 12.5 Hz /15 Hz DN 80 ... 150 (3" ... 6"): 6.25 Hz /7.5 Hz DN 200 ... 300 (8" ... 12"): 3.125 Hz / 3.75 Hz DN 350 ... 1200 (14" ... 48"): 1.5625 Hz /1.875 Hz	DN 25 ... 65 (1" ... 2½"): 12.5 Hz /15 Hz DN 80 ... 150 (3" ... 6"): 6.25 Hz /7.5 Hz DN 200 ... 1200 (8" ... 48"): 3.125 Hz / 3.75 Hz DN 1400 ... 2000 (54" ... 78"): 1.5625 Hz /1.875 Hz
<b>Process connection</b>		
Flanges • EN 1092-1  • ANSI B16.5 • AWWA C-207 • AS4087  • JIS B 2220:2004 -	PN 10 (145 psi): DN 200 ... 300 (8" ... 12"): Flat face flanges PN 10 (145 psi): DN 350 ... 1200 (14" ... 48"): Raised face flanges PN 16 (232 psi): DN 50 ... 300 (2" ... 12"): Flat face flanges PN 16 (232 psi): DN 350 ... 1200 (14" ... 48"): Raised face flanges PN 40 (580 psi): DN 25 ... 40 (1" ... 1½"): Raised face flanges  Class 150 lb: 1" ... 24": Class D: 28" ... 48", Flat face PN 16 (DN 50 ... 1200), (2" ... 48") 16 bar (232 psi)	Raised face (EN 1092-1, DIN 2501 and BS 4504 have the same mating dimensions) PN 6 (87 psi): DN 1400 ... 2000 (54" ... 78") PN 10 (145 psi): DN 200 ... 2000 (8" ... 78") PN 16 (232 psi): DN 65 ... 600 (2" ... 24") PN 40 (580 psi): DN 25 ... 50 (1" ... 2")  1" ... 24": Class 150 lb Class D: 28" ... 78"h, Flat face PN 16 (DN 50 ... 1200), (2" ... 48") 16 bar (232 psi) K10 (1" ... 24")
<b>Rated Operation conditions</b>		
Ambient temperature • Sensor • With compact transmitter MAG 5000/6000 • With compact transmitter MAG 6000 I	-40 ... +70 °C (-40 ... +158 °F) -20 ... +50 °C (-4 ... +122 °F) -20 ... +60 °C (-4 ... +140 °F)	-20 ... +70 °C (-4 ... +158 °F) -20 ... +50 °C (-4 ... +122 °F) -20 ... +60 °C (-4 ... +140 °F)
Operating pressure (Abs) [abs. bar] (maximum operating pressure decreases with increasing operating temperature)	DN 25 ... 40 (1" ... 1½"): 0.01 ... 40 bar (0.15 ... 580 psi) DN 50 ... 300 (2" ... 12"): 0.03 ... 20 bar (0.44 ... 290 psi) DN 350 ... 1200 (14" ... 48"): 0.01 ... 16 bar (0.15 ... 232 psi)	DN 25 ... 50 (1" ... 2"): 0.01 ... 40 bar (0.15 ... 580 psi) DN 65 ... 1200 (2½" ... 48"): 0.01 ... 16 bar (0.15 ... 232 psi) DN 1400 ... 2000 (54" ... 78"): 0.01 ... 10 bar (0.15 ... 145 psi)
Enclosure rating • Standard  • Option	IP67 to EN 60529 / NEMA 4X/6 (1 mH2O for 30 min)  IP68 to EN 60529 / NEMA 6P (10 mH2O continuously)	IP67 to EN 60529 / NEMA 4X/6 (1 mH2O for 30 min)  IP68 to EN 60529 / NEMA 6P (10 mH2O continuously)
Pressure drop at 3 m/s (10 ft/s)	DN 25 ... 40 (1" ... 1½"): As straight pipe DN 50 ... 300 (2" ... 12"): Max. 25 mbar (0.36 psi) DN 350 ... 1200 (14" ... 48"): As straight pipe	As straight pipe
Test pressure	1.5 x PN (where applicable)	1.5 x PN (where applicable)
Mechanical load	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 Sensor with compact MAG 6000 I mounted transmitter: 1.14 grms	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 Sensor with compact MAG 6000 I mounted transmitter: 1.14 grms
Medium conditions Temperature of medium • NBR • EPDM • Ebonite	- 10 ... +70 °C (14 ... 158 °F) - 10 ... +70 °C (14 ... 158 °F) -	- - - 10 ... +70 °C (14 ... 158 °F)
EMC	89/336 EEC	89/336 EEC

<sup>1)</sup> 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 approvals.

## 2.4 Sensor MAG 5100 W (continued)

Technical specifications	EPDM or NBR lining (Order No. 7ME6520)	Ebonite lining (Order No. 7ME6580)
Product characteristic:	Targeted towards the EU water markets and low flow applications:	Targeted towards the Non EU water markets
Design		
Material		
• Housing and flanges	Carbon steel, with corrosionresistant two-component epoxy coating (min. 150 µm)	Carbon steel ASTM A 105, with corrosionresistant two-component epoxy coating (min. 150 µm)
• Corrosivity category	Corrosivity category C4, according to ISO 12944-2	Corrosivity category C4, according to ISO 12944-2
• Measuring pipe	AISI 304 (1.4301) (DN 50 ... DN 300 (2" ... 12") Carbon steel)	AISI 304 (1.4301)
• Electrode	Hastelloy	Hastelloy
• Grounding electrode	Hastelloy	Hastelloy
• Terminal box	Fibre glass reinforced polyamide	Fibre glass reinforced polyamide
<b>Certificates and approvals</b>		
Certificates	Custody Transfer (only together with MAG 5000/6000 CT) OIML R 49 pattern approval cold water (Denmark and Germany): DN 50 ... 300 (2" ... 12") (For further details see approval : 08-3412 TS 22.36 005 or PTB 6.221/05.21) MI 001 cold water (EU): DN 50 ... 300 (2" ... 12") (For further details see approval : DK-0200-MI001-001)	
Drinking water approvals	EPDM: NSF/ANSI Standard 61 (Cold water, US) WRAS (WRc, BS6920 cold water, GB) ACS listed (F), DVGW W270 (D) Belgaqua (B) MCert NBR: NSF/ANSI Standard 61 (Cold water, US, only ANSI B16.5 flanges) MCert	NSF/ANSI Standard 61 (Cold water, US) (pending) WRAS (WRc, BS6920 cold water, GB)
Approvals	PED – 97/23 EC1), CRN FM Class 1, Div 2	PED – 97/23 EC (only < DN 600 (< 24")) FM Class 1, Div 2 (pending)

<sup>1)</sup> 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 approvals.

## 2.5.1 Transmitter MAG 5000 / MAG 6000

<b>Mode of operation and design</b>	
Measuring principle	Electromagnetic with pulsed constant field
Empty pipe	Detection of empty pipe (special cable required in remote mounted installation)
Excitation frequency	Depends on sensor size
Electrode input impedance	$> 1 \times 10^{14} \Omega$
<b>Input</b>	
<b>Digital input</b>	11 ... 30 V DC, $R_i = 4.4 \text{ K}\Omega$
• Activation time	50 ms
• Current	$I_{DC \ 11 \text{ V}} = 2.5 \text{ mA}$ , $I_{DC \ 30 \text{ V}} = 7 \text{ mA}$
<b>Output</b>	
<b>Current output</b>	0 ... 20 mA or 4 ... 20 mA
• Signal range	$< 800 \Omega$
• Load	0.1 ... 30 s, adjustable
• Time constant	
<b>Digital output</b>	0 ... 10 kHz, 50% duty cycle (uni/bidirectional)
Frequency	DC 24 V, 30 mA, $1 \text{ K}\Omega \leq R_i \leq 10 \text{ K}\Omega$ , short-circuit protected (power supplied from flowmeter)
Pulse (active)	DC 3 ... 30 V, max. 110 mA, $200 \Omega \leq R_i \leq 10 \text{ K}\Omega$ (powered from connected equipment)
Pulse (passive)	
Time constant	0.1 ... 30 s, adjustable (for batch fixed at 0.1 s)
<b>Relay output</b>	Changeover relay, same as current output
Time constant	42 V AC/2 A, 24 V DC/1 A
Load	0 ... 9.9% of maximum flow
Low flow cut off	All inputs and outputs are galvanically isolated
Galvanic isolation	
<b>Max. measuring error</b>	
MAG 5000	0.2% of rate
MAG 6000	0.22% of rate
<b>Rated operation conditions</b>	
Ambient temperature	
• Operation	• Display version: -20 ... +50 °C (-4 ... +122 °F)
• Storage	-40 ... +70 °C (-40 ... +158 °F)
<b>Mechanical load</b>	
Compact version	18 ... 1000 Hz, 3,17 G rms, sinusoidal in all directions to IEC 68-2-36
19" insert	1 ... 800 Hz, 1 G, sinusoidal in all directions to IEC 68-2-36
<b>Degree of protection</b>	
Compact version	IP67/NEMA 4X/6 to IEC 529 and DIN 40050 (1 m H <sub>2</sub> O 30 min.)
19" insert	IP20/NEMA 1 to IEC 529 and DIN 40050
<b>EMC performance</b>	
	EN 61326-1 (industrial environments) CISPR II Group 1 Class A EN 61326-2-5
<b>Display and keypad</b>	
Totalizer	Two eight-digit counters for forward, net or reverse flow
Display	Background illumination with alphanumeric text, 3 x 20 characters to indicate flow rate, totalized values, settings and faults
Time constant	Reverse flow indicated by negative sign Time constant as current output time constant
<b>Design</b>	
Enclosure material	
• Compact version	Fiber glass reinforced polyamide; optional (IP67 only): AISI 316 stainless steel
• 19" insert	Standard 19" insert of aluminium/steel (DIN 41494), width: 21 TE, height: 3 HE
• Back of panel	IP20/NEMA 1; Aluminium
• Panel mounting	IP20/Nema 1 (Prepared for IP65/NEMA 2 display side) ABS plastic
• Wall mounting	IP66/NEMA 4X; ABS plastic
<b>Dimensional drawings</b>	
Compact version	See dimensional drawings
19" insert	See dimensional drawings
<b>Weight</b>	
Compact version	0.75 kg (2 lb)
19" insert	See dimensional drawings
<b>Power supply</b>	
	115 ... 230 V AC +10% -15%, 50 ... 60 Hz, 17 VA; Fuse: 500 mA T 11 ... 30 V DC or 11 ... 24 V AC; Fuse 2 A T
<b>Power consumption</b>	
	• 115...230 V AC: 17 VA • 24 V AC : 9W, $I_N = 380 \text{ mA}$ , $I_{ST} = 8 \text{ A}$ (30 ms) • 12 V DC : 11 W, $I_N = 920 \text{ mA}$ , $I_{ST} = 4 \text{ A}$ (250 ms)
<b>Certificates and approvals</b>	
Custody transfer approval (MAG 5000/6000 CT)	CE, ULc general purpose, C-tick; CSA/FM Class 1, div 2 Mcerts Cold water: MI-001, PTB/OIML R49 (Pattern approval DE/DK) Hot water: PTB and DANAK OIML R 75 (hot water pattern approval) (MAG 6000 CT) Other media than water (milk, beer etc.) PTB and DANAK OIML R 117 (pattern approval) (MAG 6000 CT)
<b>Communication</b>	
	• MAG 5000: Without serial communication or HART as option • MAG 6000: Prepared for client mounted add-on modules: HART, Profibus PA/DP, MODBUS RTU, DeviceNet, Foundation Fieldbus H1 • MAG 5000/6000 CT: No communication moduls approved

### 2.5.4 Safety barrier (e ia)



<b>Application</b>	For use with MAG 5000/6000 19" and MAG 1100 1100 F and 3100, 3100 P, in ATEX 2 GD version		
<b>Ex approval</b>	[EEEx e ia] IIC		
<b>Cable parameter</b> Electrode	Group	Capacity in $\mu\text{F}$	Inductance in mH
	IIC	$\leq 4.1$	$\leq 1.5$
	IIB	$\leq 45$	$\leq 87$
	IIA	$\leq 45$	$\leq 87$
<b>Ambient temperature</b>	During operation: $-20 \dots +60^\circ\text{C}$ During storage: $-20 \dots +70^\circ\text{C}$		
<b>Enclosure</b> Material  Enclosure rating Mechanical load	Standard 19" insert in aluminium/steel (DIN 41494) Width: 21 TE Height 3 HE		
	IP 20 to EN 60529 and DIN 40050		
	1 G, 1-800 Hz sinusoidal in all directions to EN 60068-2-36		
<b>EMC performance</b> Emission Immunity	EN 50081-1 (Light industry)		
	EN 50082-2 (Industry)		

### 2.5.5 Cleaning unit



<b>Application</b>	For use together with MAG 5000 and 6000 19" insert to clean the measuring electrodes on sensors MAG 1100, MAG 1100F or MAG 3100. NB: Must not be used with intrinsically safe ATEX sensors NB: Not be used with sensors with Hastelloy and Tantalum electrodes NB: Only for measuring electrodes		
<b>Cleaning voltage</b> AC cleaning DC cleaning	60 V AC		
	30 V DC		
<b>Cleaning period</b>	60 sec. + 60 sec. pause		
<b>Relay</b> Load	Switch relay activated when cleaning is in progress		
	42 V/2 A		
<b>Operation</b> Automatic Manual	Switch relay activated when cleaning is in progress		
	Yes No		
<b>Indicator lamps</b>	LEDs: "ON" and "CLEANING"		
<b>Supply voltage and power consumption</b>	115 ... 230 V AC +10% ... -15%, 50 ... 60 Hz, 7 VA cleaning, 5 VA stand by 11 ... 30 V DC / 11 ... 24 V AC, 50 ... 60 Hz, 7 VA cleaning, 5 VA stand by		
<b>Ambient temperature</b>	During operation: $-20 \dots +50^\circ\text{C}$ ( $-4 \dots +122^\circ\text{F}$ )		
	During storage: $-20 \dots +70^\circ\text{C}$ ( $-4 \dots +158^\circ\text{F}$ )		
<b>Enclosure</b> Material Width: Height: Rating Mechanical load	Standard 19" insert in aluminium/steel (DIN 41494)		
	21 TE		
	3 HE		
	IP 20 to EN 60529 and DIN 40050		
	1 G, 1 ... 800 Hz sinusoidal in all directions to EN 60068-2-36		

#### **Cleaning unit**

The Siemens Flow Instruments cleaning unit can be used with MAG 5000 or 6000 in 19" insert **non-CT** version.

The cleaning unit can be used in applications where the liner material and subsequently the electrodes may be coated with deposits. If the coating is electrically insulating, the electrode signal will be reduced. If the coating is electrically conductive, the electrode signal will be partly short-circuited and in both cases the accuracy of the meter will decrease (dependent on the type and thickness of the coating).



#### **Note:**

The cleaning unit cannot be used for flammable or explosive media!

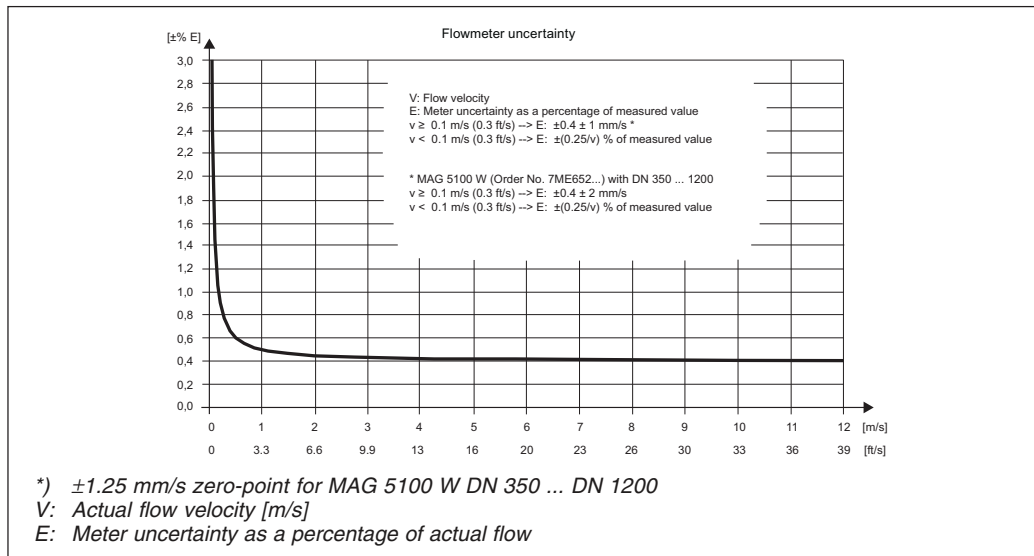


#### **Note:**

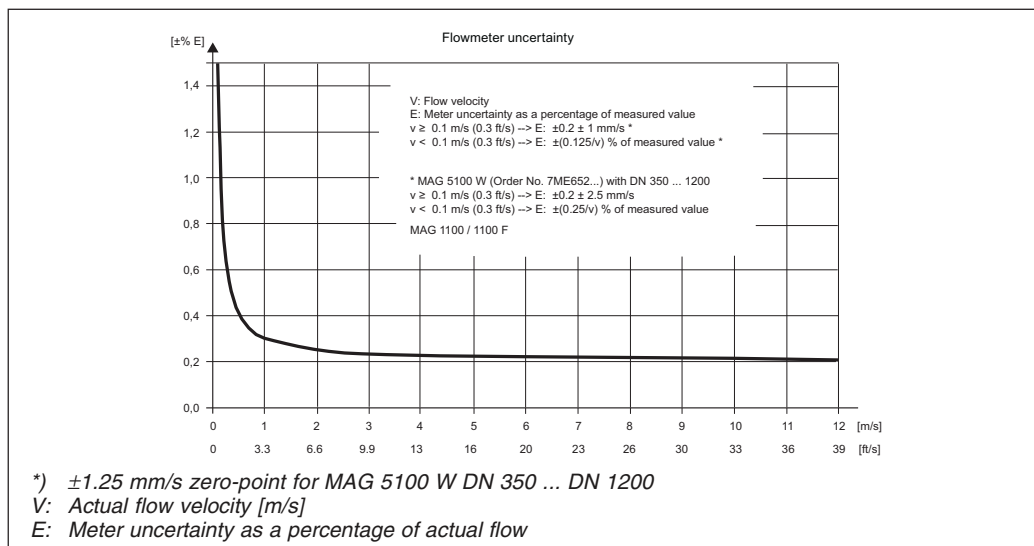
The cleaning unit cannot be used with sensors with Hastelloy and Tantalum electrodes!

## 2.6 Flowmeter accuracy

### MAG 5000 with MAG 1100, MAG 1100F, MAG 5100W, MAG 3100 and MAG 3100P and MAG 6000/6000I with MAG 1100/1100F with PFA



### MAG 6000 and MAG 6000I with MAG 1100 (ceramic), MAG 1100F (ceramic), MAG 5100W, MAG 3100 and MAG 3100P



#### Reference conditions (ISO 9104 and DIN/EN 29104)

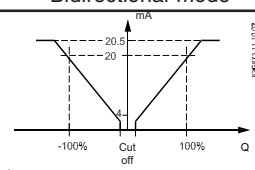
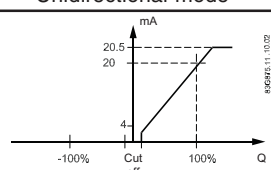
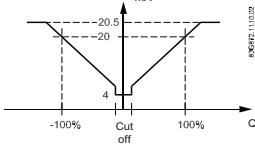
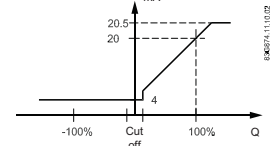
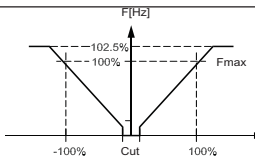
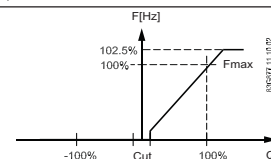
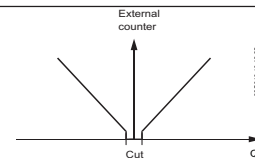
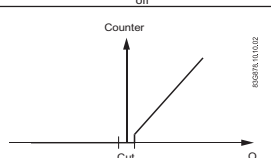
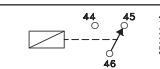
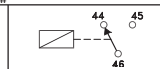
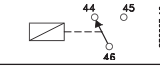
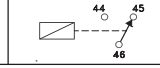
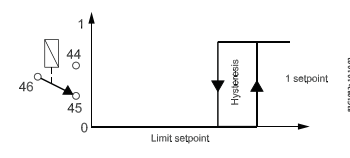
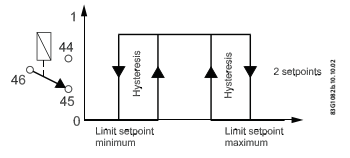
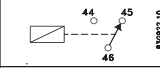
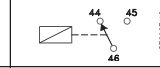

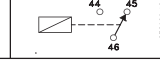
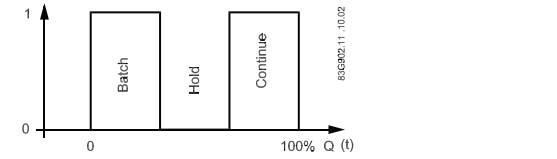
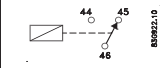
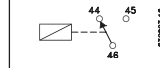
Medium temperature	20°C $\pm$ 5°C (68°F $\pm$ 9°F)
Ambient temperature	20°C $\pm$ 5°C (68°F $\pm$ 9°F)
Supply voltage	$U_n \pm 1\%$
Warming-up time	30 minutes
Incorporation in conductive pipe section	
• Inlet section	10×DN (DN $\leq$ 1200/48") 5×DN (DN > 1200/48")
• Outlet section	5×DN (DN $\leq$ 1200/48"), 3×DN (DN > 1200/48")
Flow conditions	Fully developed flow profile

#### Additions in the event of deviations from reference conditions

Current output	As pulse output $\pm(0.1\%$ of actual flow +0.05% FSO)
Effect of ambient temperature	
• Display/frequency/pulse output:	< $\pm 0.003\%$ / °C act.
• Current output:	< $\pm 0.005\%$ / °C act.
Effect of supply voltage	< 0.005% of measuring value on 1% change
Repeatability	$\pm 0.1\%$ of actual flow for $V \geq 0.5$ m/s (1.5 ft/s) and conductivity $\geq 10 \mu\text{S}/\text{cm}^3$



2.7  
Output characteristics  
MAG 5000 and MAG 6000

Output characteristics	Bidirectional mode	Unidirectional mode
0 ... 20 mA		
4 ... 20 mA		
Frequency		
Pulse output		
Relay	Power down 	Active 
Error relay	No error 	Error 
Limit switch or direction switch		
	Low flow (Reverse flow) 	Intermediate flow 
	High flow (Forward flow) 	High flow/ Low flow 
Batch on digital output		
Batch on relay	Hold 	Batch 

### 2.8.1 Conductivity of medium and sensor cables

<b>Conductivity of medium</b>	<b>Compact installation:</b> Liquids with an electrical conductivity $\geq 5 \mu\text{S/cm}$ .
	<b>Remote installation:</b>

*Standard cable*

*Special cable*

**Note**  
 ⚠ 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 0.25% and 50 meters (164 ft) to obtain 0.5%. For remote MID installations the max. cable length is 3 meters (9.8 ft). For other CT application standard requirements are applicable.

**Note**  
 ⚠ Empty sensor detection is not available with DN 2, 3 (1/12, 1/8 inch) sizes.

### 2.8.2 Cable requirements

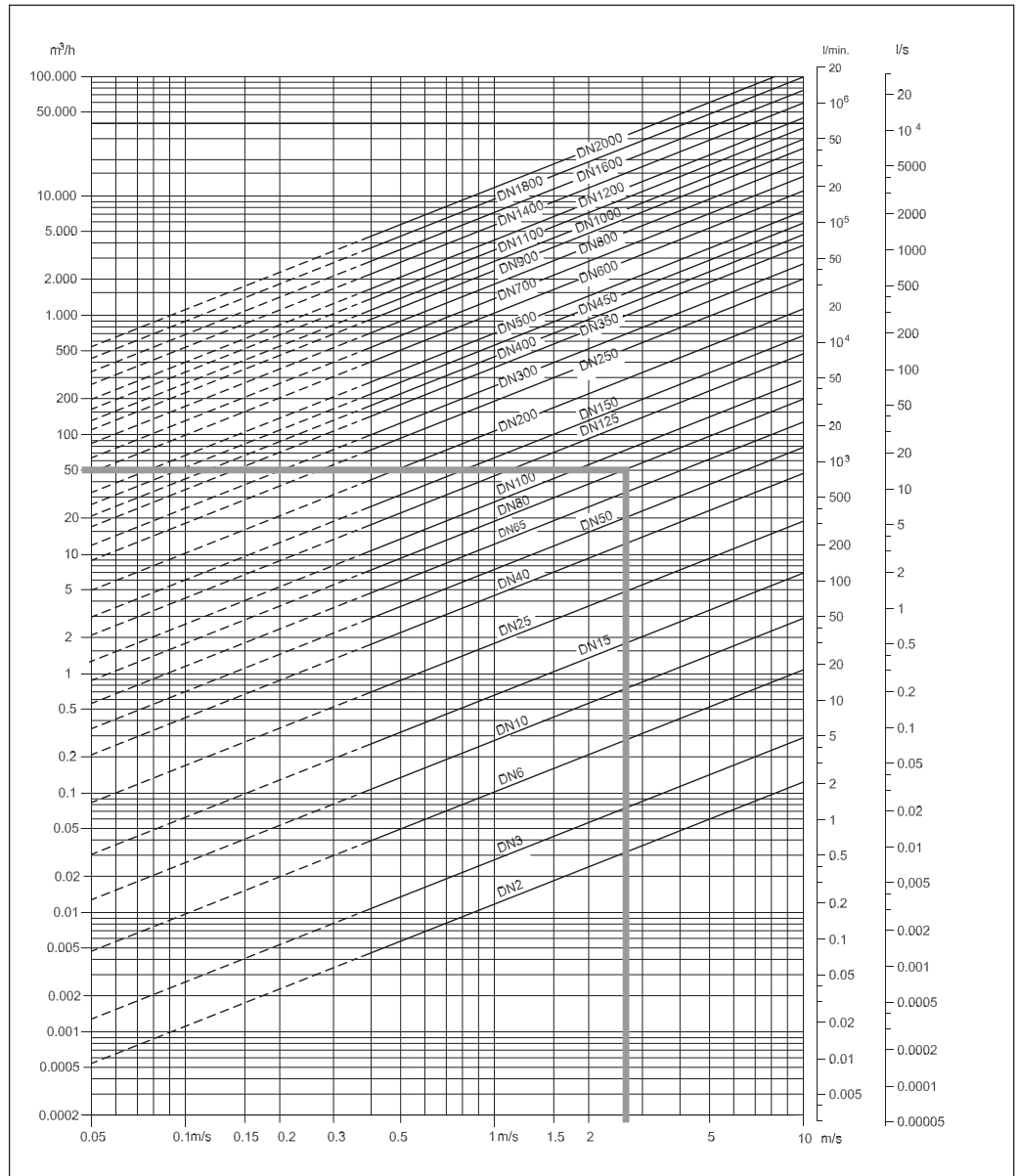
		<b>Coil cable</b>	<b>Electrode cable</b>
<b>Basic data</b>	No. of conductors	2	3
	Min. sqr. area	0.5 mm <sup>2</sup> /20 gage	0.2 mm <sup>2</sup> /22 gage
	Screen	Yes	Yes
	Max. capacitance	N.A.	350 pF/m / 107 pF/ft.
<b>Max. cable loop resistance</b>	Media temperature: < 100°C / < 210°F	40 Ω	N/A
	< 200°C / < 390°F	6 Ω	N/A
<b>Cable glands on sensor and transmitter:</b>	M20x1.5 gland - Cable ø 5-13 mm (0.20 - 0.51 Inch)		
	½"NPT gland - Cable ø 5-9 mm (0.20 - 0.35 Inch)		

### 2.9 Cable data (Supplied by Siemens Flow Instruments)

		<b>Standard cable (electrode/coil)</b>	<b>Special cable (electrode)</b>
<b>Basic data</b>	No. of conductors	3	3
	Sqr. area	1.5 mm <sup>2</sup> /18 gage	0.25 mm <sup>2</sup> /22 gage
	Screen	Yes	Double
	Color code	Brown, blue, black	Brown, blue, black
	Outside color	Grey	Grey
	Ext. diameter	7.8 mm/0,3"	8.1 mm/0,32"
	Conductor	Flexible CU	Flexible CU
	Isolation material	PVC	PVC
<b>Amb. temperature</b>	Flexible installation	-5 ... 70°C / -23 ... 160°F	-5 ... 70°C / -23 ... 160°F
	Non-flexible installation	-30 ... 70°C / -20 ... 160°F	-30 ... 70°C / -20 ... 160°F
<b>Cable parameter</b>	Capacity	161.50 pF/m / 49.24 pF/ft.	N/A
	Inductance	0.583 µH/m / 0.178 µH/ft.	N/A
	L/R	43.83 µH/Ω	N/A

3. Project guidance

3.1.1. Sizing table (DN 2 to DN 2000)



The table shows the relationship between flow velocity v, flow quantity Q and sensor dimension DN.

**Guidelines for selection of sensor**

Min. measuring range: 0 ... 0.25 m/s

Max. measuring range: 0 ... 10 m/s

Normally the sensor size is selected so that the nominal flow velocity v lies within the measuring range 1 ... 3 m/s.

Flow velocity calculation formula:

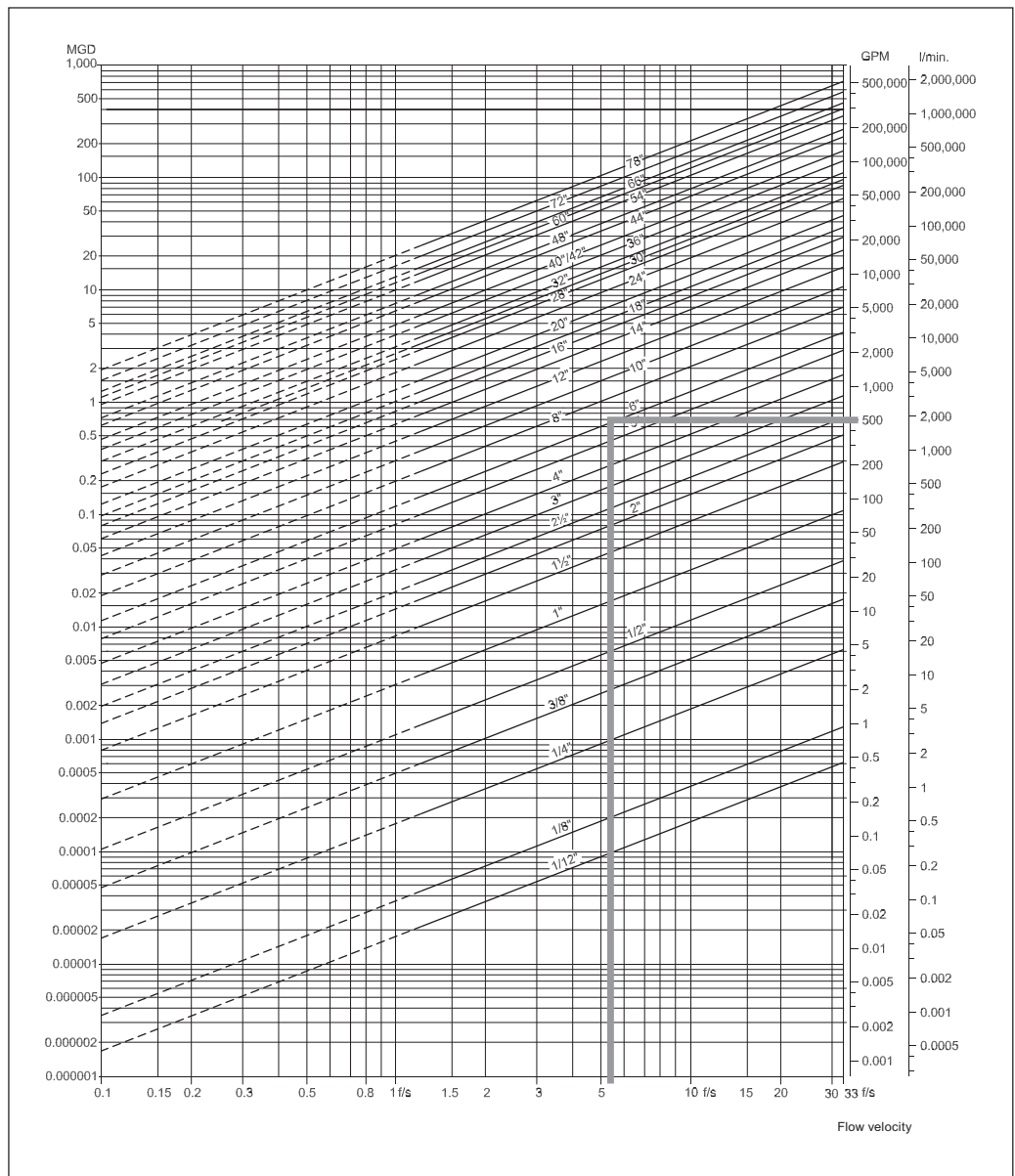
$$V = \frac{1273.24 \times Q \text{ [l/s]}}{DN^2[\text{mm}]} \text{ [m/s]} \text{ or } V = \frac{353.68 \times Q \text{ [m}^3\text{/h]}}{DN^2[\text{mm}]} \text{ [m/s]}$$

Flow velocity calculation formula:

$$V = \frac{0.408 \times Q \text{ [GPM]}}{(\text{Pipe ID})^2[\text{inch}]} \text{ [ft/s]} \text{ or } V = \frac{283.67 \times Q \text{ [MGD]}}{(\text{Pipe ID})^2[\text{inch}]} \text{ [ft/s]}$$

3. Project guidance

3.1.2. Sizing table (1/12 ... 78")



The table shows the relationship between flow velocity v, flow quantity Q and sensor dimension DN.

**Guidelines for selection of sensor**

Min. measuring range: (0 ... 0.8 ft./sec)

Max. measuring range: (0 ... 33 ft./sec)

Normally the sensor size is selected so that the nominal flow velocity v lies within the measuring range (1 ... 15 ft./sec.)

Flow velocity calculation formula:

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

Flow velocity calculation formula:

$$V = \frac{0.408 \times Q \text{ [GPM]}}{(\text{Pipe ID})^2 \text{ [inch]}} \text{ [ft/s]} \text{ or } V = \frac{283.67 \times Q \text{ [MGD]}}{(\text{Pipe ID})^2 \text{ [inch]}} \text{ [ft/s]}$$

### 3.2.1 Minimum conductivity

Applications	Min. conductivity
<b>Compact/remote</b>	
DN 2 & 3 (DN $\geq 1/12$ & $1/8$ inch)	30 $\mu\text{S/cm}$
DN $\geq 6$ (DN $\geq 1/4$ inch)	5 $\mu\text{S/cm}$
<b>With empty pipe detection</b>	50 $\mu\text{S/cm}$
<b>Ex-installations</b> (Remote mounted only)	30 $\mu\text{S/cm}$
<b>District heating systems</b> (Without DC cleaning unit)	250 $\mu\text{S/cm}$ max. 150 ft

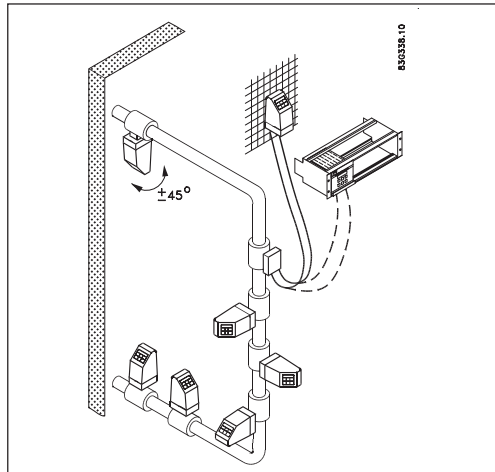
### 3.2.2 Liner selection guide

Liner	Applications
<b>Zirconium oxide <math>\text{ZrO}_2</math></b>	General purpose, aggressive chemicals
<b>Ceramics <math>\text{Al}_2\text{O}_3</math></b>	General purpose, food and beverage, aggressive chemicals
<b>PFA</b>	General purpose, food and beverage, pulp and paper, chemicals, high temperature and chemical resistance
<b>Neoprene</b>	Water and wastewater and some chemical applications
<b>EPDM</b>	Drinking water applications, (not hydrocarbons)
<b>PTFE</b>	Chemical and general process industries, high temperature and chemical resistance
<b>Linatex®</b>	Abrasive media and mining slurries
<b>Ebonite</b>	Drinking water applications, wastewater applications and certain chemical applications
<b>NBR:</b>	General purpose, Drinking water, sea water

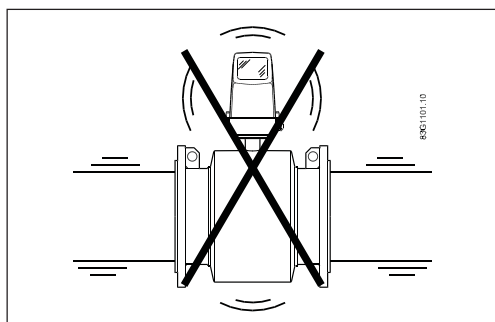
### 3.2.3 Electrode selection guide

Electrodes	Applications
<b>AISI 316 Ti</b>	General purpose, water, sewage and district heating
<b>Hastelloy C</b>	The preferred choice for water and wastewater, chemicals, food and beverage, and pharmaceutical industries
<b>Titanium</b>	Process and chemical industry which require a high corrosion resistance
<b>Tantalum</b>	Chemical industry with aggressive media
<b>Platinum and platinum/irridium</b>	The ultimate electrode material unaffected by most liquids

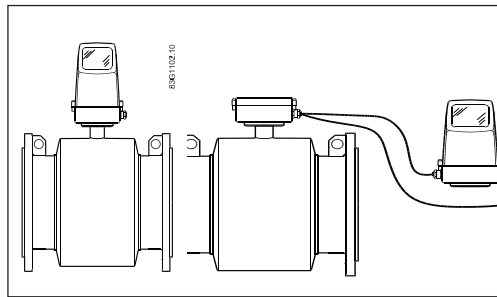
### 3.3 Installation conditions



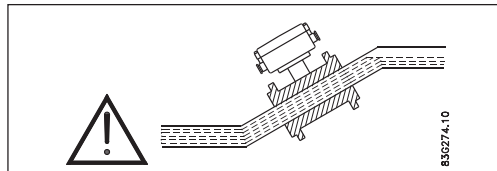
Reading and operating the flowmeter is possible under almost any installation conditions because the display can be oriented in relation to the sensor. To ensure optimum flow measurement, attention should be paid to the following:



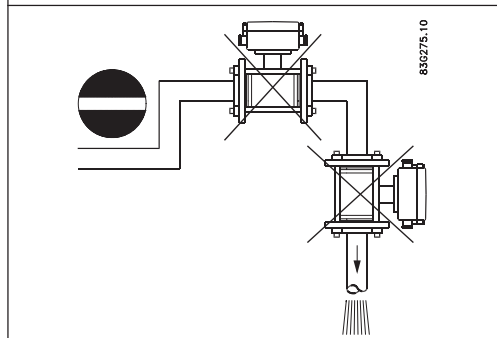
**3.3 Installation conditions**  
(continued)



Transmitter can be mounted compact or remote.

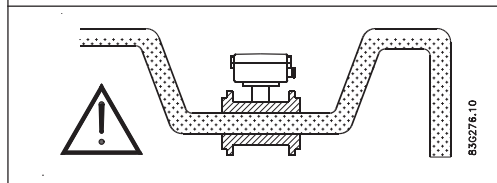


The sensor must always be completely full with liquid.



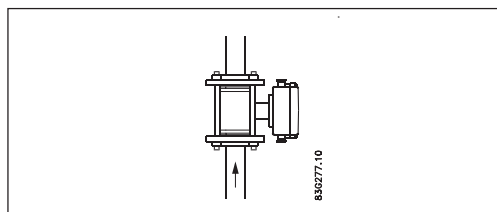
Therefore avoid:

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



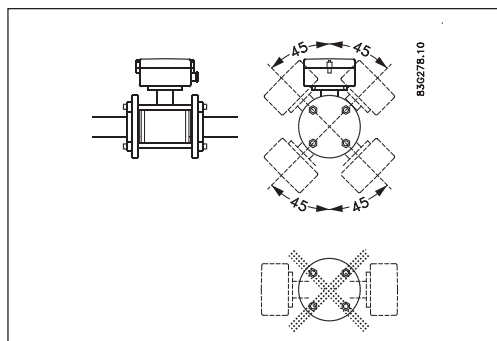
For partially filled pipes or pipes with downward flow and free outlet the flowmeter should be located in a U-tube.

**Installation in vertical pipes**



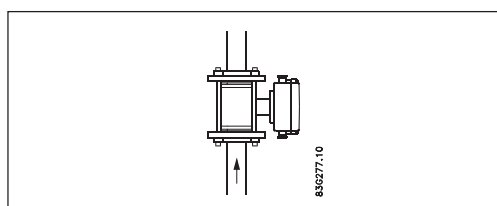
Recommended flow direction: upwards. This minimizes the effect on the measurement of any gas/air bubbles in the liquid.

**Installation in horizontal pipes**



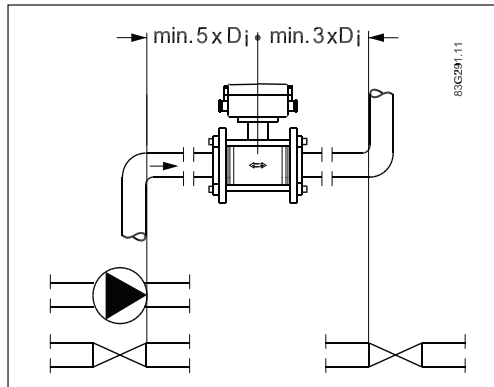
The sensor must be mounted as shown in the upper figure. Do not mount the sensor as shown in the lower figure. This will position the electrodes at the top where there is possibility for air bubbles and at the bottom where there is possibility for mud, sludge, sand etc. If using empty pipe detection, the sensor can be tilted 45°, as shown in the upper figure.

**Measuring abrasive liquids and liquids containing particles**



Recommended installation is in a vertical/inclined pipe to minimize the wear and deposits in the sensor.

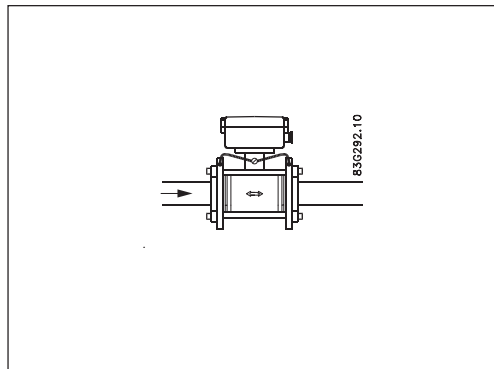
**Inlet and outlet conditions**



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

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

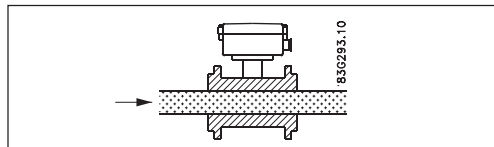
**Potential equalization**



The electrical potential of the liquid **must always** be equal to the electrical potential of the sensor. This can be achieved in different ways depending on the application:

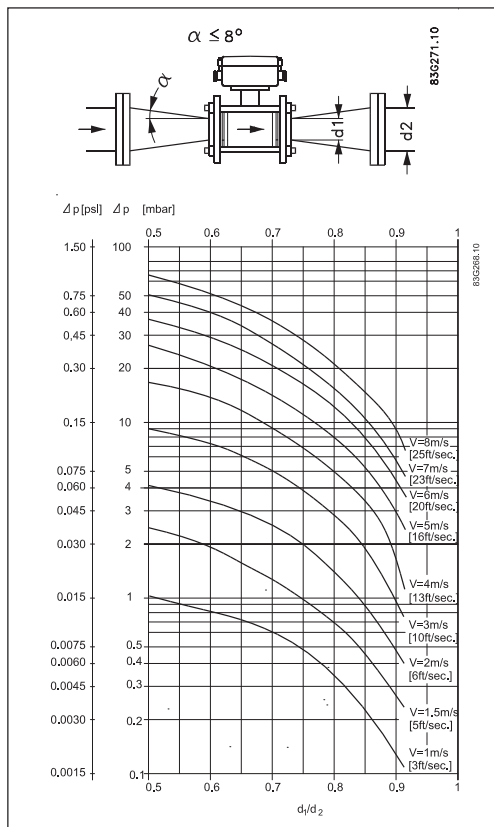
- A. Wire jumper between sensor and adjacent flanges. (MAG 1100 and MAG 3100).
- B. Direct metallic contact between sensor and fittings. (MAG 1100 FOOD).
- C. Built-in grounding electrodes. (MAG 3100 and MAG 5100 W).
- D. Optional earthing/protection flanges/rings. (MAG 1100 and MAG 3100).
- E. Optional graphite gaskets on MAG 1100. (Standard for MAG 1100 High temperature).

**Vacuum**



Avoid a vacuum in the measuring pipe, as this can damage certain liners. See "Technical data", **chapter 2**.

**Installation in large pipes**

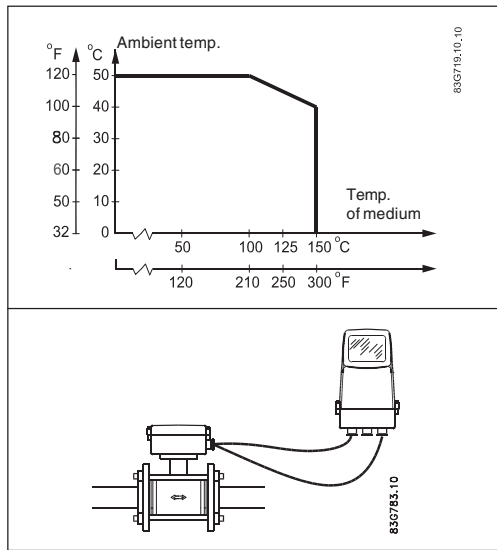


The flowmeter can be installed between two reducers (e.g. DIN 28545). At 8° the following pressure drop curves apply. The curves are applicable to water.

**Example:**

A flow velocity of 3 m/s (V) in a sensor with a diameter reduction from DN 100 to DN 80 (d<sub>1</sub>/d<sub>2</sub> = 0.8) gives a pressure drop of 2.9 mbar.

**Compact/remote installation**



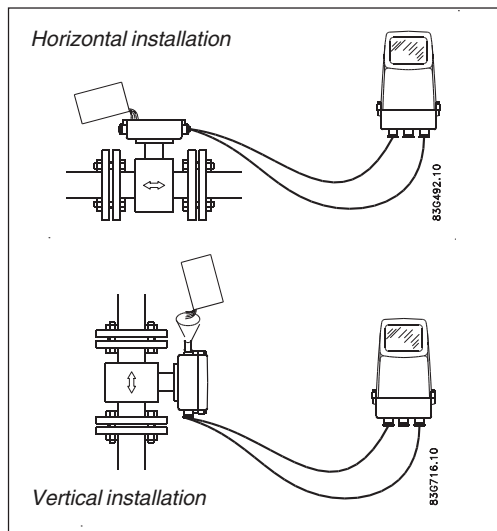
Max. **ambient** temperature as a function of temperature of medium.

The transmitter can be installed either compact or remote.

With **compact** installation the medium temperature must be in accordance with the graph.

With **remote** installation, the cable length and type described under "Technical data", chapter 2 must be used.

**IP 68 applications only**



If the sensor is buried or permanently submerged, the terminal box must be encapsulated with silicon dielectric gel.

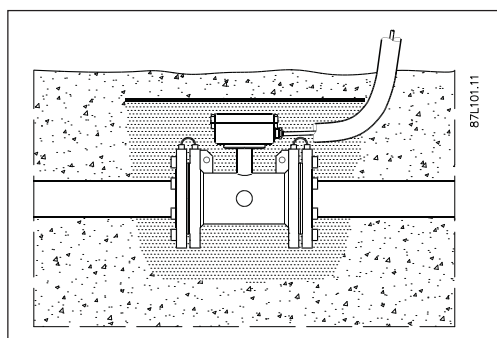
Mix the two components well and pour the contents into the terminal box.

The material is a non-toxic, transparent, self-healing gel which cures in approx. 24 hours at approx. 25°C (77°F) (curing time will increase by 100% per -10 °C).

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

The potting kit cannot be used for ATEX applications.

**Suggestions for the direct burial of MAG 3100 & MAG 5100 W sensors**



If MAG 3100 or MAG 5100 W sensors are buried directly into the ground, the SENSORPROM® unit should be removed from the terminal box on the sensor and relocated in the remote transmitter prior to burying the sensor.

All the sensor data plate information and serial number should be recorded for each sensor prior to burying. This will ensure correct matching with the SENSORPROM® unit.

The sensor should be potted to IP68 and suitable coil and electrode cables used prior to burying.

The use of pea gravel at least 300 mm (12 inch) all around the sensor. This provides some drainage and also avoids caking the sensor with earth. It also helps to locate the sensor should excavation take place.

Before covering the pea gravel with earth we suggest the use of electrical cable identification tape laid above the gravel.

The sensor should not be subject to heavy vehicles applying excessive weight above the sensor or pipeline.



### 3.4 Cleaning unit

The Siemens Flow Instruments cleaning unit can be used with MAG 5000 or 6000 in 19" insert **non-CT** version.

The cleaning unit can be used in applications where the liner material and subsequently the electrodes may be coated with deposits. If the coating is electrically insulating, the electrode signal will be reduced. If the coating is electrically conductive, the electrode signal will be partly short-circuited and in both cases the accuracy of the meter will decrease (dependent on the type and thickness of the coating).

#### Note

Not to be used with sensors with **Hastelloy or Tantalum** electrodes.

#### Mode of operation

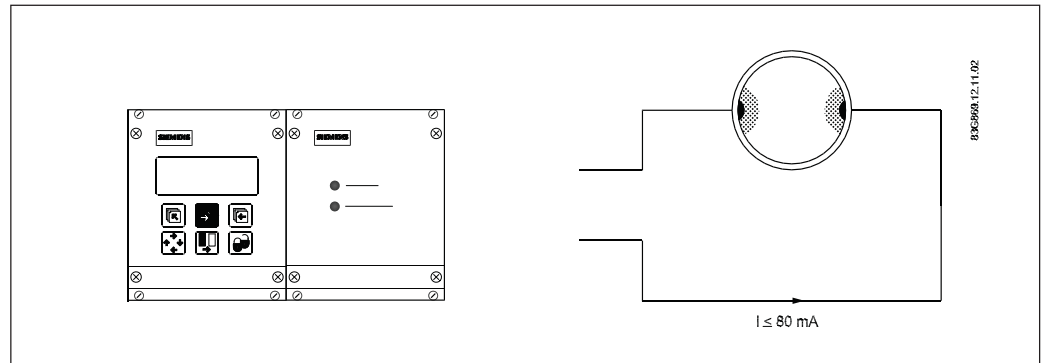
The cleaning unit cleans the electrodes electro-chemically by applying a voltage to the electrodes for approx. 60 sec. While cleaning, the transmitter stores and holds the latest measured flow reading on the display and also the signal outputs. After an additional pausing period of 60 sec. the flowmeter resumes normal measurement and the cleaning is now completed.

The relay in the transmitter activates the cleaning cycle. In the relay output menu (under cleaning) the cleaning interval can be set between 1 hour and 24 hours.

Cleaning should only take place with liquid in the pipe. This can be detected via the empty pipe detection function. It is therefore recommended to select "empty pipe detection" ON when using the cleaning unit.

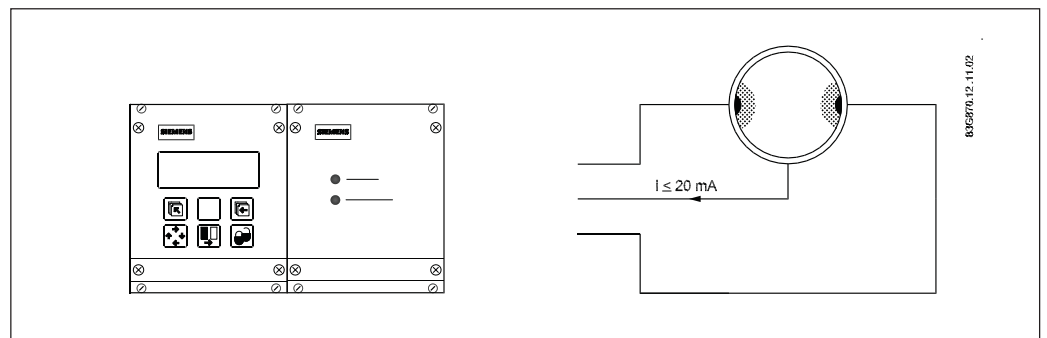
The cleaning sequence can also be controlled manually through the electrical input of the transmitter. Before this is done, ensure that the measuring pipe is full.

#### AC-cleaning



AC-cleaning is used to remove fatty deposits on the electrodes. These fatty deposits are seen in wastewater applications, in abattoirs and water applications with oil residuals. During the cleaning process, the surface of the electrodes get warmer, which tends to soften grease particles and the gas bubbles generated mechanically lift deposits away from the surface of the electrodes.

#### DC-cleaning

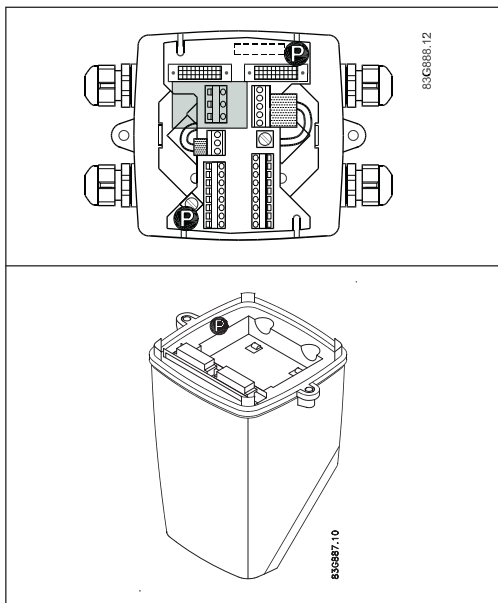


DC-cleaning is used to eliminate electrically conductive deposits in the measuring pipe influencing the measuring accuracy.

Particularly in district heating applications an electrically conductive deposit (magnetite) may occur and short-circuit the electrode signal. In this case the accuracy of the meter decreases and the signal/noise conditions of the meter become inferior. The problem only arises if the conductivity of the water is less than approx. 250  $\mu\text{S}/\text{cm}$ .

During DC-cleaning, electrolysis takes place where the flow of electrons removes the particle deposits from the electrode area.

**3.5  
Custody transfer  
approval**



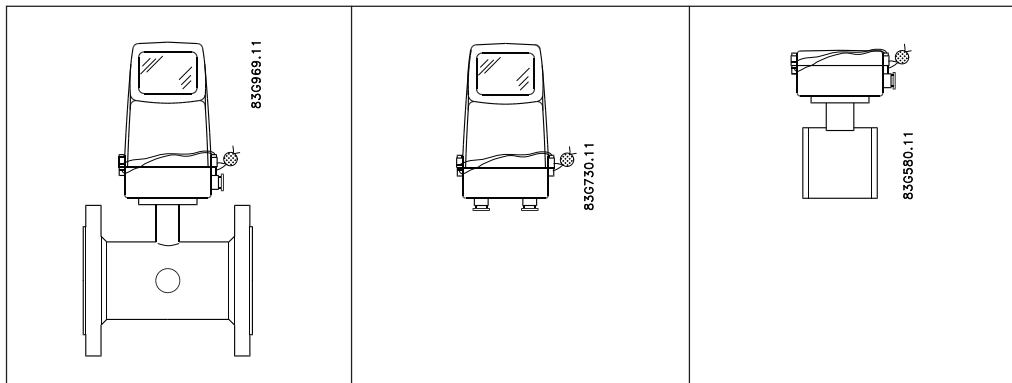
A transmitter can be supplied in a version tested and approved for custody transfer (CT). The internal counter can accordingly be used for charging. This requires verification, sealing and setting of the transmitter together with the sensor for a specific flow range. After sealing the data on the transmitter must not be changed.

The sealing of the transmitter is done by placing sealing marks on the transmitter and on the connection plate in the terminal box.

P indicates sealing locations

**3.6  
Transmitter  
MAG 5000 CT,  
MAG 6000 CT  
Sealing**

The final sealing should be carried out as shown:



MAG 6000 CT is installed like a standard MAG 6000 except for the final sealing. Calibration sealing has been carried out at calibration.

3.7 Ex survey according to Directive 94/9/EC (ATEX)

as an example:

II	2G	E	Ex	ia	IIB	T3-T6
----	----	---	----	----	-----	-------

Directive 94/9/EC (ATEX)

**Instrument groups**

<b>I</b>	Applies to instruments used in underground mining operations, as well as their above ground operations, which can be endangered by mine gas and/or flammable dusts.
<b>II</b>	Applies to instruments used in the remaining areas which can be endangered by a potentially explosive atmosphere.

**Instrument category**

Labelling with gases	Labelling with dusts	Definition
<b>1G</b> (0)	<b>1D</b> (20)	Instruments of this category are for use in areas where ignitable atmospheres, caused by a mixture of air and gasses, vapours or mists, or by dust/air mixtures, can exist all of the time or for long periods of time or else frequently.
<b>2G</b> (1)	<b>2D</b> (21)	Instruments of this category are for use in areas where ignitable atmospheres caused, by a mixture of air and gasses, vapours or mists, or by dust/air mixtures, can exist some of the time.
<b>3G</b> (2)	<b>3D</b> (22)	Instruments of this category are for use in areas where ignitable atmospheres, caused by a mixture of air and gasses, vapours or mists, or by dust/air mixtures, are not likely to exist. However, if they do occur then in all probability, only seldom or for short periods of time.

(The figures in brackets refer to IEC)

**Built according to European norm = E**

**Explosion protected electrical equipment = Ex**

Ex protection labelling in square brackets refers to "Associated electrical equipment"

**Type of protection**

o	Oil encapsulated	i	Intrinsic safety (ia, ib)
p	Pressurized apparatus	n	Non-incentive equipment
q	Powder filling	m	Encapsulation
d	Flameproof enclosure	s	Special protection
e	Increased safety		

**Explosion groups**

Gases and vapours (examples)	Minimum ignition energy [mJ]	EN / IEC
• Ammonia	-	IIA
• Acetone, aircraft fuel, benzine, crude oil, diesel oil, ethane, ethanoic acid, ether, gasolines, heating oil, hexane, methane, propane	0.18	IIA
• Ethylene, isoprene, town gas	0.06	IIB
• Acetylene, carbon disulphide, hydrogen	0.02	IIC

**Ignition temperature**

Maximum surface temperature	EN / IEC	
450°C	842°F	T1
300°C	572°F	T2
200°C	392°F	T3
135°C	275°F	T4
100°C	212°F	T5
85°C	185°F	T6

EN 50014

3.8 Approvals

**SITRANS F M sensors are ATEX approved according to the following approvals**

**MAG 1100, MAG 1100 F for mounting in Ex areas**  
SIRA 07 ATEX 3181X

**MAG 3100, MAG 3100 P for mounting in Ex areas**  
SIRA 03 ATEX 3339X

**MAG 6000 & safety barriers carry the following approvals**

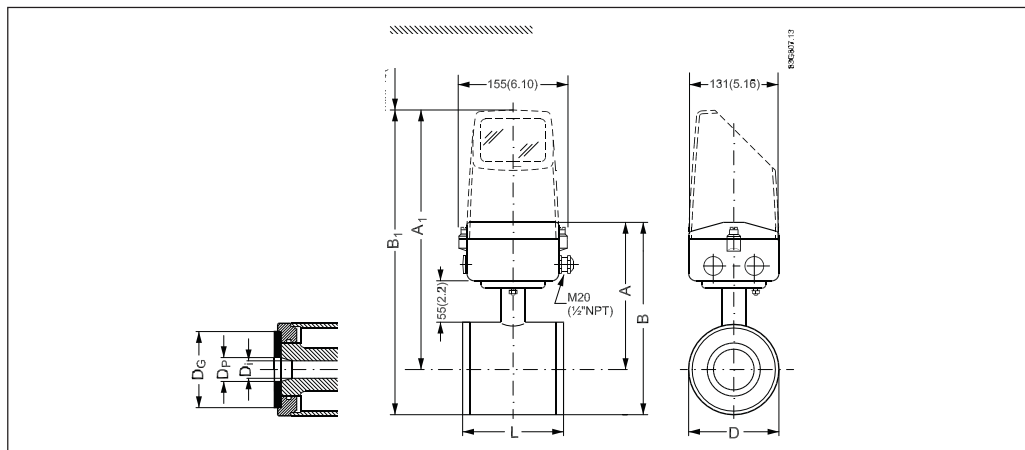
For use with **MAG 1100, MAG 1100 F, MAG 3100 and MAG 3100 P** for mounting in the safe area

[EEx ia ib] IIB,  II 2 G

DEMKO 03 ATEX 135255X CE539

MAG 1100 Standard und Ex

MAG 1100 / MAG 5000/6000 remote or compact

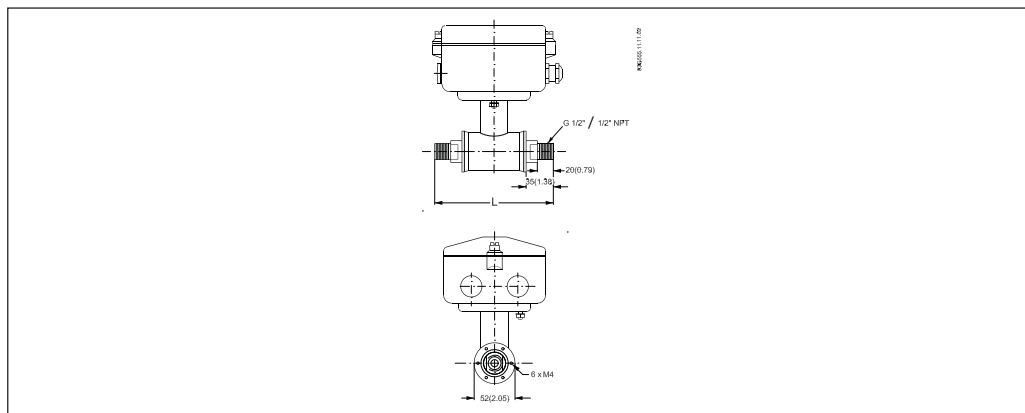


Size DN	A <sup>1)</sup> [mm]	B <sup>1)</sup> [mm]	A <sub>1</sub> [mm]	B <sub>1</sub> [mm]	D [mm]	D <sub>i</sub> [mm]	D <sub>i</sub> (PFA) [mm]	D <sub>p</sub> [mm]	D <sub>G</sub> [mm]	Weight <sup>2)</sup> [kg]
2	161	186	315	340	48.7	2		17.3	34	2.2
3	161	186	315	340	48.7	3		17.3	34	2.2
6	161	186	315	340	48.7	6		17.3	34	2.2
10	161	186	315	340	48.7	10	10	13.6	34	2.2
15	161	186	315	340	48.7	15	16	17.3	40	2.2
25	169	201	323	354	63.5	25	26	28.5	56	2.7
40	179	221	329	375	84.0	40	38	43.4	75	3.4
50	188	239	333	393	101.6	50	50	54.5	90	4.2
65	198	258	342	412	120.9	65	66	68.0	112	5.5
80	204	270	351	424	133.0	80	81	82.5	124	7.0
100	217	296	370	450	159.0	100	100	107.1	145	10.0

Size [inch]	A <sup>1)</sup> [inch]	B <sup>1)</sup> [inch]	A <sub>1</sub> [inch]	B <sub>1</sub> [inch]	D [inch]	D <sub>i</sub> [inch]	D <sub>i</sub> (PFA) [inch]	D <sub>p</sub> [inch]	D <sub>G</sub> [inch]	Weight <sup>2)</sup> [lbs]
1/12	6.34	7.33	12.40	13.39	1.92	0.08		0.68	1.34	4.8
1/8	6.34	7.33	12.40	13.39	1.92	0.12		0.68	1.34	4.8
1/4	6.34	7.33	12.40	13.39	1.92	0.24		0.68	1.34	4.8
3/8	6.34	7.33	12.40	13.39	1.92	0.39	0.39	0.53	1.34	4.8
1/2	6.34	7.33	12.40	13.39	1.92	0.39	0.63	0.68	1.57	4.8
1	6.66	7.92	12.72	13.94	2.50	0.98	1.02	1.12	2.20	4.9
1 1/2	7.05	8.70	13.11	14.76	3.31	1.57	1.50	1.71	2.95	7.5
2	7.40	9.41	13.47	15.47	4.00	1.97	1.97	2.15	3.54	9.2
2 1/2	7.80	10.16	13.82	16.22	4.76	2.56	2.60	2.68	4.41	12
3	8.03	10.63	14.06	16.70	5.24	3.15	3.19	3.25	4.88	15
4	8.54	11.65	14.57	17.72	6.26	3.94	3.94	4.22	5.91	22

1) 14.5 mm/0.57" shorter when the AISI terminal box is used (Ex or high temperature 200 °C (390 °F) version)

2) With transmitter MAG 5000 or MAG 6000 installed, weight is increased by approximately 0.8 kg (1.8 lb).

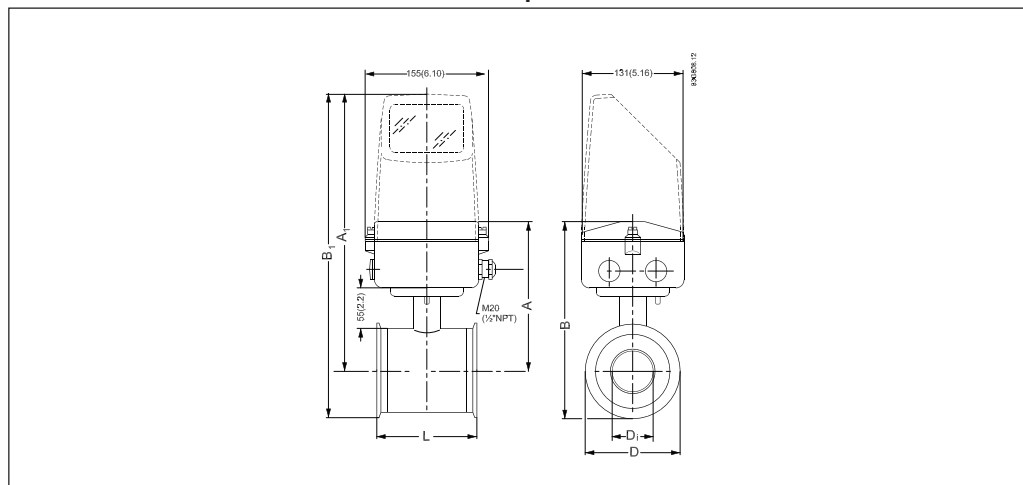


The MAG 1100 DN 2, 3, 6 and 10 (1/12", 1/8", 1/4" and 3/8") are prepared for assembly with the 1/2" pipe connections. The length "L" varies dependent on the gasket choice.

Without gasket		EPDM		Graphite		Teflon	
[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]
150	5.9	150	5.9	152	6.0	156	6.1

MAG 1100 F

MAG 1100 F / MAG 5000/6000 remote or compact

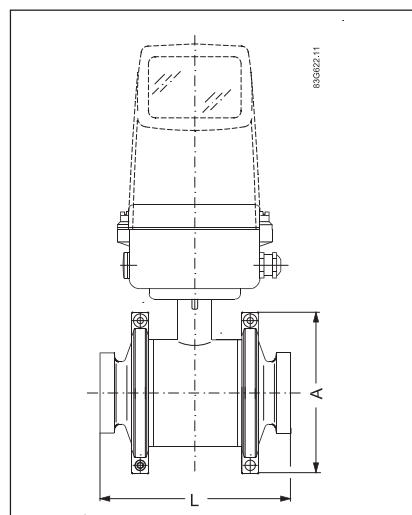


Size	L	A	A <sub>1</sub>	B <sup>1)</sup>	B <sub>1</sub>	D	D <sub>i</sub> (Al <sub>2</sub> O <sub>3</sub> )	D <sub>i</sub> (PFA)	Weight <sup>2)</sup>
DN	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kg]
10	64	161	315	193.7	344.7	64.0	10	10	2.2
15	64	161	315	193.7	344.7	64.0	15	16	2.2
25	79	169	323	207.5	359.0	77.5	25	26	2.7
40	94	179	333	228.0	379.0	91.0	40	38	3.4
50	104	188	342	247.7	398.7	119.0	50	50	4.2
65	131	197.5	351	262.6	413.6	130.0	65	66	5.5
80	156	204	357	281.0	432.0	155.0	80	81	7.0
100	186	217	370	308.0	459.0	183.0	100	100	10.0

Size	L	A	A <sub>1</sub>	B <sup>1)</sup>	B <sub>1</sub>	D	D <sub>i</sub> (Al <sub>2</sub> O <sub>3</sub> )	D <sub>i</sub> (PFA)	Weight <sup>2)</sup>
[inch]	[inch]	[inch]	[inch]	[inch]	[inch]	[inch]	[inch]	[inch]	[lb]
3/8	2.52	6.34	12.40	7.62	13.57	2.52	0.39	0.39	4.8
1/2	2.52	6.34	12.40	7.62	13.57	2.52	0.59	0.63	4.8
1	3.11	6.66	12.72	8.17	14.13	3.05	0.98	1.02	4.9
1 1/2	3.70	7.05	13.11	8.98	14.92	3.58	1.57	1.50	7.5
2	4.09	7.40	13.47	9.75	15.70	4.68	1.97	1.97	9.2
2 1/2	5.16	7.78	13.82	10.34	16.28	5.12	2.56	2.60	12.0
3	6.14	8.03	14.06	11.06	17.01	6.10	3.15	3.19	15.0
4	7.32	8.54	14.57	12.13	18.07	7.20	3.94	3.94	22.0

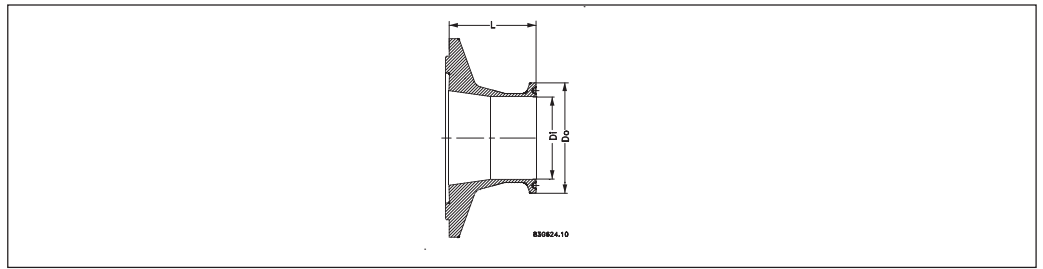
1) 13 mm/0.5" shorter when the AISI terminal box is used (Ex or high temperature 200 °C (390 °F) version)  
 2) With transmitter MAG 5000 or MAG 6000 compact weight is increased by approximately 0.8 kg (1.8 lb).

Sensor MAG 1100 F  
compact/remote -  
Built-in length



Size	Inch	A	L <sup>1)</sup>	
DN	[mm]	[Inch]	[mm]	[mm]
10	3/8	99	3.90	146
15	1/2	99	3.90	146
25	1	113	4.45	161
40	1 1/2	126	4.96	176
50	2	154	6.06	186
65	2 1/2	165	6.50	223
80	3	200	7.87	258
100	4	225	8.86	288

1) The total built-in length "L" is independent of the adapter type selected.

**Accessories**  
**MAG 1100 F**


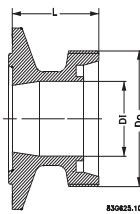
Adapter DN [mm]	Sensor DN [mm]	L [mm]	Weld-in type					
			DIN 11850		ISO 2037 (SMS 3008)		Tri-Clover® (B54825-1)	
			D <sub>i</sub> [mm]	D <sub>o</sub> [mm]	D <sub>i</sub> [mm]	D <sub>o</sub> [mm]	D <sub>i</sub> [mm]	D <sub>o</sub> [mm]
10	10	40	10.0	13.0	10.0	13.0	9.4	12.7
15	15	40	16.0	19.0	16.0	19.0	-	-
15.9	15	40	-	-	-	-	15.75	19.05
20	15	40	-	-	20.0	23.0	-	-
25	25	40	-	-	22.6	25.6	22.1	25.4
25	25	40	26.0	29.0	-	-	-	-
28	25	40	-	-	25.6	28.6	-	-
32	25	40	-	-	-	-	-	-
32	25	40	32.0	35.0	-	-	-	-
38	40	40	-	-	35.6	38.6	34.8	38.1
40	40	40	-	-	37.6	40.6	-	-
40	40	40	38.0	41.0	-	-	-	-
50	50	40	-	-	48.6	51.6	47.5	50.8
50	50	40	50.0	53.0	-	-	-	-
63.5	65	45	-	-	60.3	64.1	60.2 <sup>1)</sup>	63.5 <sup>1)</sup>
65	65	45	66.0	70.0	-	-	-	-
76	65	45	-	-	-	-	-	-
76.1	80	50	-	-	72.9	76.7	72.9	76.2
80	80	50	81.0	85.0	-	-	-	-
100	100	50	100	104	-	-	-	-
101.6	100	50	-	-	97.6	102.5	97.38 <sup>1)</sup>	101.6 <sup>1)</sup>
114.3	100	50	-	-	110.3	115.6	-	-

<sup>1)</sup> For BS4825-1 see ISO 2037

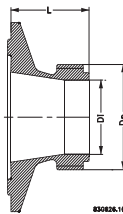
Adapter DN [mm]	Sensor DN [mm]	L [mm]	Weld-in type					
			DIN 11850		ISO 2037 (SMS 3008, B54825-3)		Tri-Clover®	
			D <sub>i</sub> [mm]	D <sub>o</sub> [mm]	D <sub>i</sub> [mm]	D <sub>o</sub> [mm]	D <sub>i</sub> [mm]	D <sub>o</sub> [mm]
10	10	40	10.0	34.0	10.0	34.0	10.0	34.0
15	15	40	16.0	34.0	16.0	34.0	10.0	34.0
25	25	40	-	-	-	-	22.6	50.5
25	25	40	26.0	50.5	26.0	-	-	-
33.7	25	40	-	-	31.3	50.5	-	-
38	40	40	-	-	35.6	38.6	35.6	50.5
40	40	40	38.0	50.0	-	-	-	-
50	50	40	50.0	64.0	-	-	-	-
51	50	40	-	-	48.6	64.0	48.6	64.0
63.5	65	45	-	-	60.3	77.5	60.3	77.5
65	65	45	66.0	91.0	-	-	-	-
76.1	80	50	-	-	72.9	91.0	72.9	91.0
80	80	50	81.0	85.0	-	-	-	-
100	100	50	100	119.9	-	-	-	-
101.6	100	50	-	-	97.6	119.0	97.6	119.0

Tri-Clover® is a registered trademark for Ladish Co.

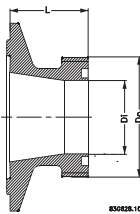
**Accessories**  
**MAG 1100 F**  
 (continued)



Adapter DN [mm]	Sensor DN [mm]	L [mm]	Threaded type	
			DIN 11851	
			Di [mm]	Do [mm]
10	10	40	10.0	28.0
15	15	40	16.0	34.0
20	15	40	20.0	44.0
25	25	40	26.0	52.0
32	25	40	32.0	58.0
40	40	40	38.0	65.0
50	50	40	50.0	78.0
65	65	45	66.0	95.0
80	80	50	81.0	110.0
100	100	50	100.0	130.0



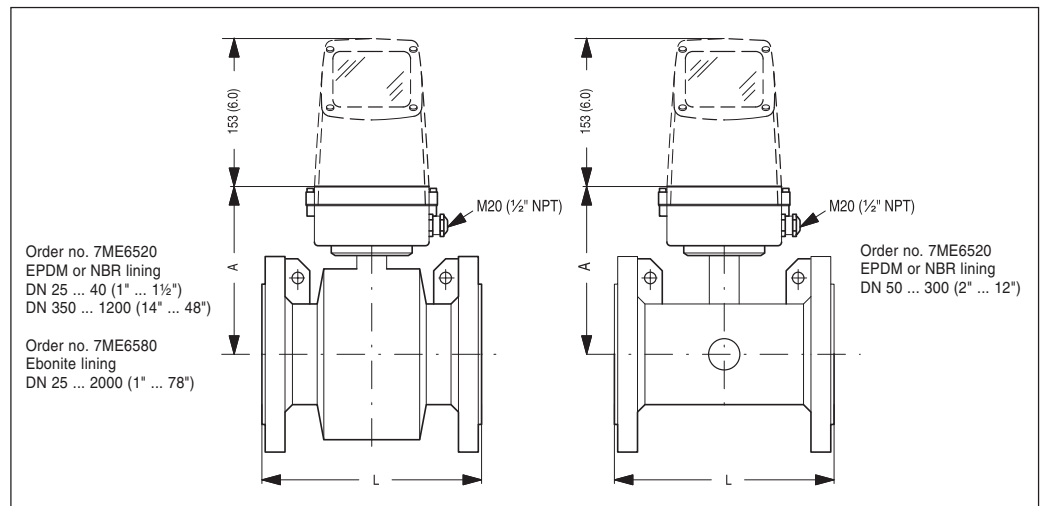
Adapter DN [mm]	Sensor DN [mm]	L [mm]	Threaded type			
			ISO 2853		BS 4825-4	
			Di [mm]	Do [mm]	Di [mm]	Do [mm]
25	25	40	22.6	37.0	22.6	37.0
38	40	40	35.6	51.0	35.6	51.0
51	50	40	48.6	64.0	48.6	64.0
63.5	65	45	60.3	78.0	60.3	78.0
76.1	80	50	72.9	91.0	72.9	91.0
101.6	100	50	-	-	97.6	126.0
101.6	100	50	97.6	118.0	-	-



Adapter DN [mm]	Sensor DN [mm]	L [mm]	Threaded type	
			SMS 1145	
			Di [mm]	Do [mm]
25	25	40	22.6	40.0
38	40	40	35.6	60.0
51	50	40	48.6	70.0
63.5	65	45	60.3	85.0
76	65	45	72.0	98.0



4.3  
Sensor MAG 5100 W



Nominal size		A				L											
		Order No. 7ME6520 NBR or EPDM liner		Order No. 7ME6580 Ebonite liner		PN 10		PN 16		PN 16 non PED		PN 40		Class 150 AWWA		AS	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
25	1"	187	7.4	187	7.4	N/A	N/A	N/A	N/A	N/A	N/A	200	7.9	200	7.9	200	7.87
40	1½"	197	7.8	197	7.8	N/A	N/A	N/A	N/A	N/A	N/A	200	7.9	200	7.9	200	7.87
50	2"	188	7.4	205	8.1	N/A	N/A	200	7.9	N/A	N/A	N/A	N/A	200	7.9	200	7.87
65	2½"	194	7.6	212	8.3	N/A	N/A	200	7.9	N/A	N/A	N/A	N/A	200	7.9	200	7.87
80	3"	200	7.9	222	8.7	N/A	N/A	200	7.9	N/A	N/A	N/A	N/A	200	7.9	200	7.87
100	4"	207	8.1	242	9.5	N/A	N/A	250	9.8	N/A	N/A	N/A	N/A	250	9.8	250	9.84
125	5"	217	8.5	255	10.0	N/A	N/A	250	9.8	N/A	N/A	N/A	N/A	250	9.8	250	9.84
150	6"	232	9.1	276	10.9	N/A	N/A	300	11.8	N/A	N/A	N/A	N/A	300	11.8	300	11.81
200	8"	257	10.1	304	12.0	350	13.8	350	13.8	N/A	N/A	N/A	N/A	350	13.8	350	13.78
250	10"	284	11.2	332	13.1	450	17.7	450	17.7	N/A	N/A	N/A	N/A	450	17.7	450	17.72
300	12"	310	12.2	357	14.1	500	19.7	500	19.7	N/A	N/A	N/A	N/A	500	19.7	500	19.69
350	14"	382	15.0	362	14.3	550	21.7	550	21.7	N/A	N/A	N/A	N/A	550	21.7	550	21.65
400	16"	407	16.0	387	15.2	600	23.6	600	23.6	N/A	N/A	N/A	N/A	600	23.6	N/A	23.62
450	18"	438	17.2	418	16.5	600	23.6	600	23.6	N/A	N/A	N/A	N/A	600	23.6	600	23.62
500	20"	463	18.2	443	17.4	600	23.6	600	23.6	N/A	N/A	N/A	N/A	600	23.6	600	23.6
600	24"	514	20.2	494	19.4	600	23.6	600	23.6	N/A	N/A	N/A	N/A	600	23.6	600	23.6
700	28"	564	22.2	544	21.4	700	27.6	700	27.6	N/A	N/A	N/A	N/A	700	27.6	700	27.6
750	30"	591	23.3	571	22.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	750	29.5	750	N/A
800	32"	616	24.3	606	23.9	800	31.5	800	31.5	N/A	N/A	N/A	N/A	800	31.5	800	31.5
900	36"	663	26.1	653	25.7	900	35.4	900	35.4	N/A	N/A	N/A	N/A	900	35.4	900	35.4
1000	40"	714	28.1	704	27.7	1000	39.4	1000	39.4	N/A	N/A	N/A	N/A	1000	39.4	1000	39.4
	42"	714	28.1	704	27.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1000	39.4	N/A	N/A
	44"	765	30.1	755	29.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1100	43.3	N/A	N/A
1200	48"	820	32.3	810	31.9	1200	47.2	1200	47.2	N/A	N/A	N/A	N/A	1200	47.2	1200	47.2
1400	54"	N/A	N/A	925	36.4	1400	55.1	N/A	N/A	1400	55.1	N/A	N/A	1200	47.2	1200	47.2
1500	60"	N/A	N/A	972	38.2	1500	59.1	N/A	N/A	1500	59.1	N/A	N/A	1200	47.2	1200	47.2
1600	66"	N/A	N/A	1025	40.4	1600	63.0	N/A	N/A	1600	63.0	N/A	N/A	1200	47.2	1200	47.2
1800	72"	N/A	N/A	1123	44.2	1800	70.9	N/A	N/A	1800	70.9	N/A	N/A	1200	47.2	1200	47.2
2000	78"	N/A	N/A	1223	48.1	2000	78.7	N/A	N/A	2000	78.7	N/A	N/A	1200	47.2	1200	47.2

## MAG 5100 W weight

Nominal size		Order No. 7ME6520 NBR or EPDM liner										Order No. 7ME6580 Ebonite liner	
		PN 10		PN 16		PN 40		Class 150		AWWA		PN 16	
mm	inch	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs
25	1"	N/A	N/A	N/A	N/A	4	9	4	9	4	9	5	11
40	1½"	N/A	N/A	N/A	N/A	7	15	6	13	7	15	8	17
50	2"	N/A	N/A	9	20	N/A	N/A	8	20	9	20	9	20
65	2½"	N/A	N/A	10.7	24	N/A	N/A	11	24	10.7	24	11	24
80	3"	N/A	N/A	11.6	26	N/A	N/A	13	28	11.6	26	12	24
100	4"	N/A	N/A	15.2	33	N/A	N/A	19	41	15.2	33	16	35
125	5"	N/A	N/A	20.4	45	N/A	N/A	24	52	20.4	45	19	42
150	6"	N/A	N/A	26	57	N/A	N/A	29	64	26	57	27	60
200	8"	48	106	48	106	N/A	N/A	56	124	48	106	40	68
250	10"	64	141	69	152	N/A	N/A	79	174	69	152	60	132
300	12"	76	167	86	189	N/A	N/A	110	243	86	189	80	176
350	14"	104	229	125	274	N/A	N/A	139	307	115	254	110	242
400	16"	119	263	143	314	N/A	N/A	159	351	125	277	125	275
450	18"	136	299	173	381	N/A	N/A	182	400	141	311	175	385
500	20"	163	359	223	491	N/A	N/A	225	495	189	418	200	440
600	24"	236	519	338	744	N/A	N/A	320	704	301	664	287	633
700	28"	270	595	314	692	N/A	N/A	273	602	320	704	330	728
750	30"	N/A	N/A	N/A	N/A	N/A	N/A	329	725	N/A	N/A	360	794
800	32"	346	763	396	873	N/A	N/A	365	804	428	944	450	992
900	36"	432	951	474	1043	N/A	N/A	495	1089	619	1362	530	1168
1000	40"	513	1130	600	1321	N/A	N/A	583	1282	636	1399	660	1455
	42"	N/A	N/A	N/A	N/A	N/A	N/A	687	1512	N/A	N/A	N/A	N/A
	44"	N/A	N/A	N/A	N/A	N/A	N/A	763	1680	N/A	N/A	1140	2513
1200	48	643	1415	885	1948	N/A	N/A	861	1896	813	1789	1180	2601
1400	54	1592	3510	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1600	3528
1500	60	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2460	5423
1600	66	2110	4652	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2525	5566
1800	72	2560	5644	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2930	6460
2000	78	3640	8025	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3665	8080

The effect of temperature on  
working pressure  
MAG 5100 W

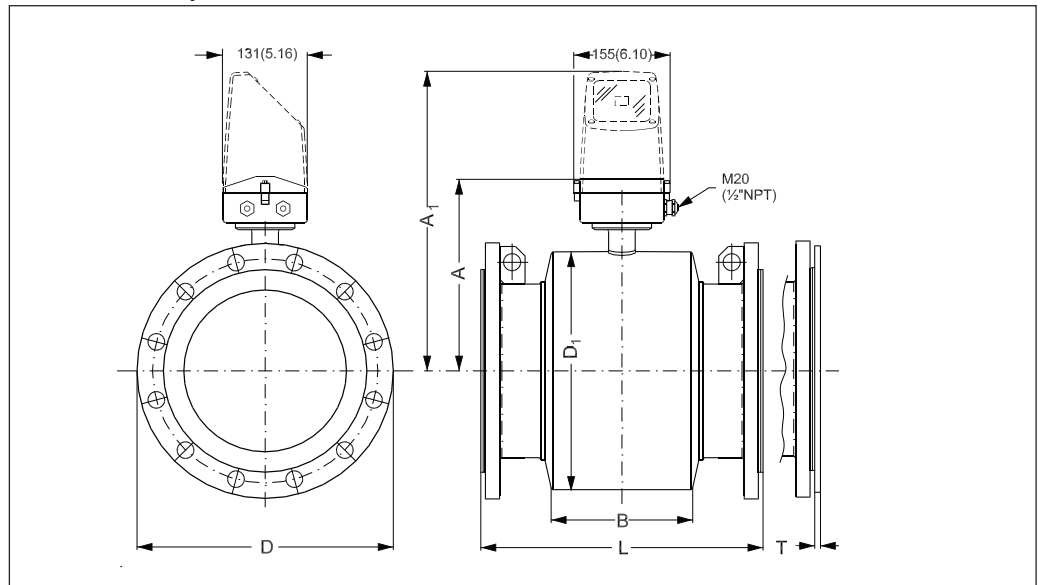
Metric (pressures in bar)						
Sizes 25 mm, 40 mm & > 300 mm						
Flange spec.	Flange rating	Temperature °C				
		-5	10	50	90	
EN 1092-1	PN 10	10.0	10.0	9.7	9.4	
	PN 16	16.0	16.0	15.5	15.1	
	PN 40	40.0	40.0	38.7	37.7	
ANSI B16.45	150 lb	19.7	19.7	19.3	18.0	
AWWA C-207	Class D	10.3	10.3	10.3	10.3	
Sizes 50 mm ... 300 mm (order no. 7ME6520 only)						
EN 1092-1	PN 10	10.0	10.0	10.0	8.2	
	PN 16	10.0	16.0	16.0	13.2	
ANSI B16.45	150 lb	10.0	19.7	19.7	16.2	

Imperial (pressures in psi)					
Sizes 1", 1½", & > 12"					
Flange spec.	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 B16.45	150 lb	286	286	280	261
AWWA C-207	Class D	150	150	150	150
Sizes 2" ... 12" (order no. 7ME6520 only)					
EN 1092-1	PN 10	145	145	145	119
	PN 16	145	232	232	191
ANSI B16.45	150 lb	145	286	286	235

4.4  
Sensor MAG 3100



MAG 3100, compact/remote



DN	A <sup>1)</sup>	A <sub>1</sub>	B	D <sub>1</sub>	L <sup>2)</sup>								T (grounding ring)			Weight <sup>5)</sup>			
					EN 1092-1-2001						ANSI 16.5		AS 2129 E, AS 4087 PN 16-21-35	AWWA C-207 Class D	Type C		Type E <sup>3)</sup>	Type F <sup>4)</sup>	
					PN 6, 10	PN 16/ PN 16 non PED	PN 25	PN 40	PN 63	PN 100	Class 150	Class 300							
[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kg]
15	187	338	59	104	200	200	200	200	-	-	200	200	200	-	-	6	2	4	
25	187	338	59	104	200	200	200	200	-	260	200	200	200	-	1,2	6	2	5	
40	197	348	82	124	200	200	200	200	-	280	200	200	200	-	1,2	6	2	8	
50	205	356	72	139	200	200	200	200	276	300	200	200	200	-	1,2	6	2	9	
65	212	363	72	154	200	200	200	200	320	350	200	272	200	-	1,2	6	2	11	
80	222	373	72	174	200	200	272	272	323	340	272	272	200 <sup>6)</sup>	-	1,2	6	2	12	
100	242	393	85	214	250	250	250	250	380	400	250	310	250	-	1.2	6	2	16	
125	255	406	85	239	250	250	250	250	420	450	250	335	250	-	1.2	6	2	19	
150	276	427	85	282	300	300	300	300	415	450	300	300	300	-	1.2	6	2	27	
200	304	455	137	338	350	350	350	350	480	530	350	350	350	-	1.2	8	2	40	
250	332	483	137	393	450	450	450	450	550	620	450	450	450	-	1.2	8	2	60	
300	357	508	137	444	500	500	500	500	600	680	500	500	500	-	1.6	8	2	80	
350	362	513	270	451	550	550	550	550	-	-	550	550	550	-	1.6	8	-	110	
400	387	538	270	502	600	600	600	600	-	-	600	600	600	-	1.6	10	-	125	
450	418	569	310	563	600	600	600	600	-	-	600	640	600	-	1.6	10	-	175	
500	443	594	350	614	600	600	625	680	-	-	600	730	600 <sup>7)</sup>	-	1.6	10	-	200	
600	494	645	430	715	600	600	750	800	-	-	600	860	600 <sup>8)</sup>	-	1.6	10	-	287	
700	544	695	500	816	700	700	-	-	-	-	-	-	700	700	2.0	-	-	330	
750	571	722	556	869	-	-	-	-	-	-	-	-	750	750	2.0	-	-	360	
800	606	757	560	927	800	800	-	-	-	-	-	-	800	800	2.0	-	-	450	
900	653	804	630	1032	900	900	-	-	-	-	-	-	900	900	2.0	-	-	530	
1000	704	906	670	1136	1000	1000	-	-	-	-	-	-	1000	1000	2.0	-	-	660	
1100	755	906	770	1238	-	-	-	-	-	-	-	-	1100	1400	2.0	-	-	1140	
1200	810	961	792	1348	1200	1200	-	-	-	-	-	-	1200	1200	2.0	-	-	1180	
1400	925	1076	1000	1675	1400	1400	-	-	-	-	-	-	-	1400	2.0	-	-	1600	
1500	972	1123	1020	1672	-	-	-	-	-	-	-	-	-	1500	3.0	-	-	2460	
1600	1025	1176	1130	1915	1600	1600	-	-	-	-	-	-	-	1600	3.0	-	-	2140	
1800	1123	1274	1250	1974	1800	1800	-	-	-	-	-	-	-	1800	3.0	-	-	2930	
2000	1223	1374	1375	2174	2000	2000	-	-	-	-	-	-	-	2000	3.0	-	-	3665	

1) 14.5 mm shorter when the AISI terminal box is used (Ex or high temperature 200 °C version)

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

3) Included and factory-mounted on high temperature 180 °C PTFE

4) Tantalum flat type grounding ring 1 mm

5) Weights are approx. (for PN 16) without transmitter

6) PN 35 DN 80 = 272 mm

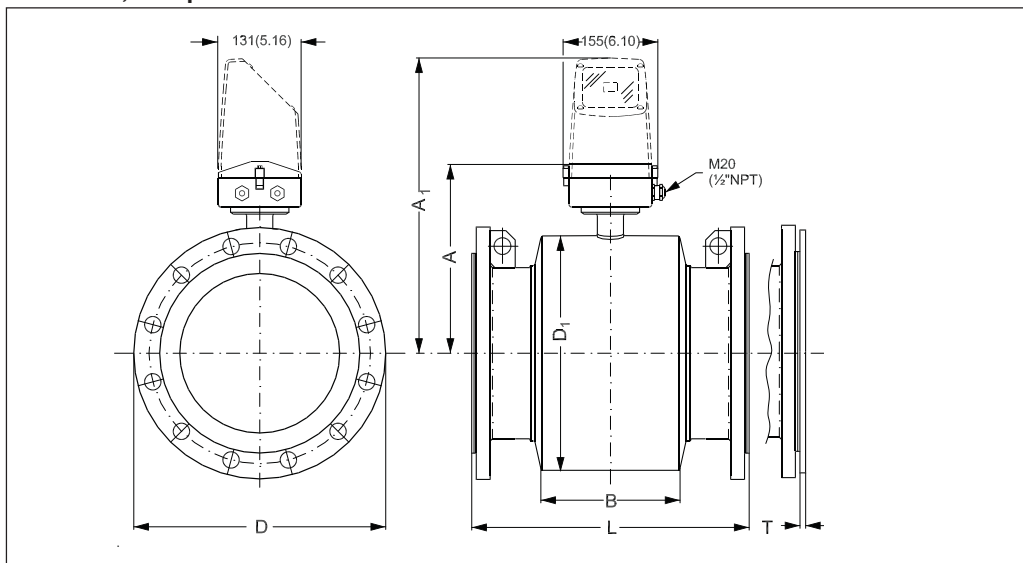
7) PN 35 DN 500 = 680 mm

8) PN 35 DN 600 = 750 mm

D = Outside diameter of flange, see flange tables

4.4.1  
Sensor MAG 3100

MAG 3100, compact/remote



DN	A <sup>1)</sup>	A <sub>1</sub>	B	D <sub>1</sub>	L <sup>2)</sup>										T (grounding ring)			Weight <sup>5)</sup>	
					EN 1092-1-2001						ANSI 16.5		AS 2129 E, AS 4087 PN 16-21-35	AWWA C-207 Class D	Type C	Type E <sup>3)</sup>	Type F <sup>4)</sup>		
					PN 6, 10	PN 16/ PN 16 non PED	PN 25	PN 40	PN 63	PN 100	Class 150	Class 300							
[inch]	[inch]	[inch]	[inch]	[inch]	[inch]	[inch]	[inch]	[inch]	[inch]	[inch]	[inch]	[inch]	[inch]	[inch]	[inch]	[inch]	[inch]	[inch]	[lb]
1/2	7.36	13.31	2.32	4.09	-	-	-	7.87	-	-	7.87	7.87	-	7.87	-	0.24	0.08	11	
1	7.36	13.31	2.32	4.09	-	-	-	7.87	-	10.24	7.87	7.87	-	7.87	0.05	0.24	0.08	13	
1 1/2	7.76	13.70	3.23	4.88	-	-	-	7.87	-	11.02	7.87	7.87	-	7.87	0.05	0.24	0.08	17	
2	8.07	14.01	2.83	5.47	-	-	-	7.87	10.87	11.81	7.87	7.87	-	7.87	0.05	0.24	0.08	28	
2 1/2	8.35	14.29	2.83	6.06	7.87	7.87/-	-	7.87	12.60	13.78	7.87	10.71	-	7.87	0.05	0.24	0.08	30	
3	8.74	14.69	2.83	6.85	7.87	7.87/-	-	10.71	12.72	13.39	10.71	10.71	-	7.87 <sup>6)</sup>	0.05	0.24	0.08	33	
4	9.53	15.47	3.35	8.43	9.84	9.84/-	-	9.84	14.96	-	9.84	12.20	-	9.84	0.05	0.24	0.08	44	
5	10.04	15.98	3.35	9.41	9.84	9.84/-	-	9.84	16.54	-	9.84	13.10	-	9.84	0.05	0.24	0.08	55	
6	10.87	16.81	5.39	11.10	11.81	11.81/-	-	11.81	16.34	-	11.81	11.81	-	11.81	0.05	0.24	0.08	66	
8	11.97	17.91	5.39	13.31	13.78	13.78/-	13.78	13.78	18.90	-	13.78	13.78	-	13.78	0.05	0.31	0.08	110	
10	13.07	19.02	6.18	15.47	17.72	17.72/-	17.72	17.72	-	-	17.72	17.72	-	17.72	0.05	0.31	0.08	155	
12	14.05	20.00	6.18	17.48	19.69	19.69/-	19.69	19.69	-	-	19.69	19.69	-	19.69	0.06	0.31	0.08	176	
14	14.25	20.20	10.63	17.76	21.65	21.65/-	21.65	21.65	-	-	21.65	21.65	-	21.65	0.06	0.31	-	242	
16	15.24	21.18	10.63	19.76	23.62	23.62/-	23.62	23.62	-	-	23.62	23.62	-	23.62	0.06	0.39	-	275	
18	16.45	22.40	12.20	22.16	23.62	23.62/-	23.62	23.62	-	-	23.62	23.62	-	23.62	0.06	0.39	-	385	
20	17.44	23.39	13.78	24.17	23.62	23.62/-	24.61	26.77	-	-	23.62	28.70	-	23.62 <sup>7)</sup>	0.06	0.39	-	335	
24	19.45	25.39	16.93	28.15	23.62	23.62/-	29.53	31.50	-	-	23.62	33.80	-	23.62 <sup>8)</sup>	0.06	0.39	-	630	
28	21.42	27.36	19.69	32.13	27.56	34.45/27.56	-	-	-	-	-	-	27.56	27.56	0.08	-	-	725	
30	22.48	28.43	21.89	34.21	-	-	-	-	-	-	-	-	29.52	29.52	0.08	-	-	830	
32	23.86	29.80	22.05	36.50	31.50	39.37/31.50	-	-	-	-	-	-	31.50	31.50	0.08	-	-	990	
36	25.71	31.65	24.80	40.63	35.43	44.29/35.43	-	-	-	-	-	-	35.43	35.43	0.08	-	-	1160	
40	27.72	35.67	26.38	44.72	39.37	49.21/39.37	-	-	-	-	-	-	39.37	39.37	0.08	-	-	1453	
42	27.72	35.67	26.38	44.72	-	-	-	-	-	-	-	-	39.37	-	0.08	-	-	1453	
44	29.72	35.67	30.31	48.74	-	-	-	-	-	-	-	-	43.31	43.31	0.08	-	-	-	
48	31.89	37.83	31.18	53.07	47.24	59.06/47.24	-	-	-	-	-	-	47.24	47.24	0.08	-	-	2592	
54	36.42	42.36	39.37	65.94	55.12	55.12	-	-	-	-	-	-	55.12	-	0.12	-	-	2940	
60	38.27	44.21	40.15	65.83	59.06	59.06/59.06	-	-	-	-	-	-	59.06	-	0.12	-	-	3422	
66	40.35	46.30	44.49	75.39	62.99	62.99	-	-	-	-	-	-	63.00	-	0.12	-	-	3904	
72	44.21	50.16	49.21	77.72	70.87	70.87	-	-	-	-	-	-	70.87	-	0.12	-	-	4846	
78	48.15	54.09	54.13	85.59	78.74	78.74	-	-	-	-	-	-	78.74	-	0.12	-	-	6806	

1) 0.571 inch shorter when the AISI terminal box is used (Ex or high temperature 390 °F version)

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

3) Included and factory-mounted on high temperature 356 °F PTFE

4) Tantalum flat type grounding ring 1 mm

5) Weights are approx. (for PN 16) without transmitter

6) PN 35 DN 80 = 10.70 inch

7) PN 35 DN 500 = 26.77 inch

8) PN 35 DN 600 = 29.53 inch

D = Outside diameter of flange, see flange tables

Earthing/protection flange

Type C

Type E

DN/ Size	t <sub>1</sub> [mm/ inch]	t <sub>2</sub> [mm/ inch]	Weight [kg/ lbs]
25 ... 250/1" ... 10"	1.2/0.05	15/0.6	0.03-0.4/<1
300 ... 600/12" ... 24"	1.6/0.06	20/0.8	0.6 ... 2.6/1 ... 6
700 ... 1200/28" ... 48"	2.0/0.08	25/1.0	3 ... 5/6 ... 11
1400 ... 2000/54" ... 78"	3.0/0.12	40/1.6	9 ... 16/20 ... 35

DN/ Size	t <sub>1</sub> [mm/ inch]	Weight [kg/ lbs]
15/½"	6/0.2	0.07/0.15
25 ... 150/1" ... 6"	6/0.2	0.3 ... 1.4/1 ... 3
200 ... 350/8" ... 14"	8/0.3	1.7 ... 4.1/4 ... 9
400 ... 600/16" ... 24"	10/0.4	6.5 ... 13.0/14 ... 28

DN/ Size	t <sup>1)</sup> [mm/ inch]	Weight [kg/ lbs]
15 ... 40/½" ... 1½"	2/0.08	0.015 ... 0.12/0.033 ... 0.26
50 ... 100/1" ... 6"	2/0.08	0.159 ... 0.316/0.35 ... 0.7
125 ... 200/8" ... 14"	2/0.08	0.316 ... 0.723/0.7 ... 1.6
250 ... 300/16" ... 24"	2/0.08	0.884 ... 1.485/1.95 ... 3.27

1) Flat type grounding ring in tantalum 1/0.04

Type C flanges for liners of neoprene, EPDM, Linatex<sup>®</sup> and ebonite.

Type E flanges for liners of PTFE.

Flat rings for neoprene, EPDM, Linatex, ebonite, PFA and PTFE 130°/260°F (Not PTFE 180°/360°F)

**Note**

MAG 3100 high temperature (PTFE) is always equipped with 2 pcs. type E earthing flanges.

4.5 Transmitter

Compact polyamide

Transmitter installed in compact mode

Weight: MAG 6000 and MAG 5000:  
0.75 kg (1.7 lbs)

Transmitter installed remote

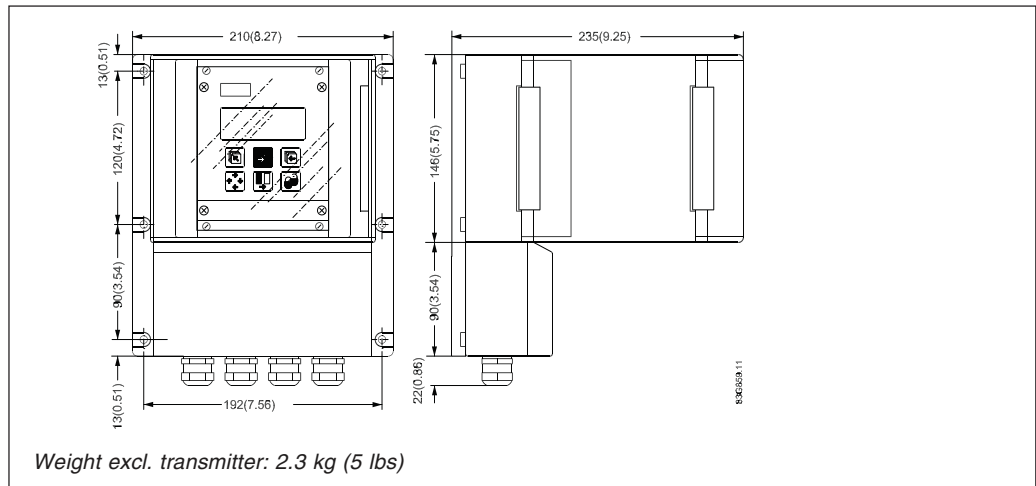
Weight: Wall bracket:  
0.9 kg (2 lbs)

19" insert, standard unit

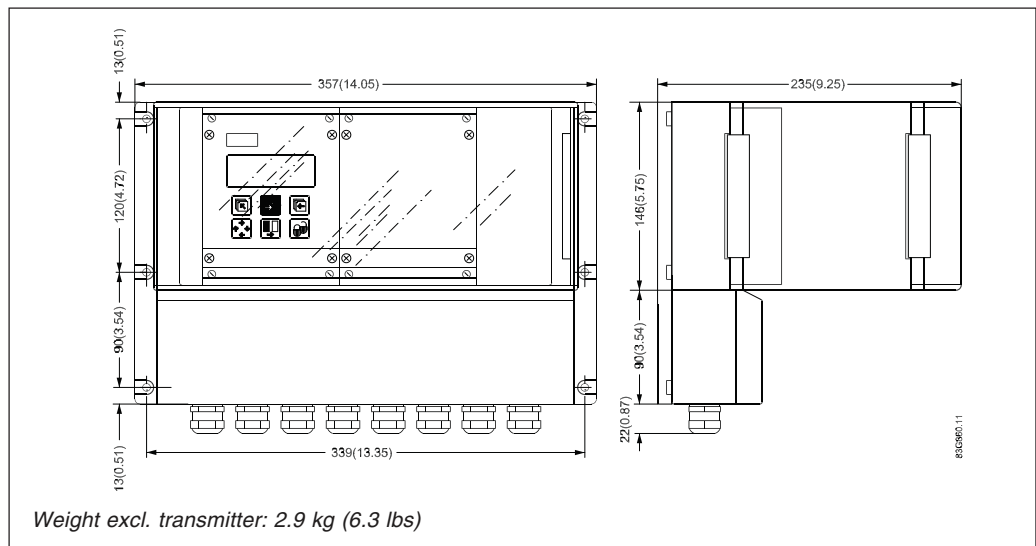
Weight incl. back print:

- MAG 5000: 0.8 kg/1.8 lbs
- MAG 6000: 0.8 kg/1.8 lbs
- Safety barrier (ia/ib): 1.0 kg/2.2 lbs
- Safety barrier (ia): 0.8 kg/1.8 lbs
- Cleaning unit: 0.9 kg/2.0 lbs

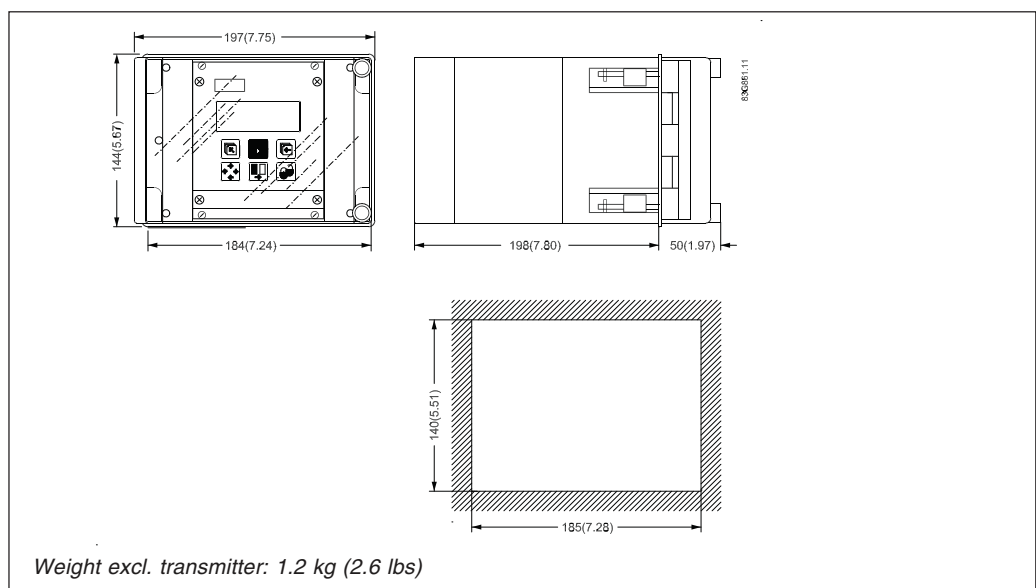
**Wall mounting box 21 TE**



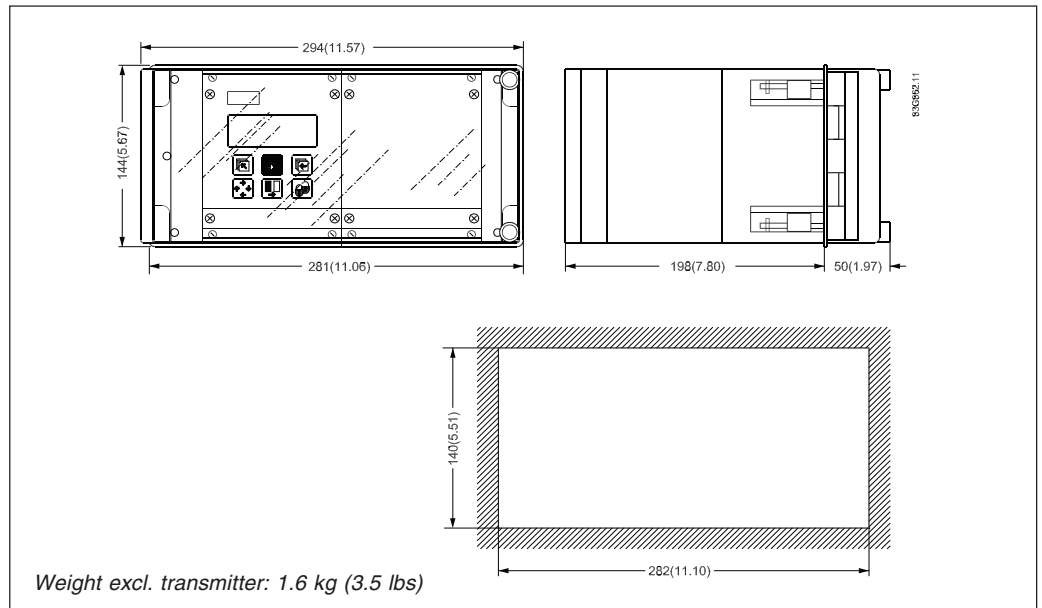
**Wall mounting box 42 TE**



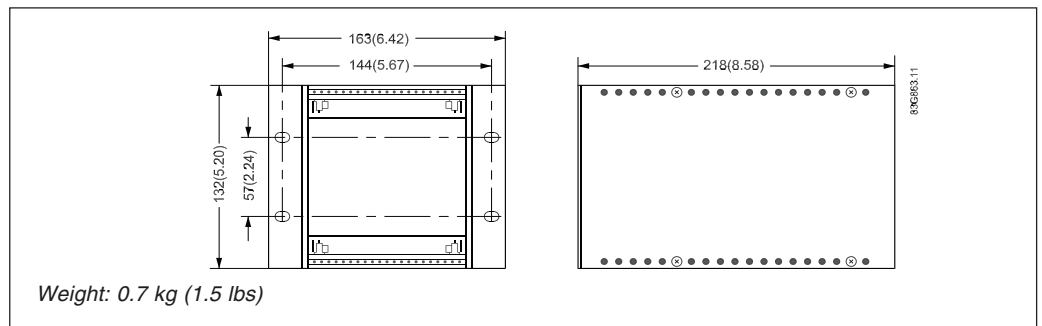
**Panel front unit 21 TE**



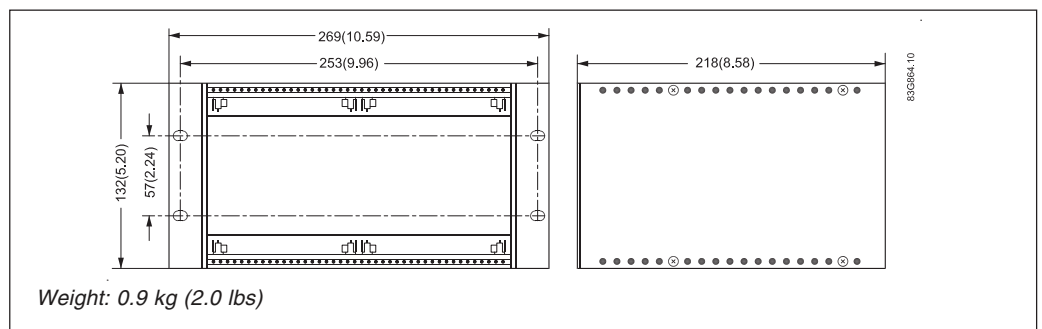
**Panel front unit 42 TE**



**Back of panel unit 21 TE**



**Back of panel unit 42 TE**

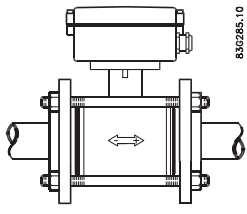
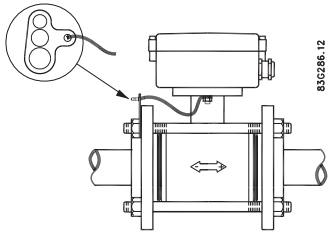
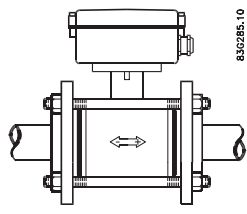
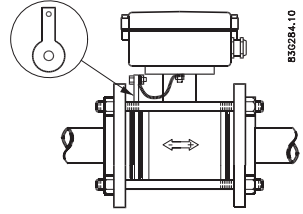


5. Installation of sensor

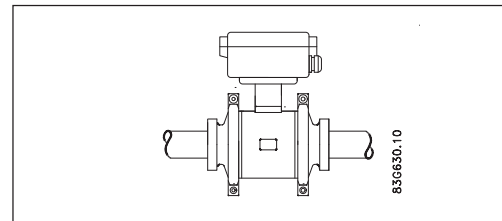
To obtain optimum results from the measuring system, the chassis body of the sensor must have the same electrical potential as the liquid being measured.

5.1 Potential equalization

MAG 1100

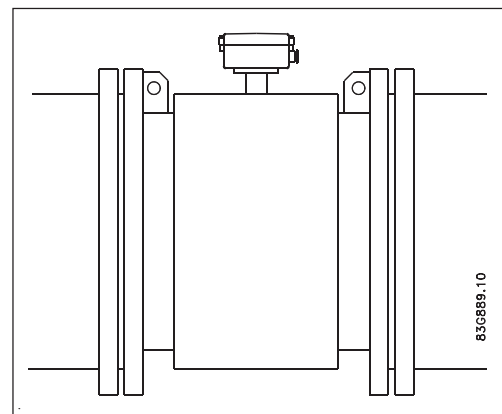
	Graphite gaskets	EPDM or PTFE gaskets
Electrically conductive piping	 <p><b>A:</b> Potential equalization with electrically conductive graphite gaskets</p>	 <p><b>B:</b> Potential equalization using earth strap supplied.</p>
Electrically non-conductive piping	 <p><b>C:</b> Potential equalization with electrically conductive graphite gaskets</p>	 <p><b>D:</b> Potential equalization using separate potential equalization ring</p>

MAG 1100 F



The sensor must be installed between two adapters. Potential equalization with the liquid occurs automatically via these adapters and through the adjacent pipe.

MAG 3100 / MAG 5100 W (except PTFE and PFA liner)

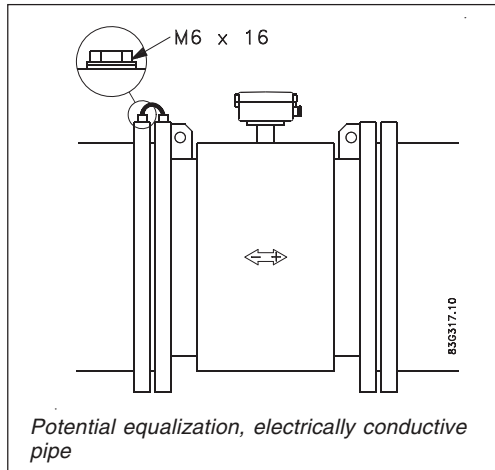


Potential equalization is carried out with the built-in grounding electrodes. No further actions need to be taken.

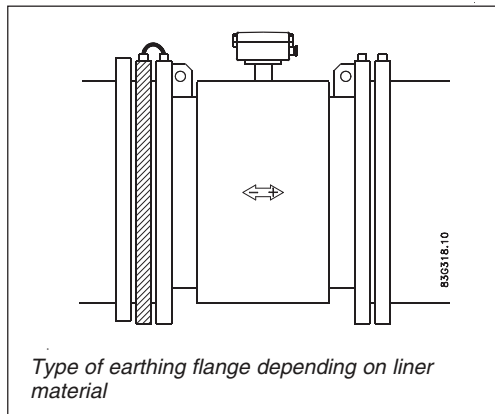
**Please note:** MAG 3100 has no grounding electrodes if the electrodes materials are platinum or tantalum or PN 100.



**MAG 3100  
(PTFE liner and PFA)**



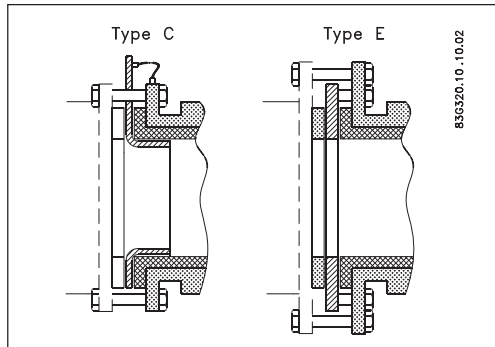
**Electrically conductive piping**  
Use an earth strap on one side.



**Non-conductive piping**  
Use an earthing flange. Place the flange between flowmeter and the adjacent pipe flange. Selection of earthing flange depends on the medium, liner material and application, see figure.

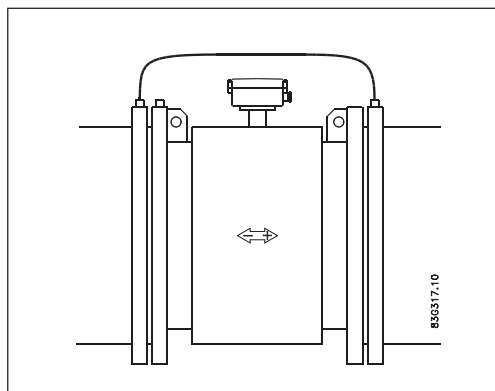
Liner material	Suitable earthing flange
PTFE	Type E
PFA	Flat ring

**5.2  
Inlet protection MAG 3100**



With abrasive liquids, flowmeter inlet protection may be necessary. Here type C and E earthing flanges are used. Type C (for all liners except PTFE and PFA) is clamped between the flanges. Type E (for PTFE liner only) is fitted to the flange. Flat ring (for PFA liner only) is fitted to the flange. When using an earthing flange, gaskets must always be used between the adjacent pipe flange and the earthing flange.

**5.3  
Cathodic protected piping**



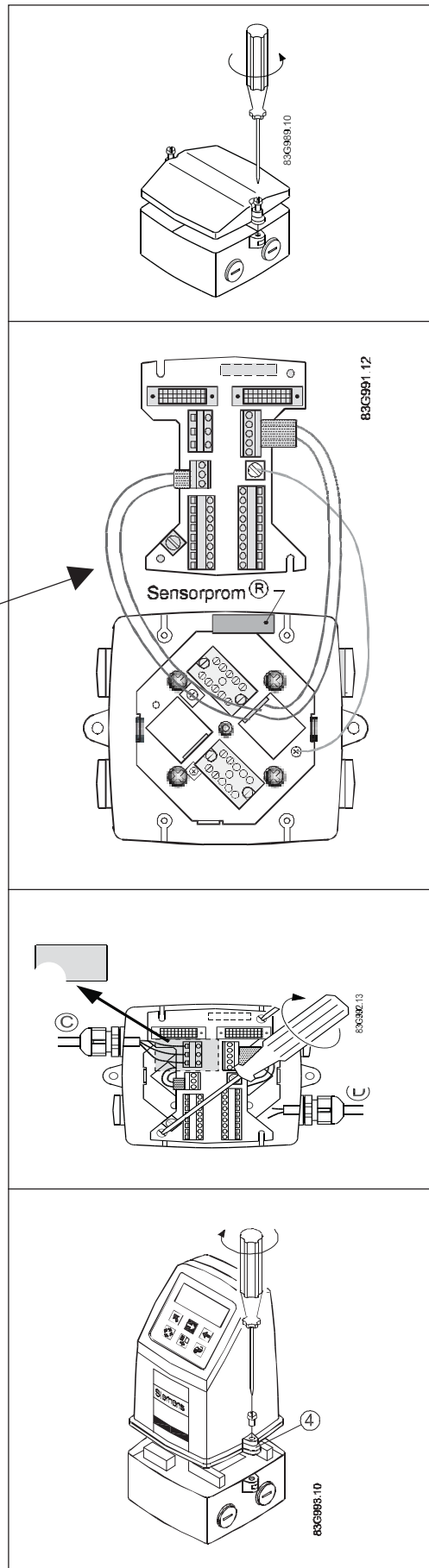
Special attention must be given to systems with cathodic protection.  
**Compact installation:**  
The transmitter must be supplied through an isolation transformer. The terminal "PE" must never be connected.  
**Remote installation:**  
The screen must only be connected at the sensor end via a 1.5 µF condensator. The screen must never be connected at both ends.  
**Isolated sensor:**  
If above mentioned connections are unacceptable, the sensor must be isolated from the pipe work.  
The bolts must be isolated from pipe.

6. Installation of transmitter

6.1 Compact installation  
MAG 5000 and MAG 6000  
Compact polyamide

**Note**  
System will not register flow if black plugs are not connected to connection board

**Caution**  
Exposing the transmitter to direct sunlight may increase the operating temperature above its specified limit, and decrease display visibility



**Step 1**

Remove and discard the terminal box lid of the sensor.

Fit the M20/½NPT cable glands for the supply and output cables.

**Step 2**

Remove the two black plug assemblies for coil and electrode cables in the terminal box and connect them to their corresponding terminal numbers on the connection board.

**Step 3**

Connect earth wire on connection board to bottom of connection box.

Connect the 2 pin connector and 3 pin connector as shown.

**Note**

In earlier version the 3 pin connector was a 5 pin connector.

**Step 4**

Mount the connection plate in the terminal box. The SENSORPROM® unit connections will be established automatically when the connection plate is mounted in the terminal box.

**Note**

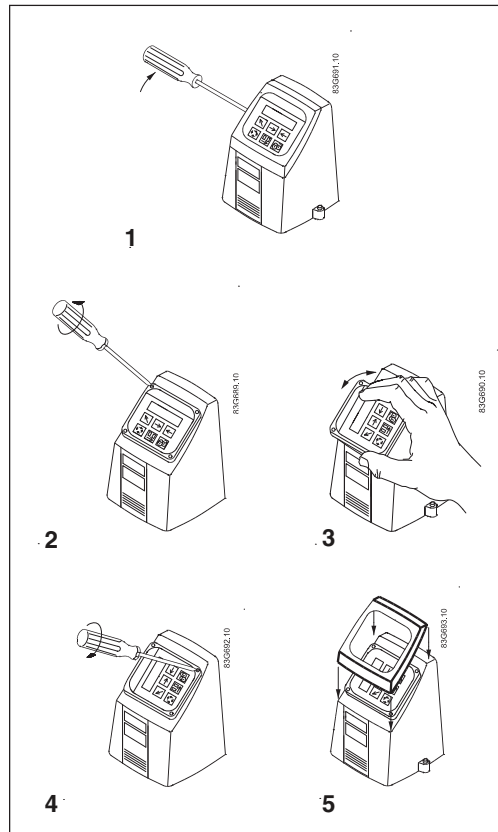
Check that your connection board lines up with the SENSORPROM® unit, if not, move the SENSORPROM® unit to the other side of the terminal box.

**Step 5**

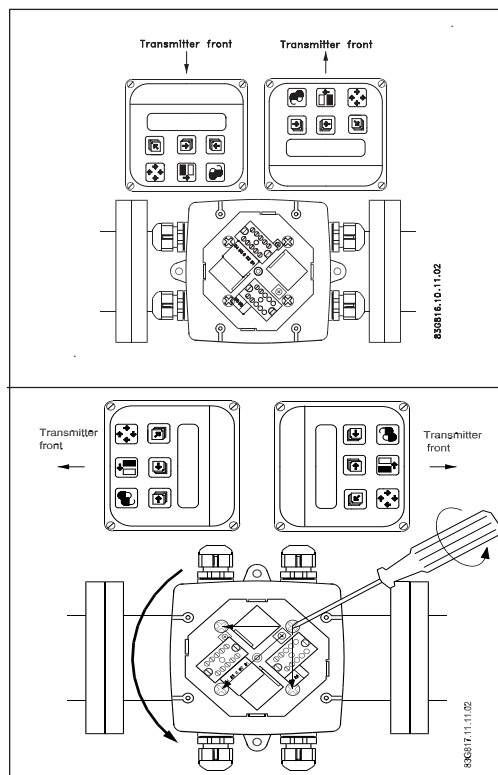
Fit the supply and output cables respectively and tighten the cable glands to obtain optimum sealing.

Please refer to the wiring diagram in chapter 7 for the electrical connections.

Mount the transmitter on the terminal box.

**Turning the control pad**

1. Use a screwdriver to remove the outer frame.
2. Loosen the 4 screws retaining the control pad.
3. Withdraw the control pad and turn it to the required orientation.
4. Tighten the 4 screws until a mechanical stop is felt in order to obtain IP 67 enclosure rating.
5. Snap-lock the outer frame onto the control pad (click).

**Turning the transmitter**

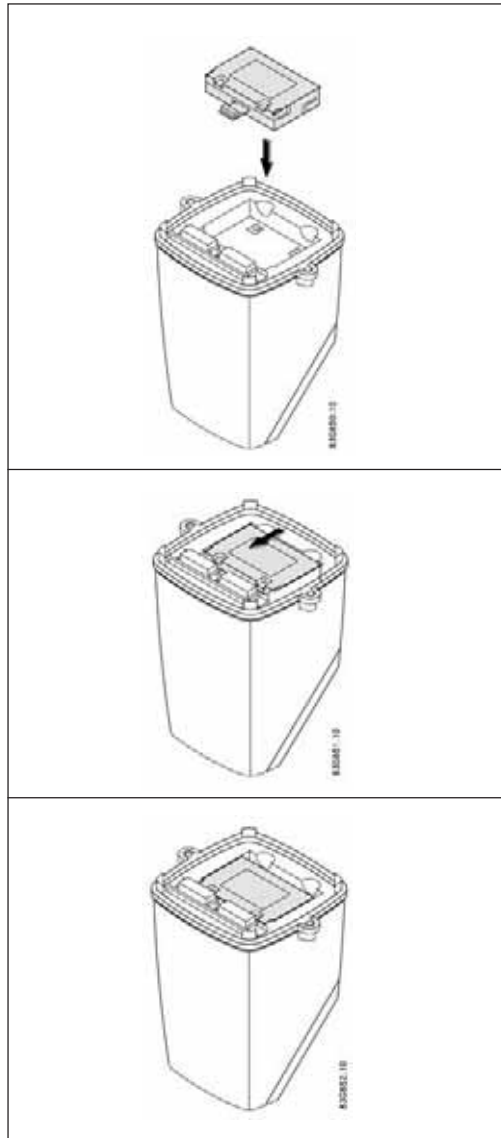
The transmitter can be mounted in either direction as the arrow indicates without turning the terminal box.

The connection board needs to be oriented according to the display direction.

The terminal box can be rotated  $\pm 90^\circ$  in order to optimize the viewing angle of the transmitter display/keypad:

1. Unscrew the four screws in bottom of terminal box.
2. Turn terminal box to required position.
3. Retighten screws firmly

**6.2.1**  
**Add-on modules**  
**MAG 6000 only**

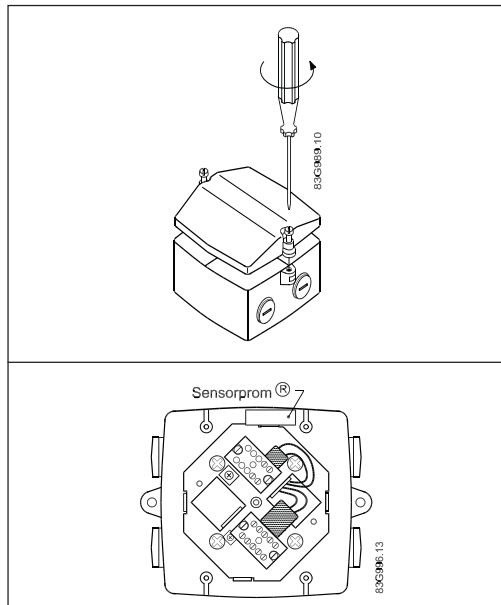


Locate the add-on module in the bottom of the MAG 6000 transmitter.

Press the add-on module forwards as far as possible.

The add-on module has now been installed and the transmitter is ready to be installed on the terminal box.  
 Communication to the operator menu and electrically inputs and outputs is automatically established by power on.

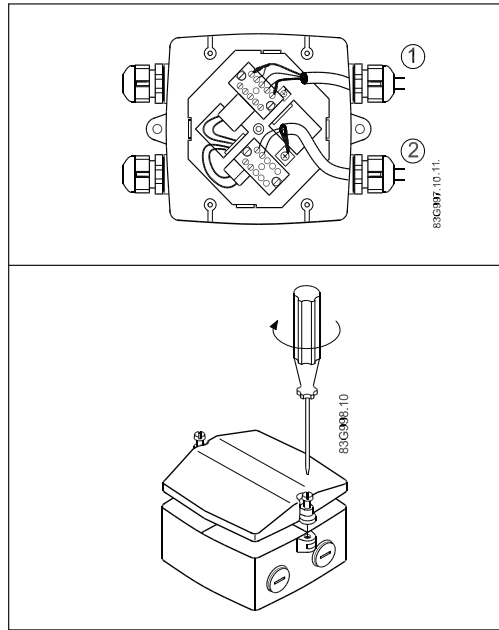
**6.2.2**  
**Remote installation -**  
**At the sensor**



**Step 1**  
 Remove the terminal box lid of the sensor.

**Step 2**  
 Remove the SENSORPROM® unit from the sensor and mount it on the connection plate in the transmitter.

**6.2.2**  
Remote installation -  
*At the sensor*



**Step 3**

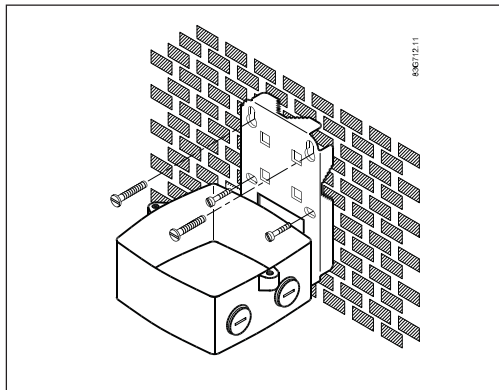
Fit the ½”NPT or M20 cable glands for the supply and output cables.  
Fit and connect the electrode and coil cables as shown in chapter 7 “Electrical connections”. The unscreened cable ends must be kept as short as possible.  
The electrode cable and the coil cable must be kept separate to prevent interference.  
Tighten the cable glands well to obtain optimum sealing.

**Step 4**

Mount the lid on the terminal box.

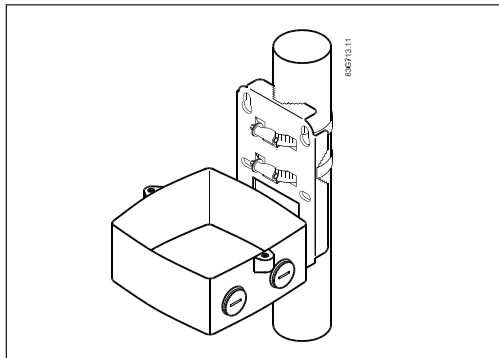
**6.2.3**  
Remote installation -  
*Wall mounting*

MAG 6000



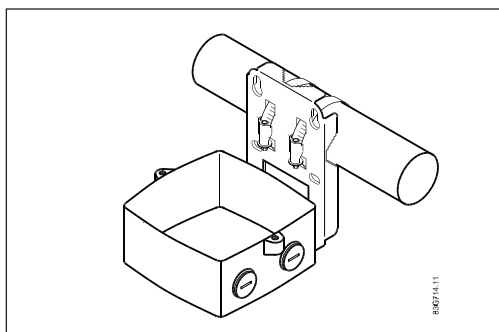
Mount wall bracket on a wall or into the back of a panel.

*Vertical pipe mounting*



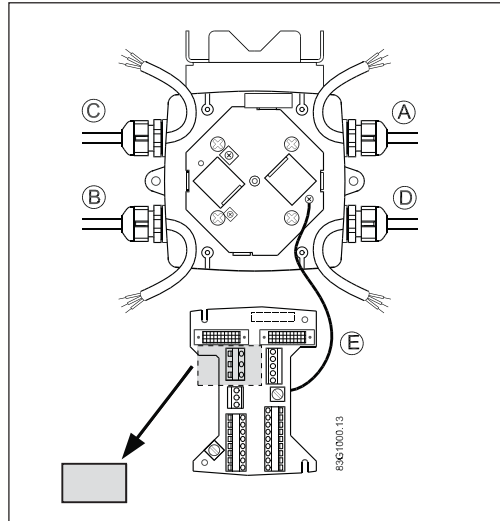
Mount wall bracket on a vertical or horizontal pipe using an ordinary hose clip or a duct strap.

*Horizontal pipe mounting*



**6.2.3**  
**Remote installation -**  
**Wall mounting**  
*(continued)*

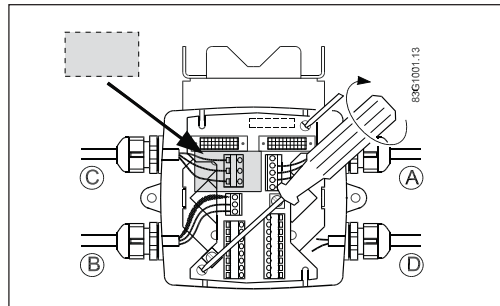
**MAG 6000**



**Step 2**

Take the SENSORPROM® memory unit from the sensor. Mount the SENSORPROM® unit in the wall mounting unit as shown. The text on the SENSORPROM® unit must face towards the wall bracket.

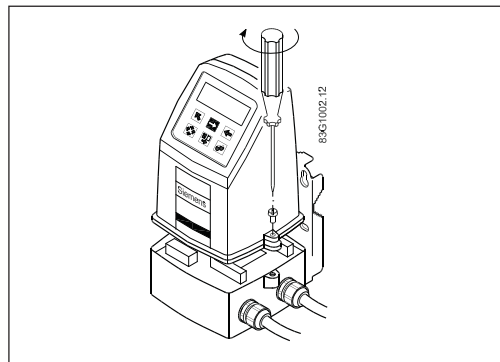
Mount an earth wire between PE on connection board and bottom of connection box.



**Step 3**

Mount the connection plate in the terminal box. Fix the connection plate with the two diagonal opposite screws.

Fit the coil (B), electrode (A), supply (C) and output cables (D) respectively and tighten the cable glands to obtain optimum sealing. Please see the wiring diagram in "Electrical connections"



**Step 4**

Mount the transmitter on the terminal box.

**Caution**

Exposing the transmitter to direct sunlight may increase the operating temperature above its specified limit, and decrease display visibility



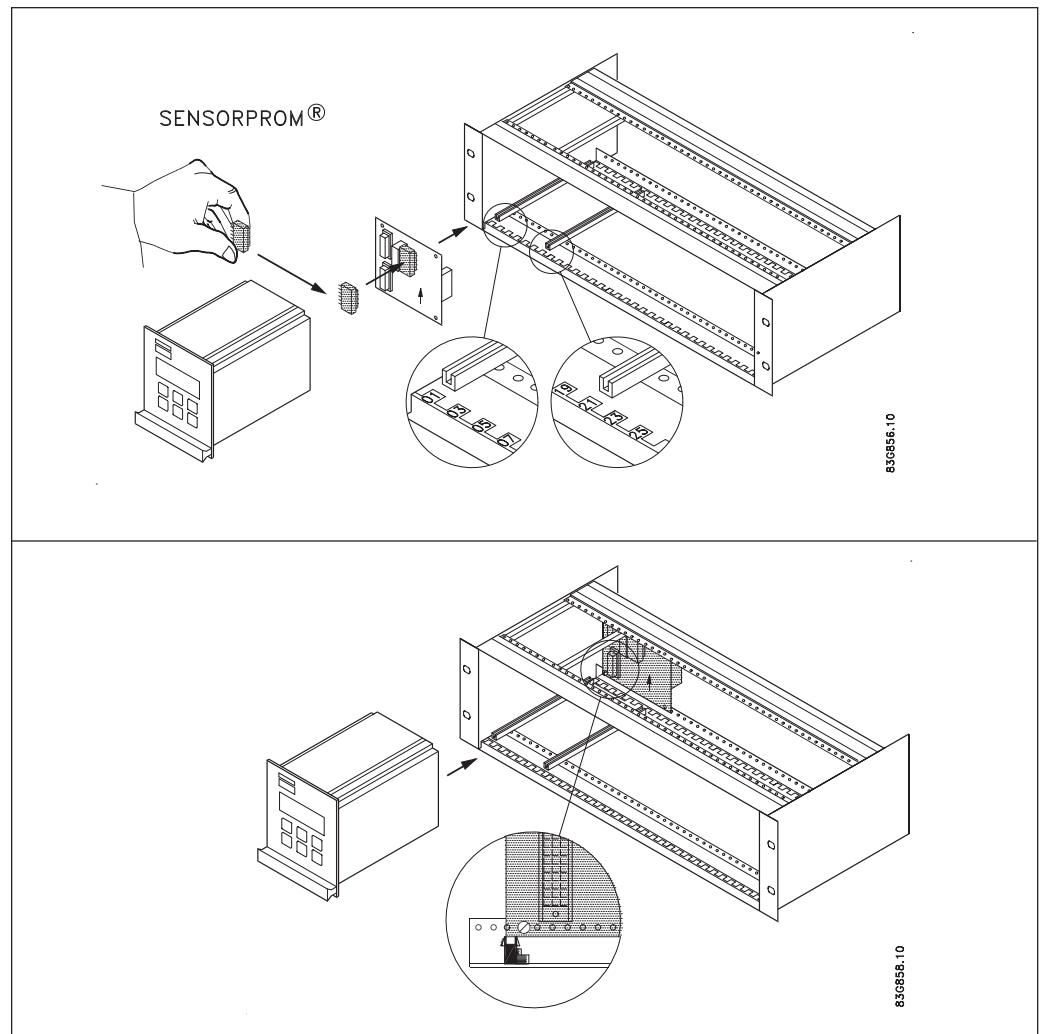
**Attention**

When remote mounted, power supply PE wire must be connected to PE terminal.

Coil cable shield must be connected to SHIELD terminal.

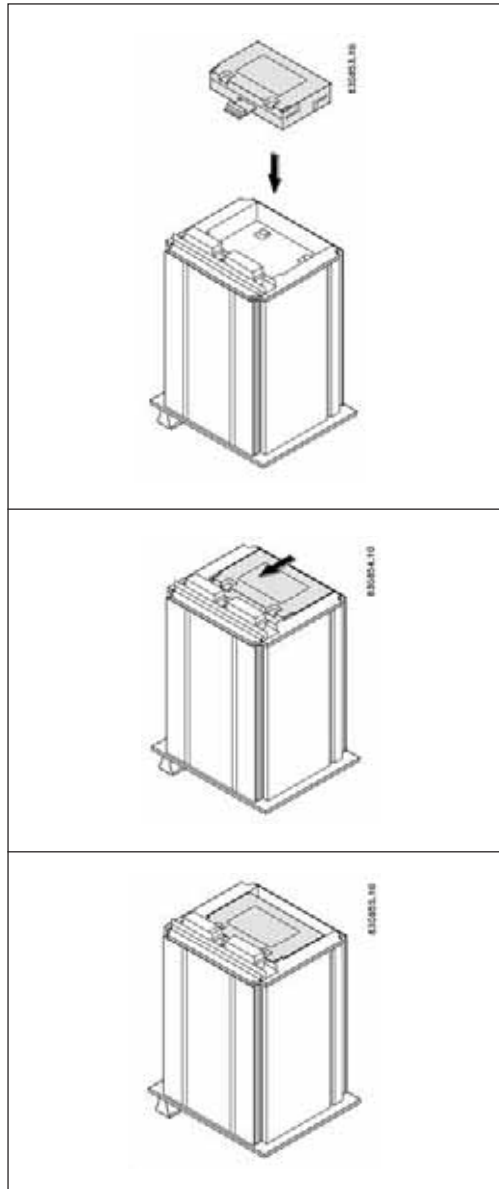
Use the supplied insulating tube to insulate the core shield.

6.2.4  
Remote installation -  
*Transmitter in 19" insert*



1. Fit the SENSORPROM® memory unit on the connection board supplied with the transmitter. The SENSORPROM® unit is supplied with the sensor in the terminal box.
2. Mount the guide rails into the rack system as shown. Distance between guide rails is 20 TE. Guide rails are supplied with the rack system and not with the transmitter.
3. Mount the connection board as shown.
4. Connect the cables as shown under "**Electrical connection**", chapter 7.
5. Insert the transmitter into the rack system.

**6.2.5**  
**Add-on modules**  
**MAG 6000 only**



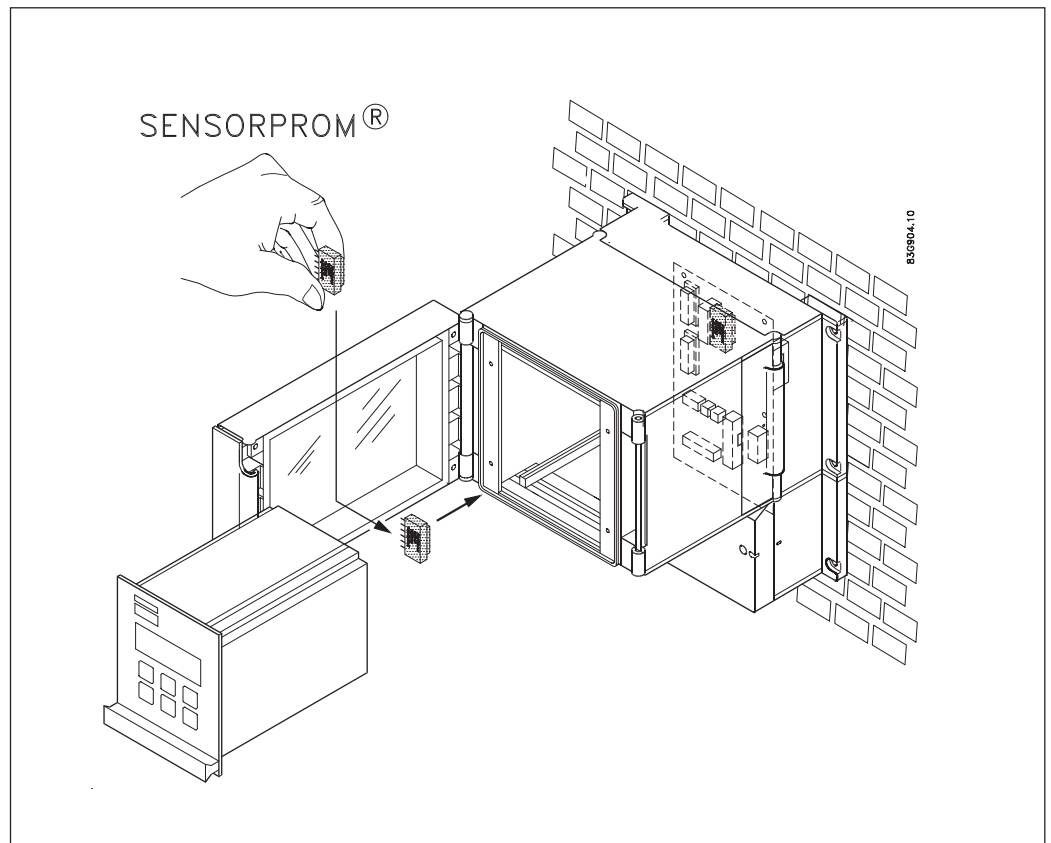
Locate the add-on module in the bottom of the MAG 6000 transmitter.

Press the add-on module forwards as far as possible.

The add-on module has now been installed and the transmitter is ready to be installed on the terminal box.  
Communication to the operator menu and electrically inputs and outputs is automatically established by power on.

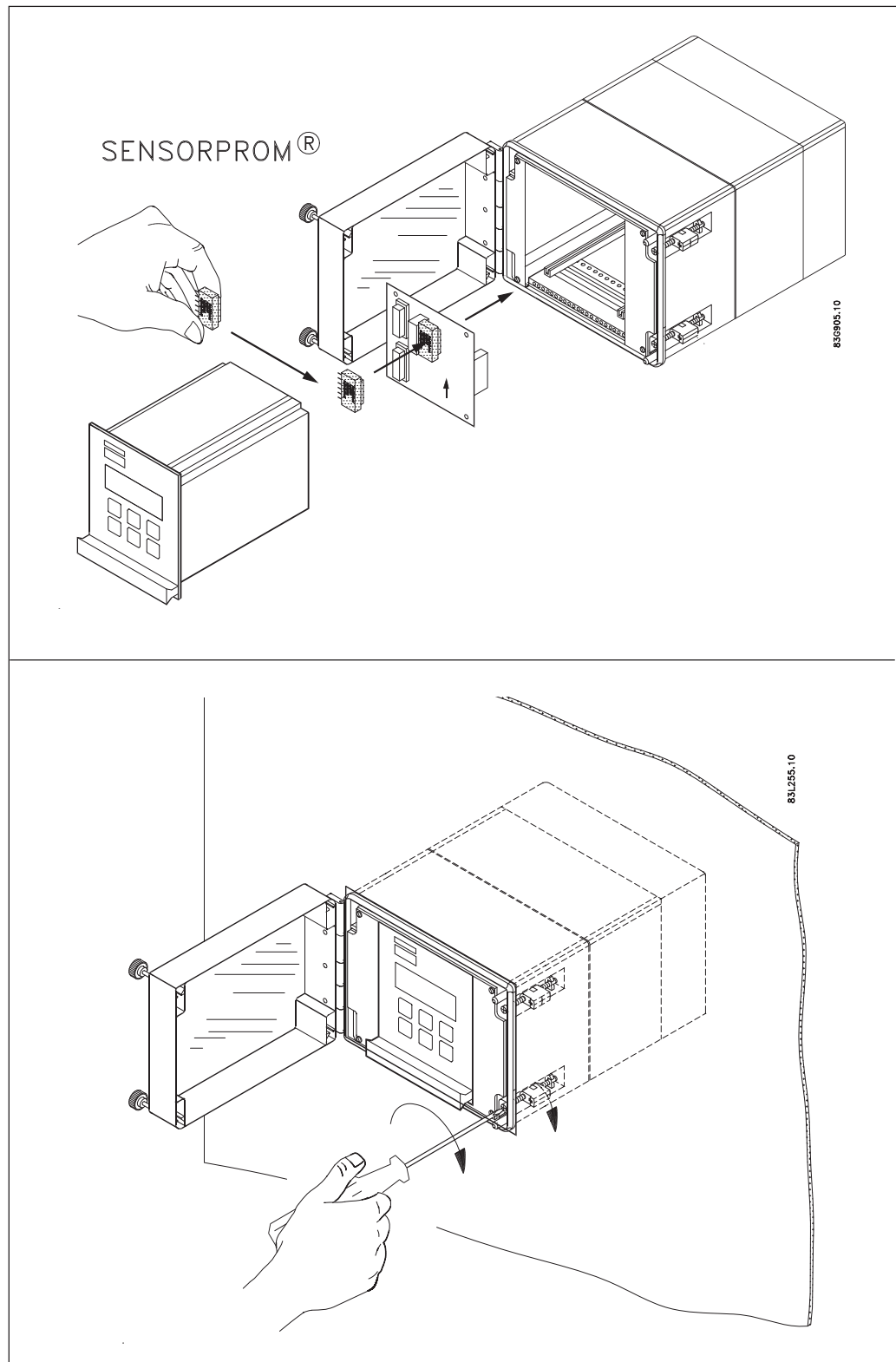


### 6.2.6 Installation in IP 66 wall mounting enclosure



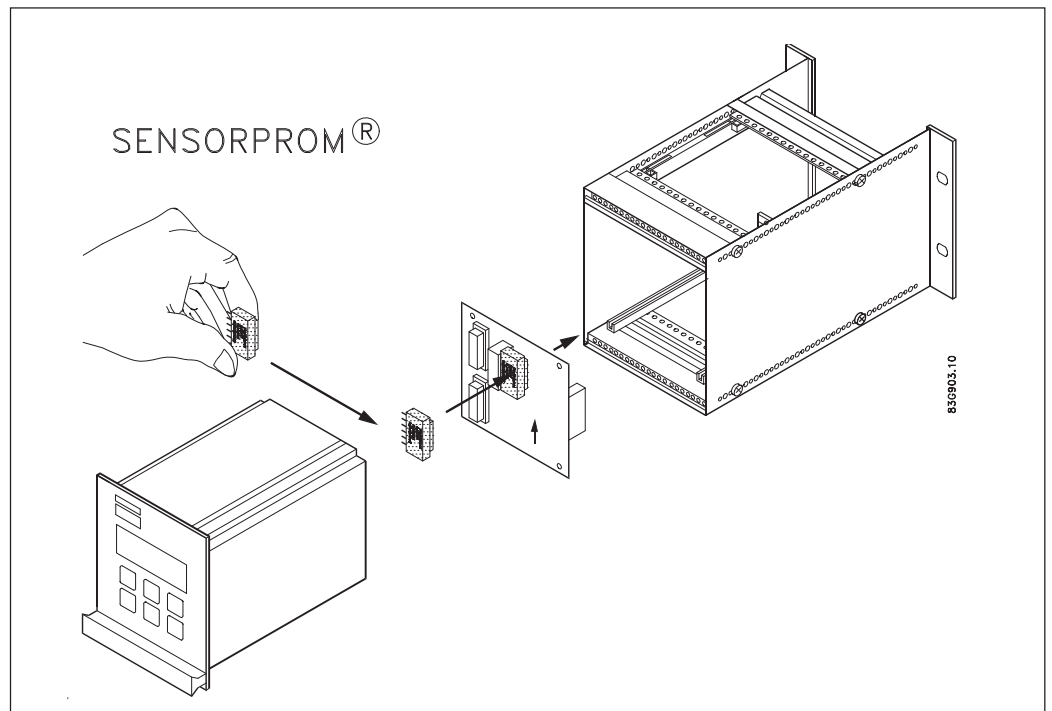
1. Mount the IP 66 enclosure on the wall with four screws.
2. Mount the SENSORPROM® memory unit on the connection board as shown. The SENSORPROM® unit is supplied with the sensor in the terminal box. The connection board for IP 66 wall mounting boxes must be used.
3. Connect the cables to the terminals, see "**Electrical connection**", **chapter 7**.
4. Insert the transmitter and close the cover.

6.2.7  
Installation in IP 65 panel  
mounting enclosure  
(front of panel)



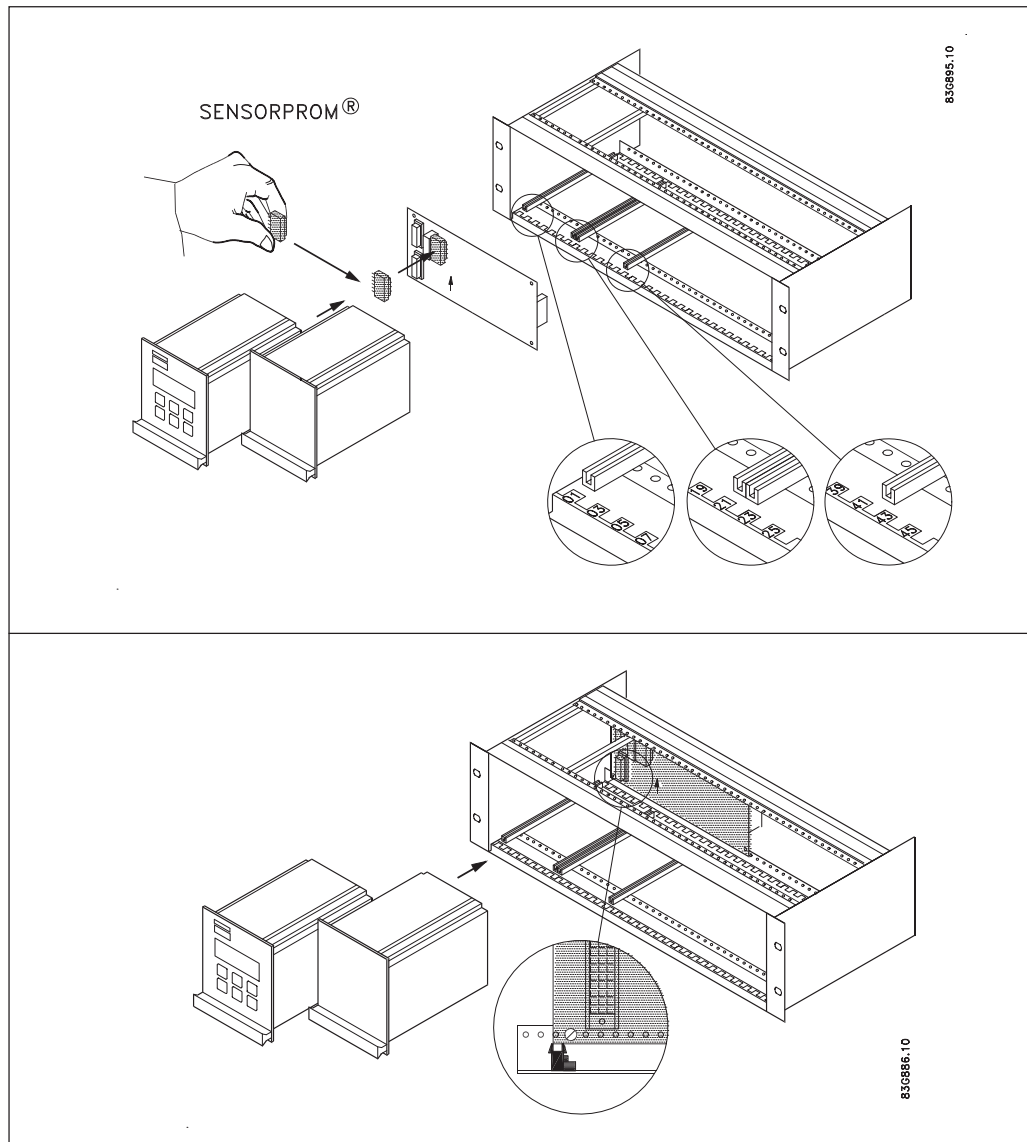
1. Mount the SENSORPROM® memory unit on the connection board as shown. The SENSORPROM® unit is supplied with the sensor in the terminal box.
2. Fit the enclosure in a cut out at the front of a panel. Fasten the four screws accessible at the front.
3. Connect the cables as shown under "**Electrical connection**", chapter 7.
4. Insert the transmitter and close the cover.

### 6.2.8 Installation into the back of a panel



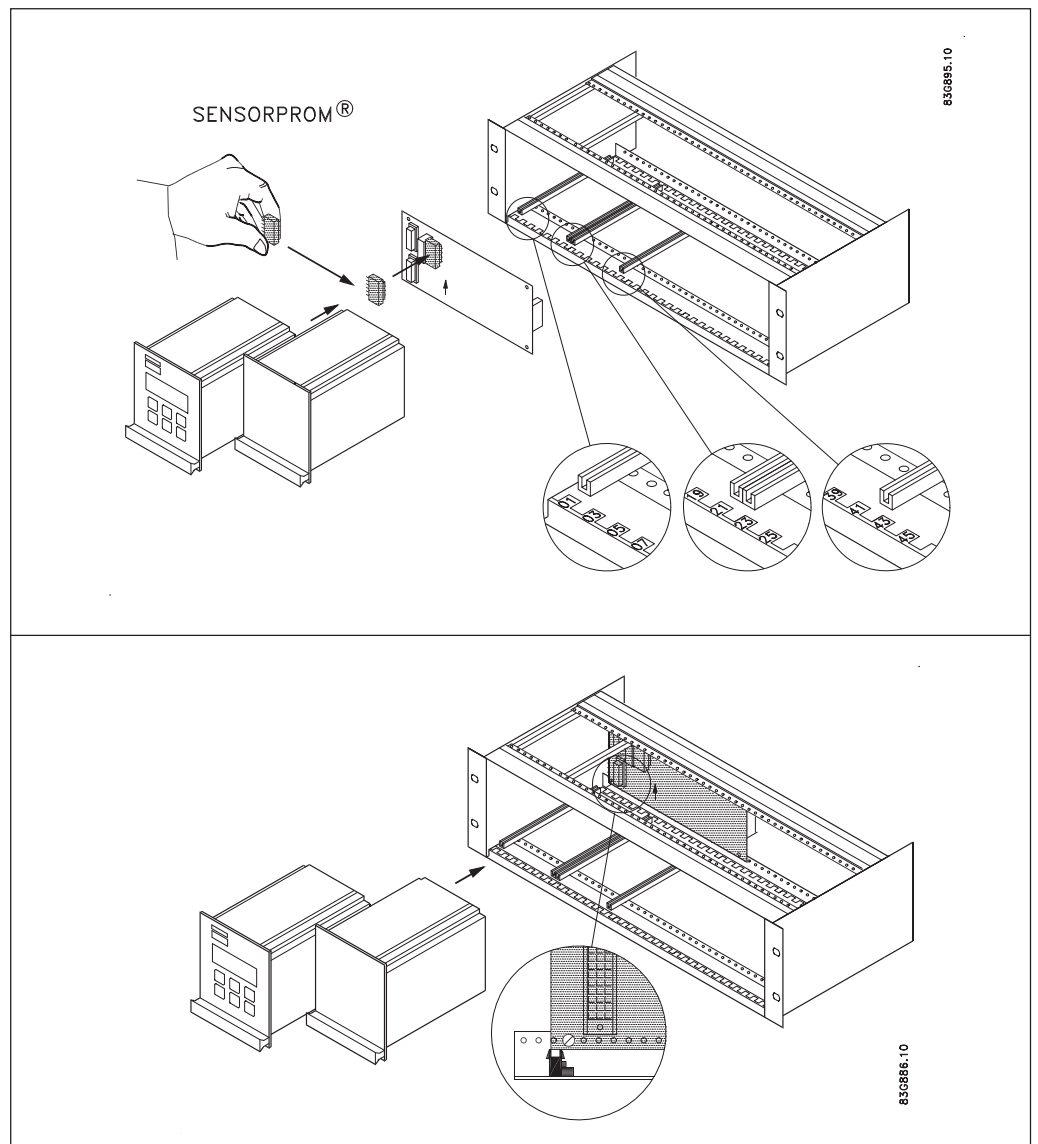
1. Mount the SENSORPROM® memory unit on the connection board as shown. The SENSORPROM® unit is supplied with the sensor in the terminal box.
2. Mount the connection board into the back of the enclosure.
3. Connect the cables as shown under "**Electrical connection**", **chapter 7**.
4. Mount the enclosure into the back of a panel with four screws.
5. Insert the transmitter.

### 6.3 Transmitter Safety barrier



1. Fit the SENSORPROM® memory unit on the connection board supplied with the safety barrier. The SENSORPROM® unit is delivered mounted in the terminal box of the sensor. The connection board supplied with the transmitter is not used.
2. Mount the guide rails into the rack system as shown. Distance between guide rails is 20 TE. Guide rails are supplied with the rack system and not with the transmitter.
3. Mount the connection board as shown. The mounting screw must be installed just in line with the guide rails.
4. Connect the cables as shown under "**Electrical connection**", chapter 7.
5. Insert the transmitter and the safety barrier into the rack system.

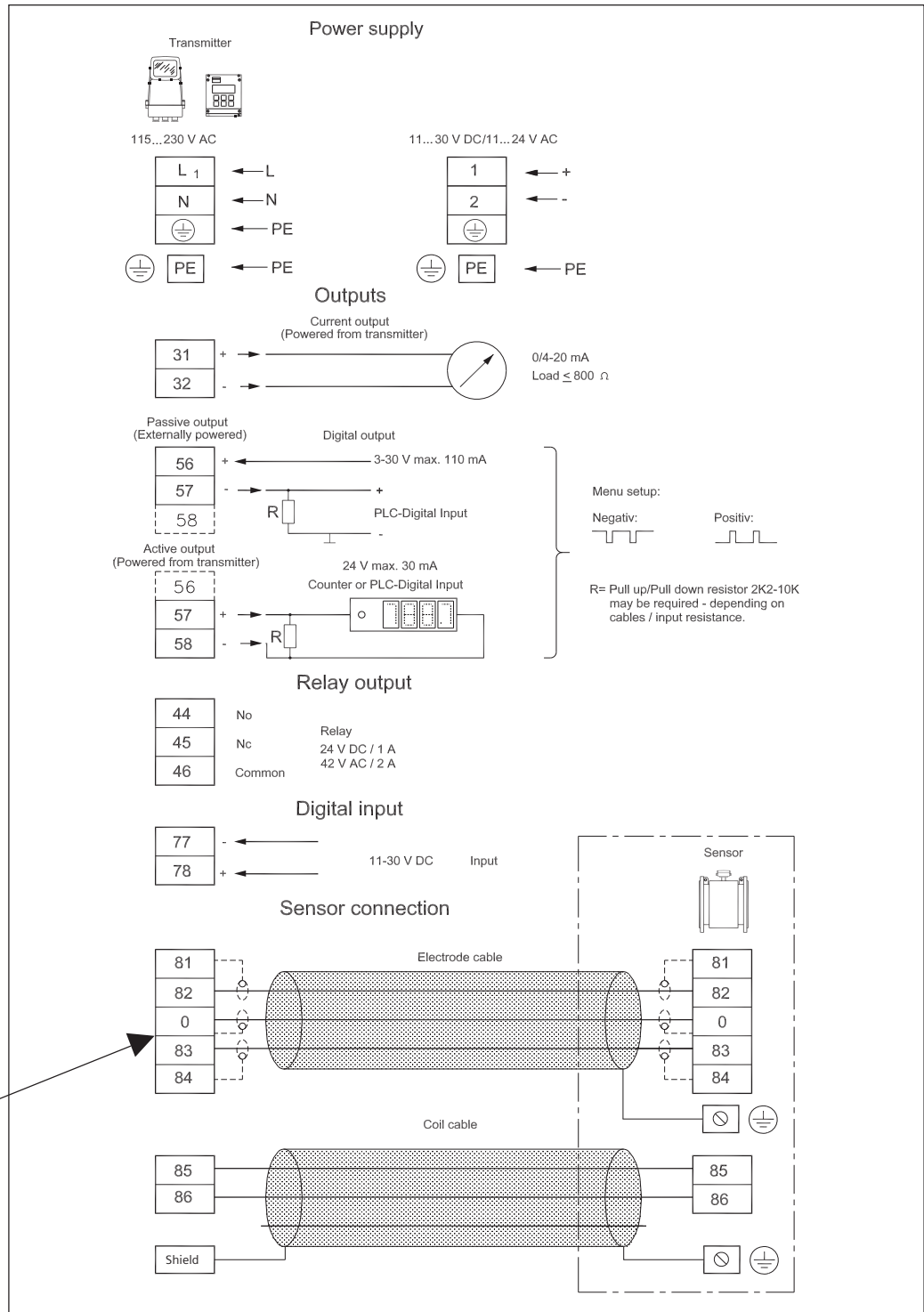
### 6.4 Transmitter Cleaning unit



1. Fit the SENSORPROM® memory unit on the connection board supplied with the cleaning unit. The SENSORPROM® unit is delivered mounted in the terminal box of the sensor. The connection board supplied with the transmitter is not used.
2. Mount the guide rails into the rack system as shown. Distance between guide rails is 20 TE. Guide rails are supplied with the rack system and not with the transmitter.
3. Mount the connection board as shown. The mounting screw must be installed just in line with the guide rails.
4. Connect the cables as shown under "**Electrical connection**", chapter 7.
5. Select AC-cleaning or DC-cleaning mode at the switch located on the base of the cleaning unit.
6. Insert the cleaning unit and the transmitter into the rack system.

7. Electrical connection

7.1 Transmitter  
MAG 5000 and MAG 6000  
connection diagram



**Note**  
Special cable with individual wire shields (shown as dotted lines) are only required when using empty pipe function or long cables. (See "Technical data" chapter 2 for further details.)



**Potential Hazards Grounding**

The mains protective earth wire must be connected to the PE terminal in accordance with the diagram (class 1 power supply).

**Mechanical counters**

When mounting a mechanical counter to terminals 57 and 58 (active output), a 1000 µF capacitor must be connected to the terminals 56 and 58. Capacitor + is connected to terminal 56 and capacitor - to terminal 58.

**Output cables**

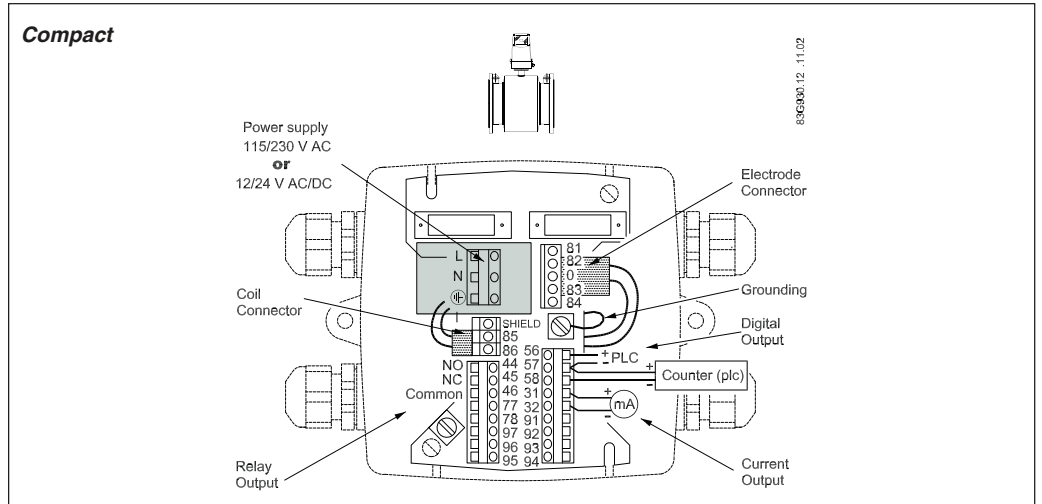
If long cables in noisy environment, we recommend to use screened cable.

**Electrodes cables**

Dotted connections only to be made when using special electrode cable.

7.2  
Wiring diagram for trans-  
mitter and sensor

**Compact installation**



**Note**  
Mount the grounding wire from connection box to PE to ensure sufficient grounding.

**Cathodic protected piping**

*Compact installation:*

The transmitter must be supplied through an isolation transformer. The terminal "PE" must not be connected.

*Remote installation:*

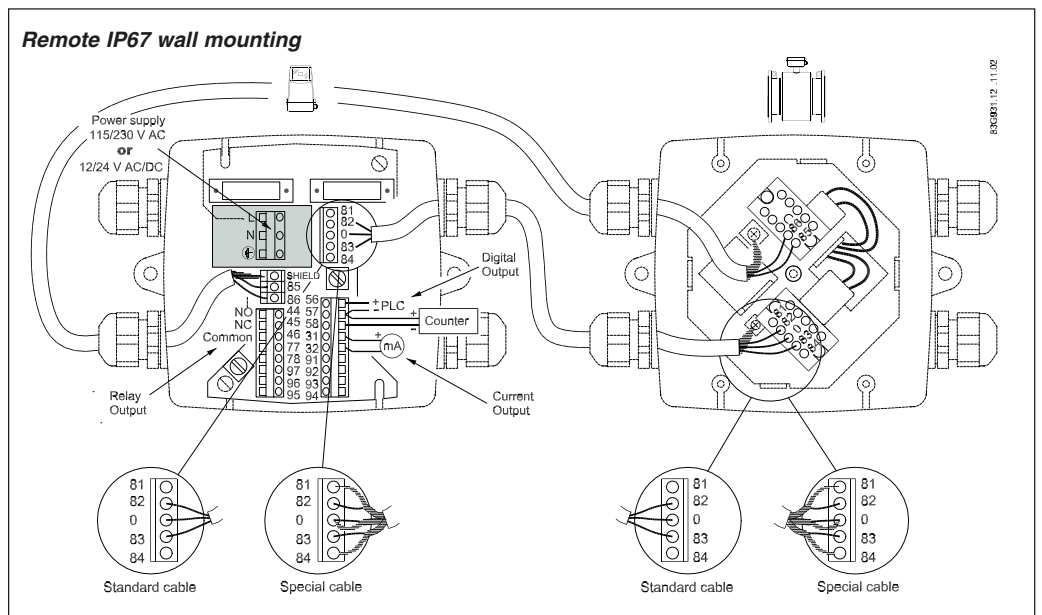
The screen must only be connected at the sensor end via a 1.5 µF capacitor. The screen must never be connected at both ends.

**Remote installation**

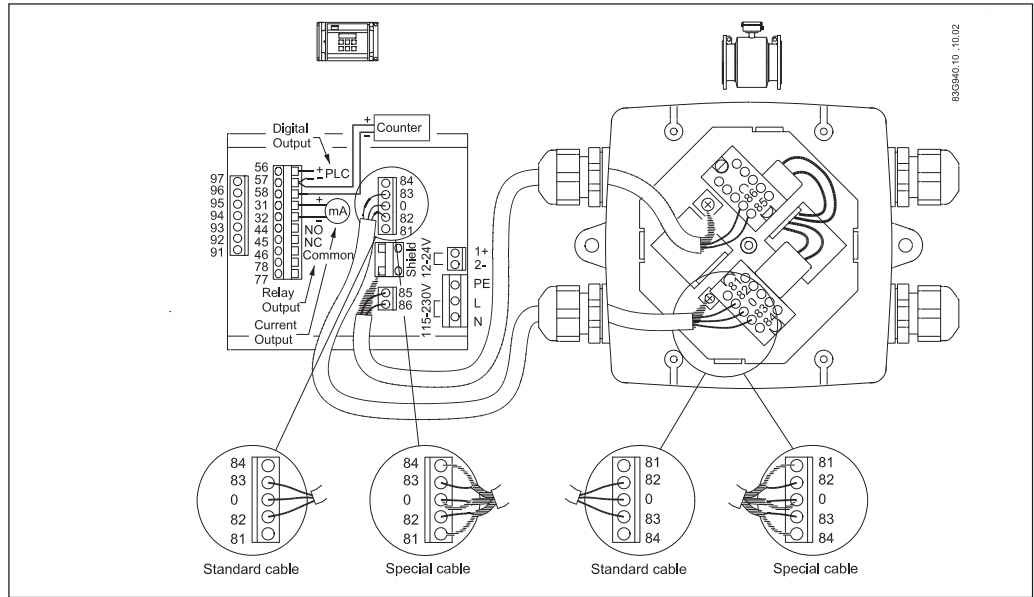
**Sensor cables**

- Unscreened cable ends must be as short as possible and the two cables must be kept separate. Cables must be in one length and must not be taken to a distribution box or similar terminal arrangement.
- Terminals 81 and 84 are only connected when special electrode cable with double screening is used.
- Coil cable screen must be connected in both ends. Electrode cable screen must be connected at sensor side only.

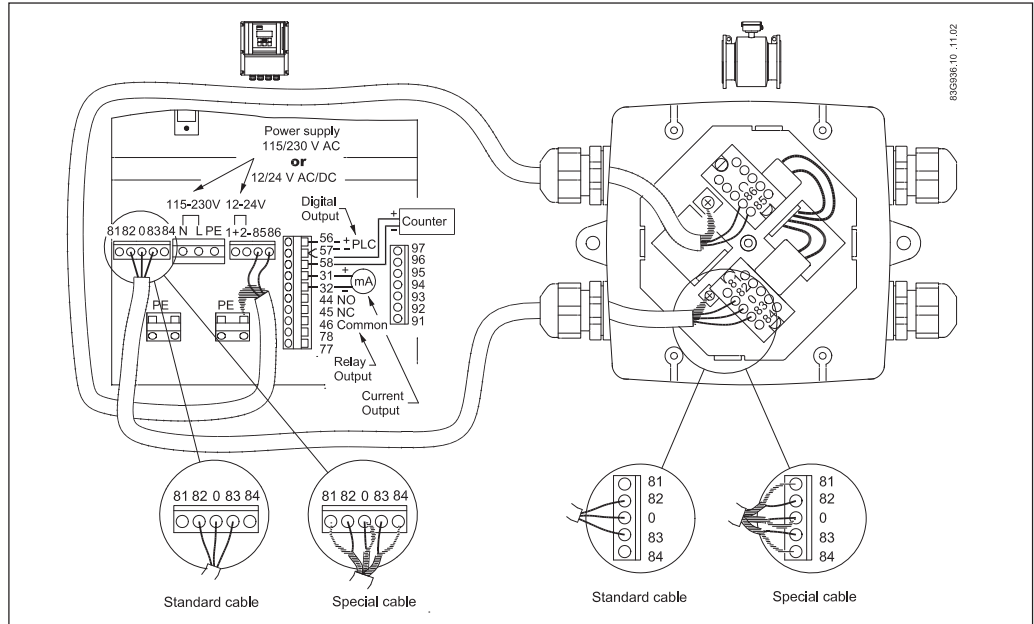
**Note**  
See 5.3 when using cathodic protection.



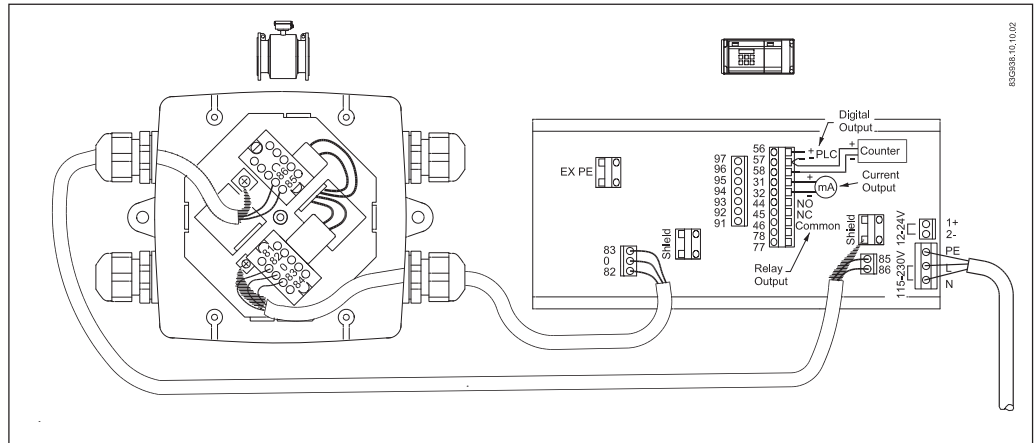
19" IP-20 version



19" IP-66 version

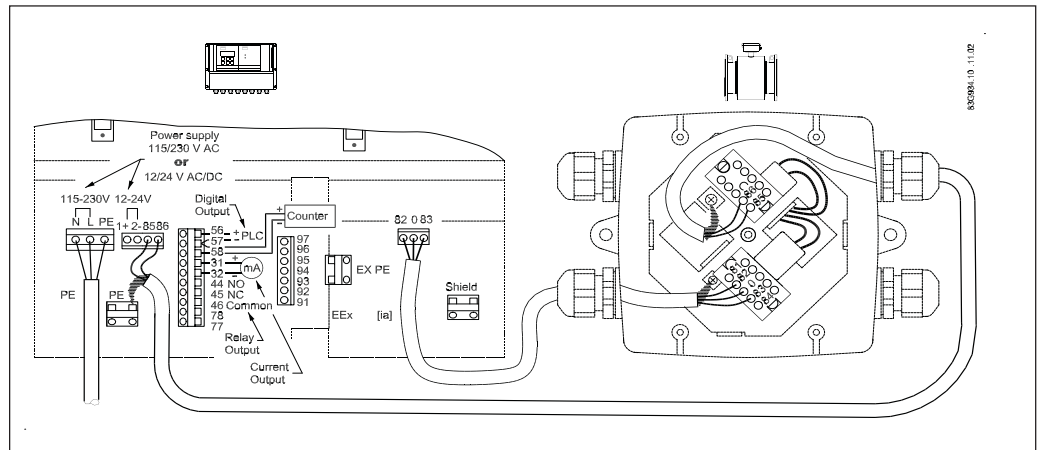


19" IP-20 version EEx e

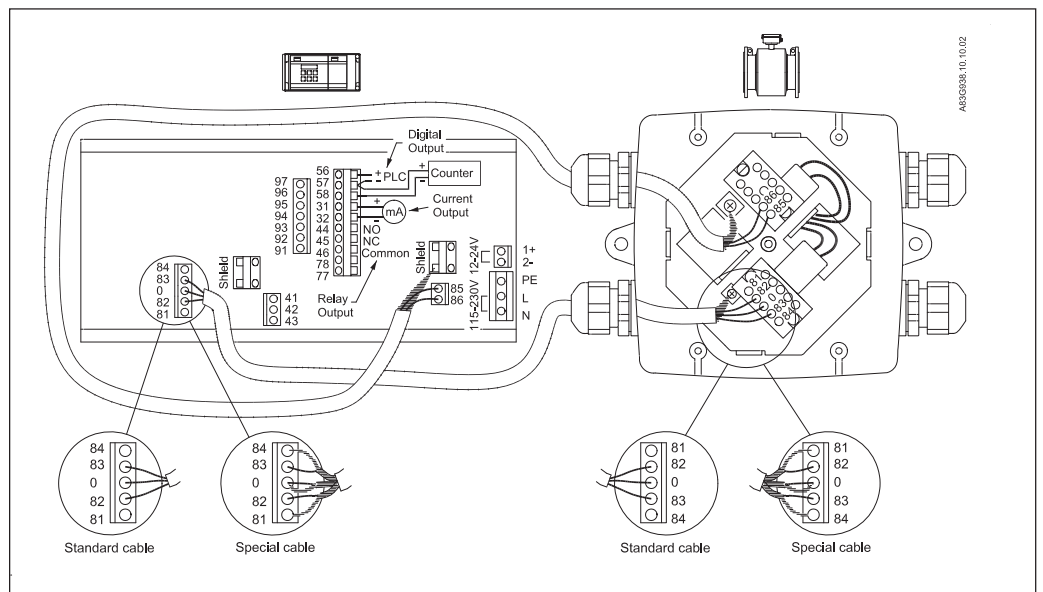




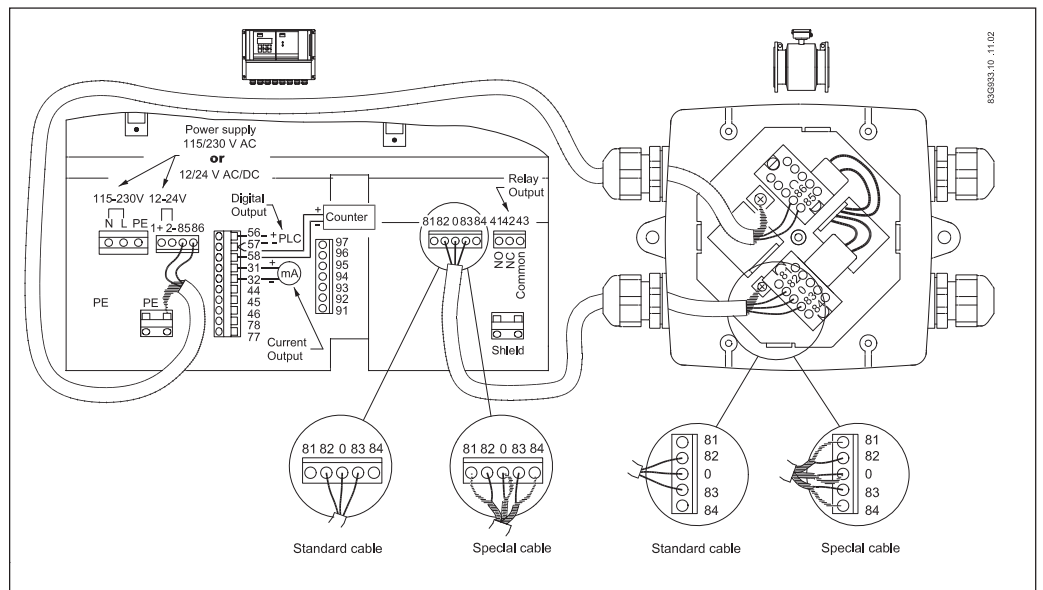
**19" IP66 version  
EEx e**



**19" IP20 version with  
cleaning**

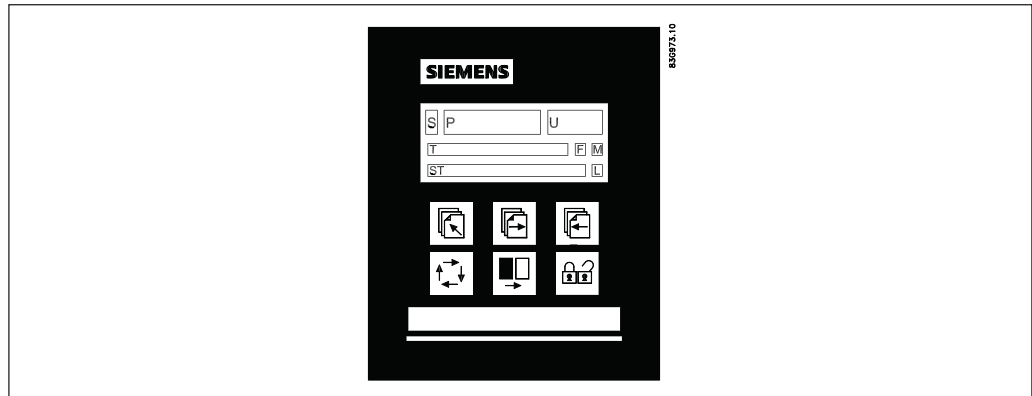


**19" IP66 version with  
cleaning**









8. Commissioning

8.1 Keypad and display layout



Keypad

The keypad is used to set the flowmeter. The function of each key is as follows:

- TOP UP KEY  This key (hold 2 sec.) is used to switch between operator menu and setup menu. In the transmitter setup menu, a short press will cause a return to the previous menu.
- FORWARD KEY  This key is used to step forward through the menus. It is the only key normally used by the operator.
- BACKWARD KEY  This key is used to step backward through the menus.
- CHANGE KEY  This key changes the settings or numerical values.
- SELECT KEY  This key selects the figures to be changed.
- LOCK/UNLOCK KEY  This key allows the operator to change settings and gives access to submenus.

Display

The display is alphanumerical and indicates flow values, flowmeter settings and error messages. The upper line is for primary flow readings and will always show either flow rate, totalizer 1 or totalizer 2. The line is divided into 3 fields.













- S: Sign field
- P: Primary field for numerical value
- U: Unit field

The centre line is the title line (T) with individual information according to the selected operator or setup menu.





The lowest line is the subtitle line (ST) which will either add information to the title line or keep individual information independent of the title line.

**F: The alarm field.**  Two flashing triangles will appear in case of a fault condition.

M: The mode field. The symbols indicate the following.

 Communication mode	 Basic settings	 Operator active
 Service mode	 Output	 Operator inactive
 Operator menu	 External input	
 Product identity	 Sensor characteristics	
 Language mode	 Reset mode	

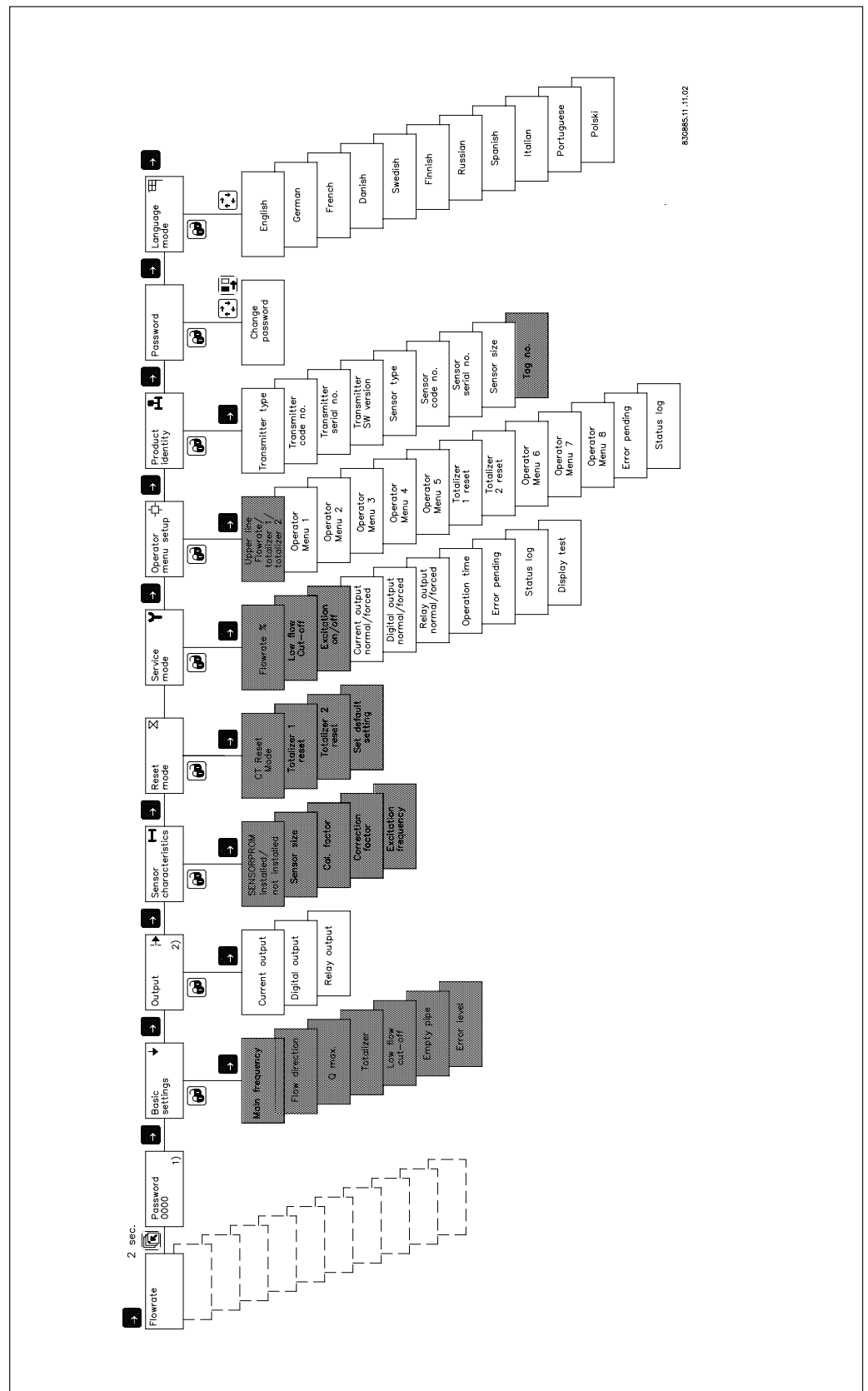
L: The lock field. Indicates the function of the lock key.

 Ready for change	 Access to submenu
 Value locked	 RESET MODE: Zero setting of totalizers and initialization of setting



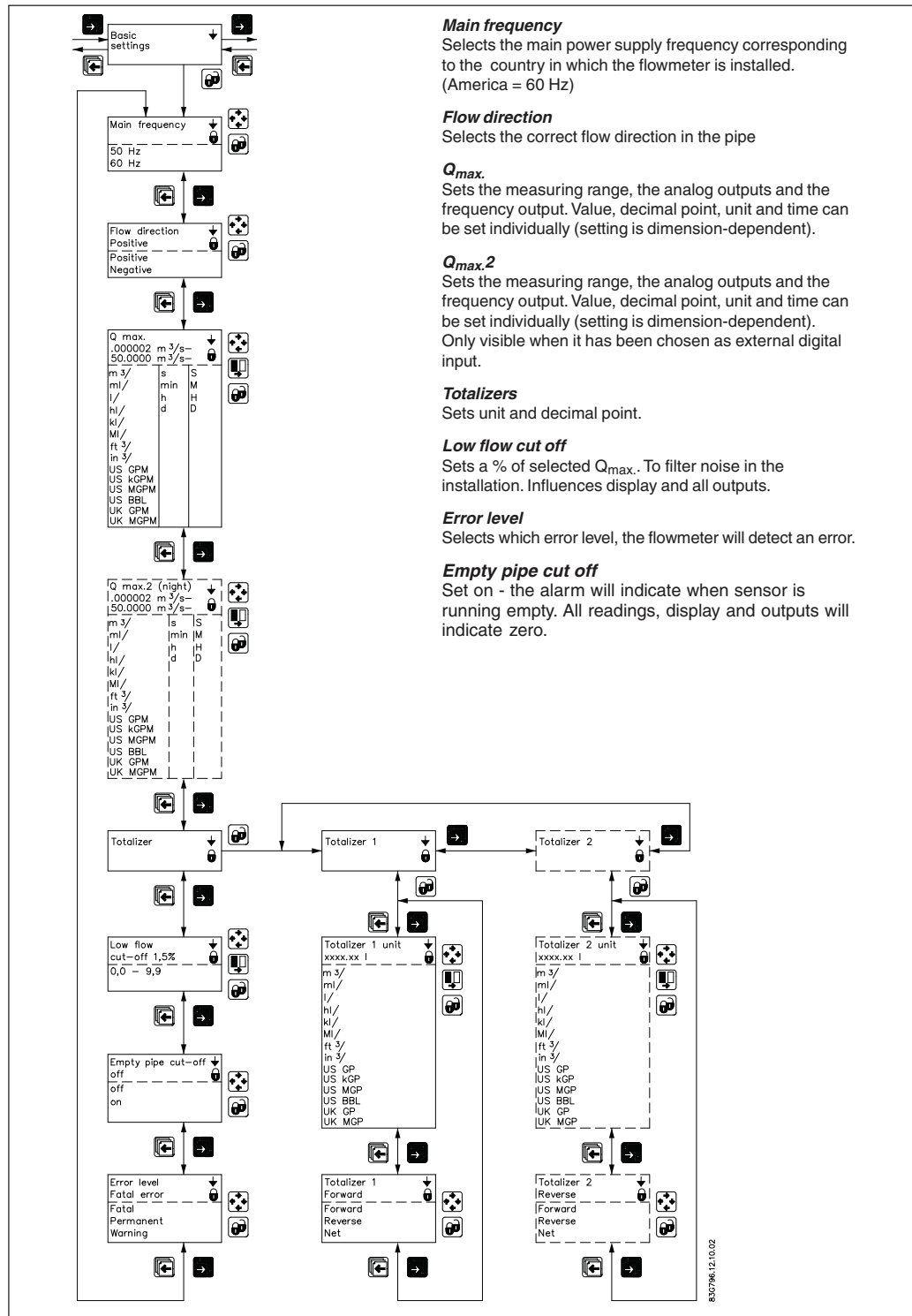


8.3.2 MAG 5000 CT and  
MAG 6000 CT






830665.11.10.02

### 8.4.1 Basic settings



Decimal point for flow rate, totalizer 1 and totalizer 2 can be individually positioned.

- open the respective window.
- ensure that the cursor is positioned below the comma. Use the select key .
- move the comma to the requested position. Use the change key .

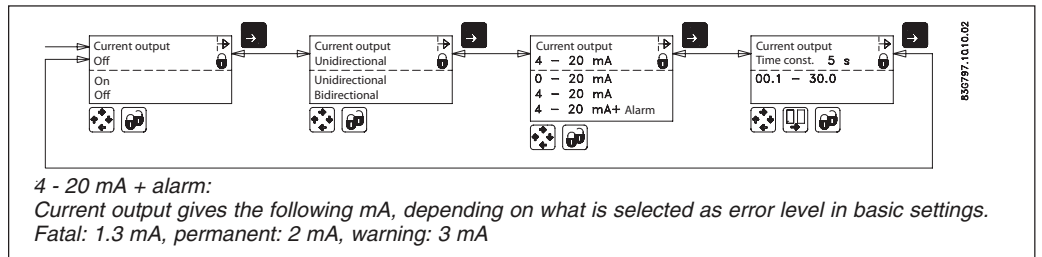
Units are changed by means of the change key  with the cursor placed below the unit selected. Select units (cursor moved) by means of the select key .

**Totalizer 2 is not visible when batch is selected as digital output.**

**Q<sub>max. 2</sub> - is only visible when it has been chosen as external input.**

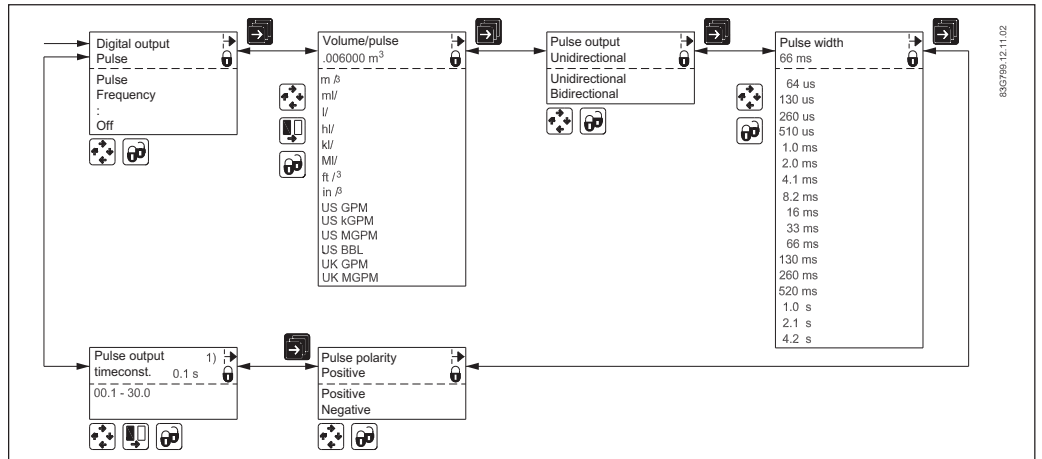
8.4.2  
Outputs

**Current output**  
*Proportional to flowrate*  
(Terminals 31 and 32)



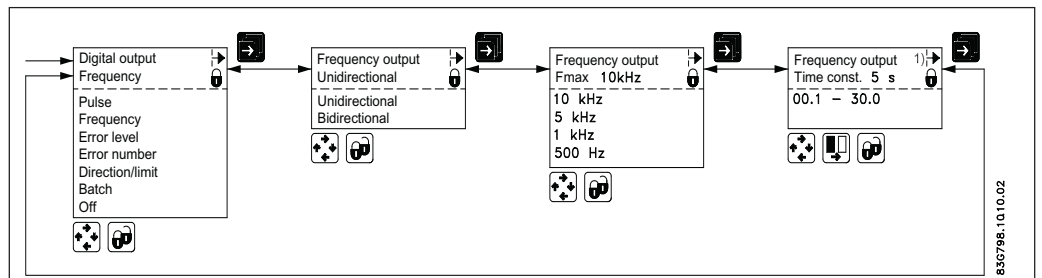
The current output must be set off when not used.

**Digital output**  
*Pulse/volume*  
(Terminals 56, 57, and 58)



1) Not at batch

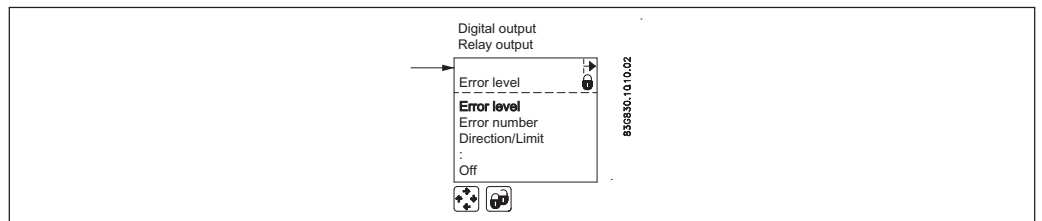
**Digital output**  
*Frequency*  
*Proportional to flowrate*  
(Terminals 56, 57, and 58)



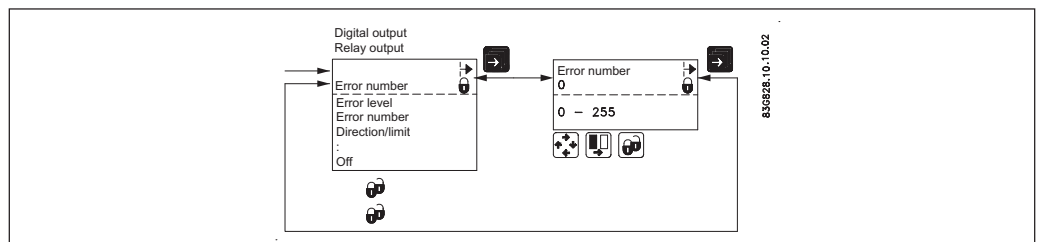
1) Not at batch

8.4.3  
Digital and relay outputs

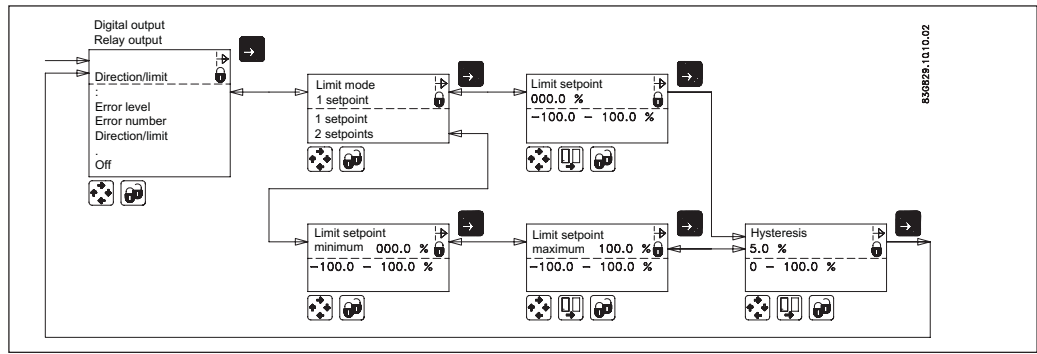
**Error level**



**Error number**



**Limit/direction**



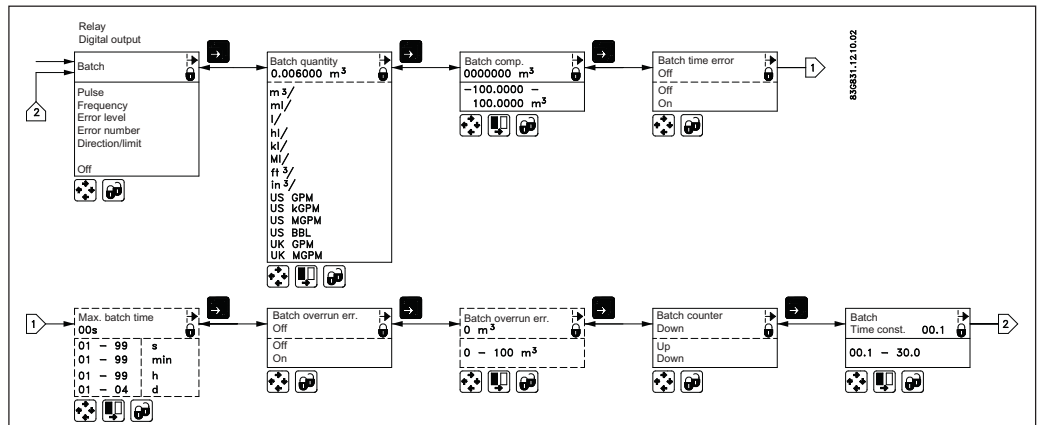
Limit switches are available for both digital and relay outputs.

**Direction mode:** 1 set point at 0% flow; hysteresis 5%.

If 2 set points must activate 2 separate outputs, a single set point has to be selected individually for digital as well as relay outputs.

**Batch**

(MAG 6000 only) Non CT  
(Possible through relay and digital output)

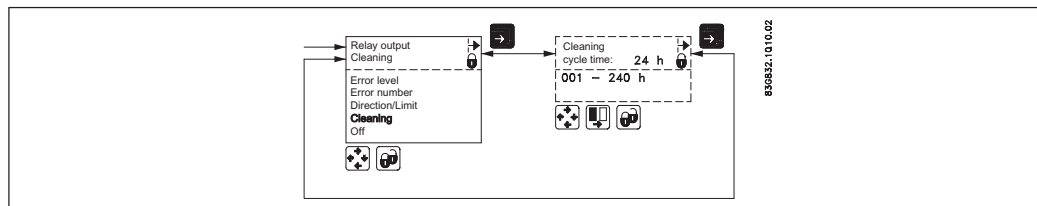


**Note**

When batch function is on relay - the pulse/frequency output is not possible.

**8.4.4 Relay outputs**

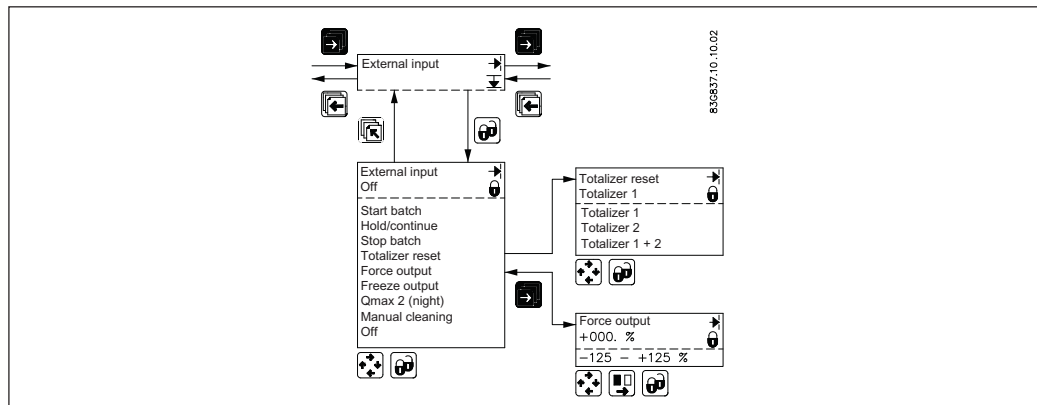
**Cleaning**



The relay output must always be used to operate the cleaning unit when a cleaning unit has been installed together with the transmitter. The relay output cannot be used for other purposes.

**8.4.5 External input**

Non CT versions only

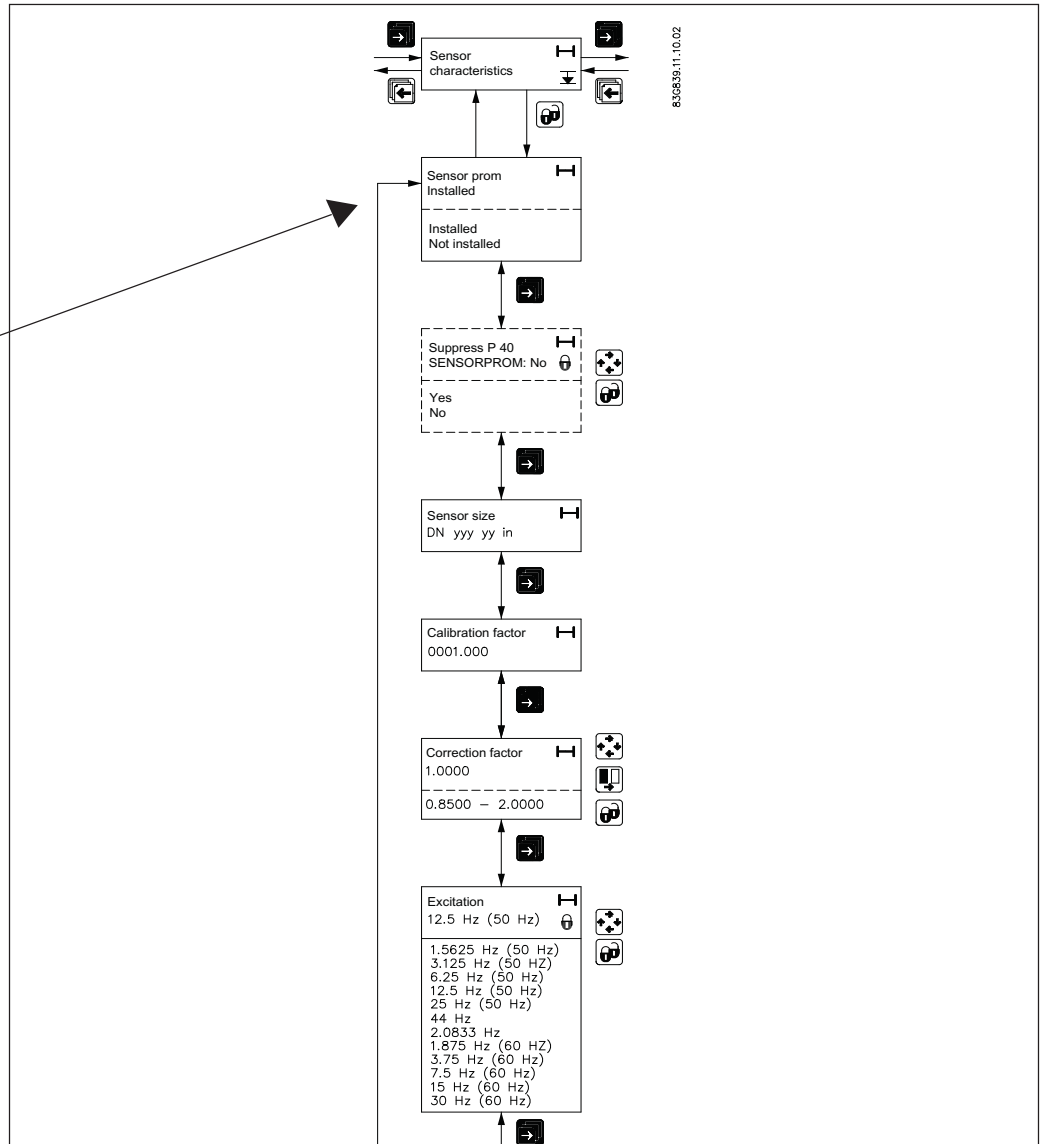


Batch control is available on MAG 6000 only.

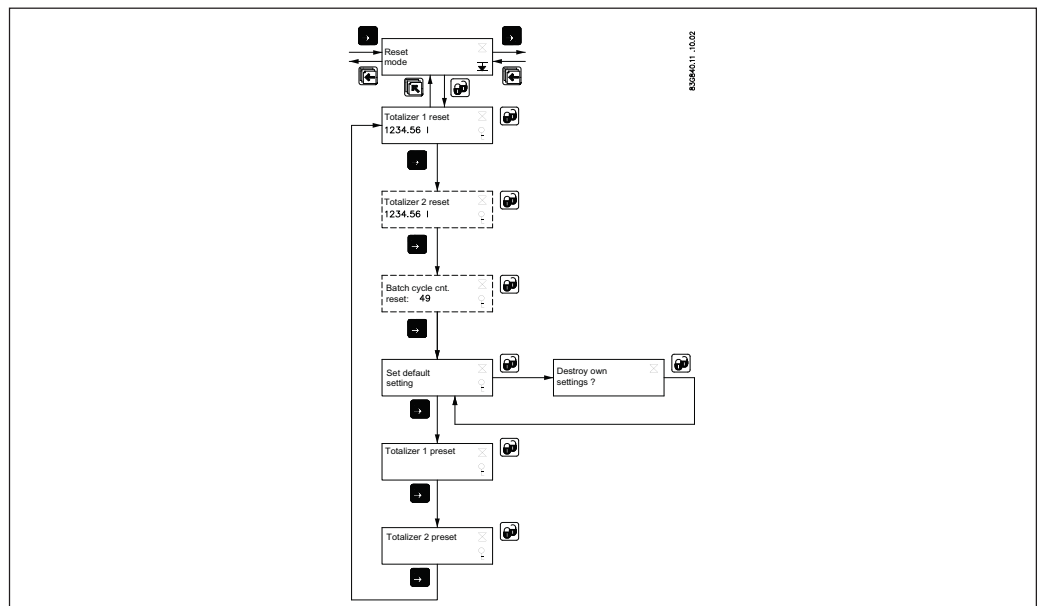


8.4.6  
Sensor characteristics

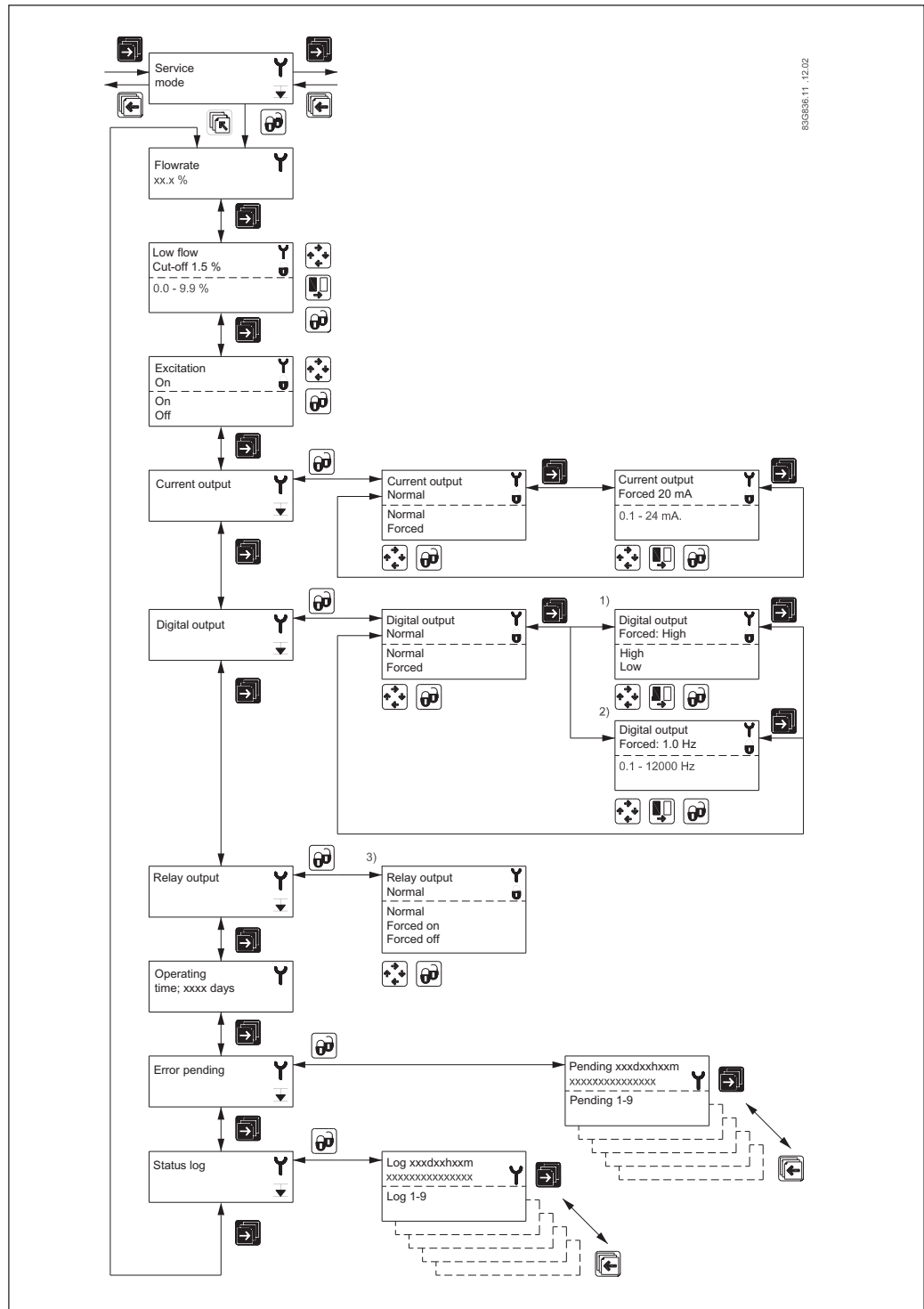
If "SENSORPROM not installed" is shown, refer to chapter 6 (depending on type of mounting configuration).



8.4.7  
Reset mode



8.4.8 Service mode



All previous settings are reinitialized when service mode is exited using the top up key .

**The error system**

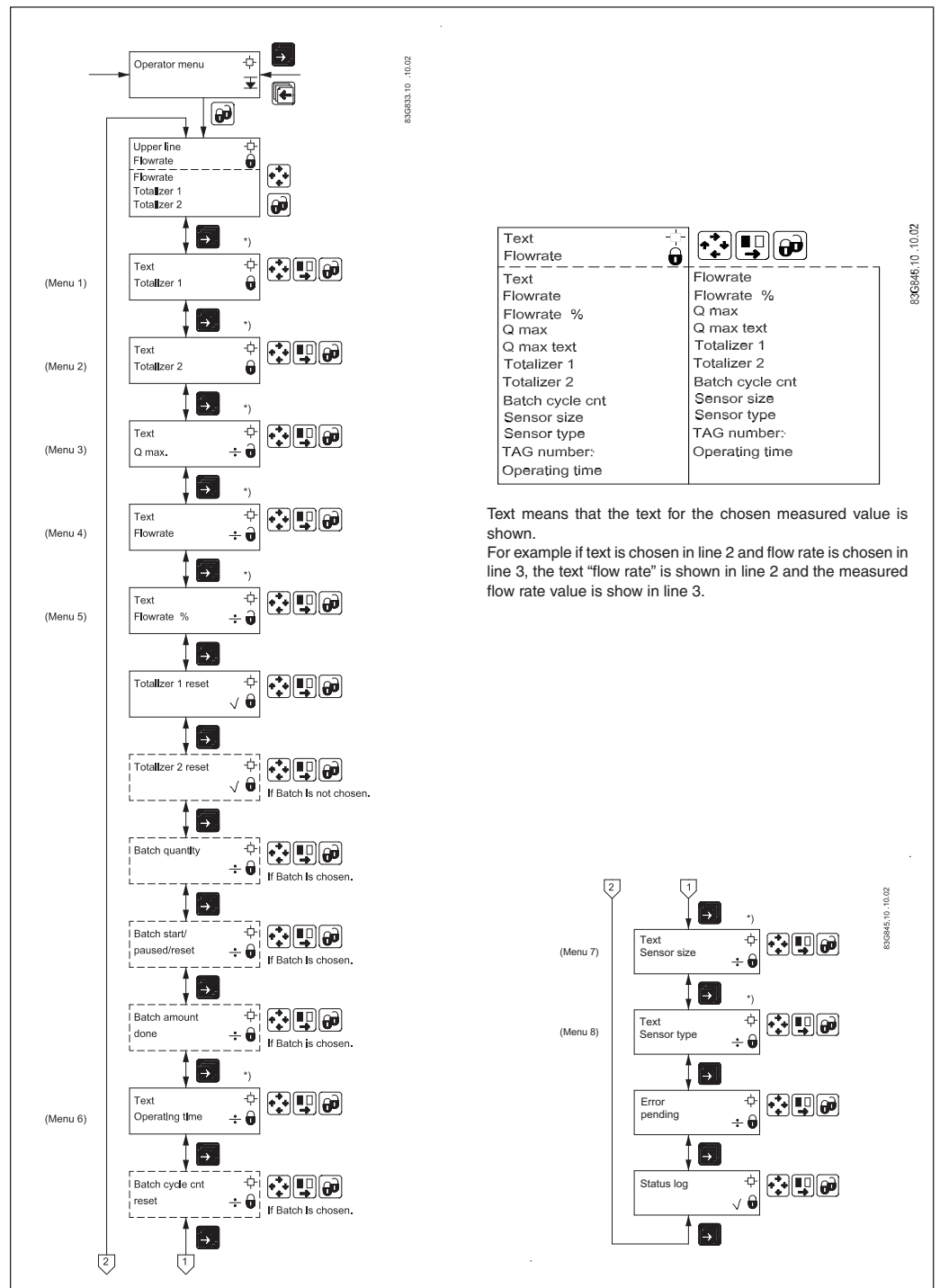
The error system is divided into an error pending list and a status log list. Time is gained as days, minutes and hours since the error has occurred.

The first 9 standing errors are stored in error pending. When an error is removed it is removed from error pending.

The latest 9 errors are stored in the status log. When an error is removed it is still kept in status log. Errors in status log is stored for 180 days.

Error pending and status log are accessible when enabled in the operator menu.


8.4.9 Operator menu setup





Text means that the text for the chosen measured value is shown.

For example if text is chosen in line 2 and flow rate is chosen in line 3, the text "flow rate" is shown in line 2 and the measured flow rate value is shown in line 3.

The upper line is always active and can never be deselected.

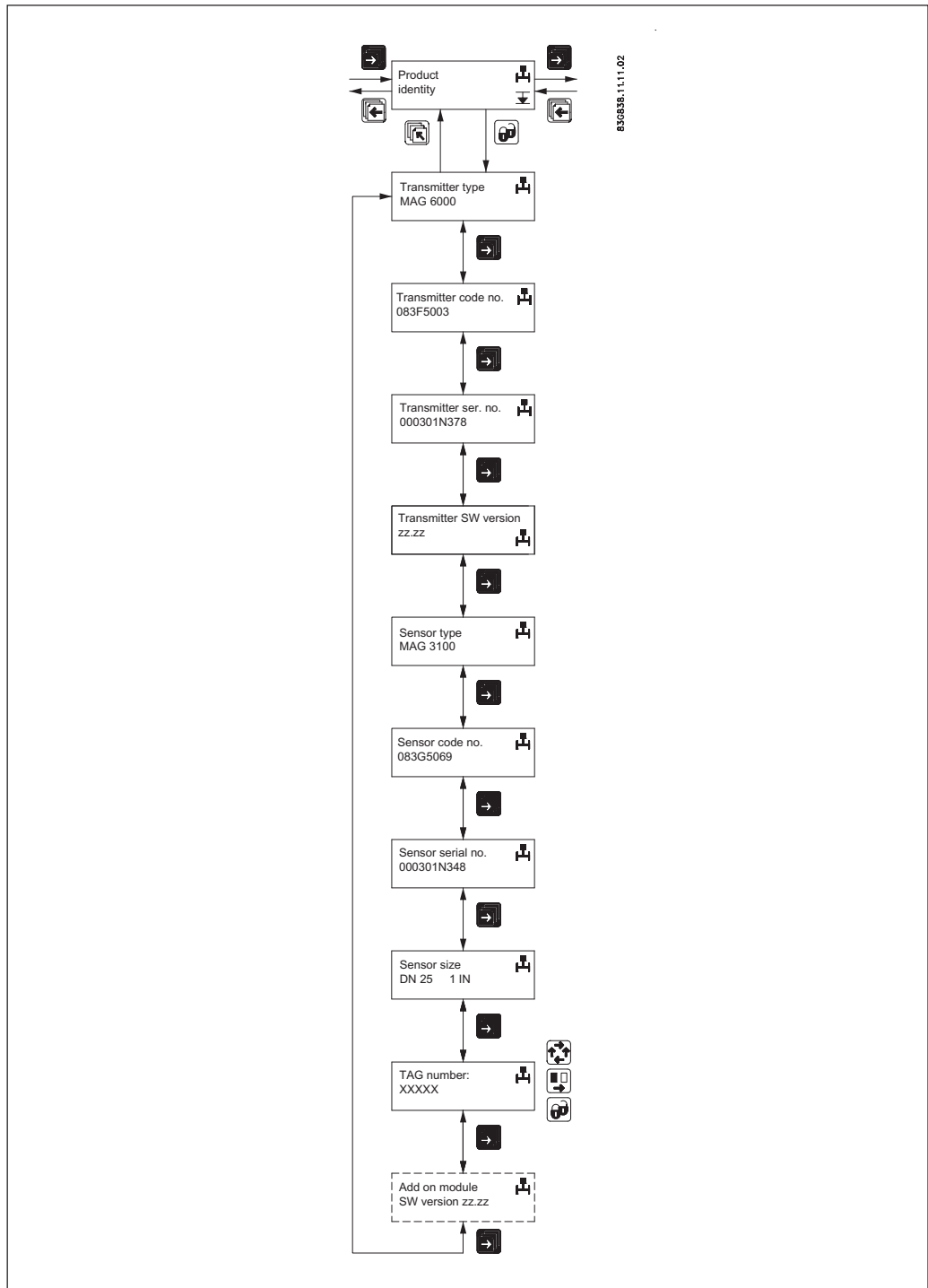
The two lower lines are for individual operator information. Information which the operator can scroll through with the forward key .

- A  in the operator menu setup, means that the menu is enabled when viewing the operator menu.
- A  means that the menu is not available in the operator menu.

The middle line can either be used as a heading "Text line" for the lower line, or as a flow reading. A flow reading can be individually selected for each menu.

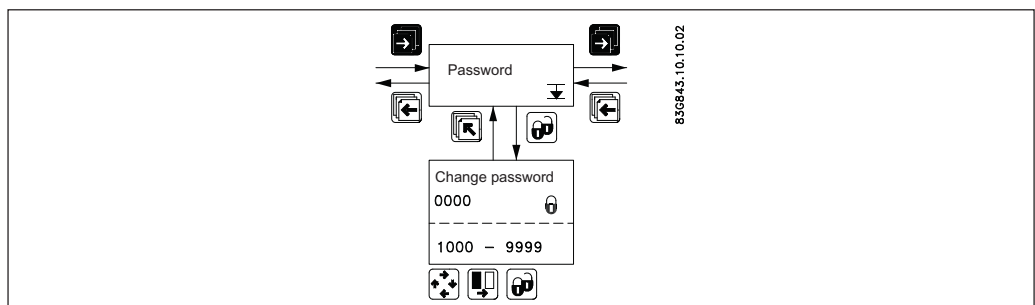
The lower line may be used for an additional flow reading to the reading already available in the upper line.

8.4.10  
Product identity

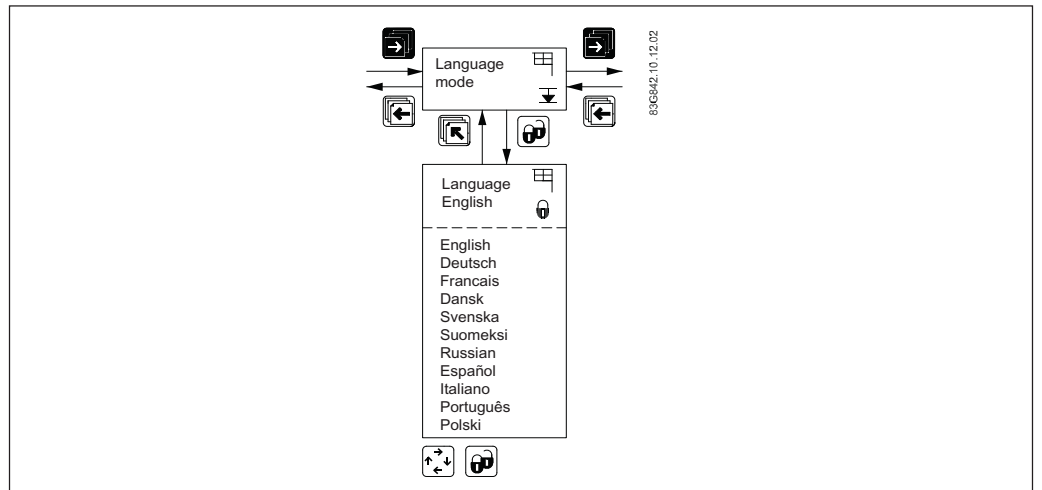


Software version of add-on module is only available if the add-on module has been installed.

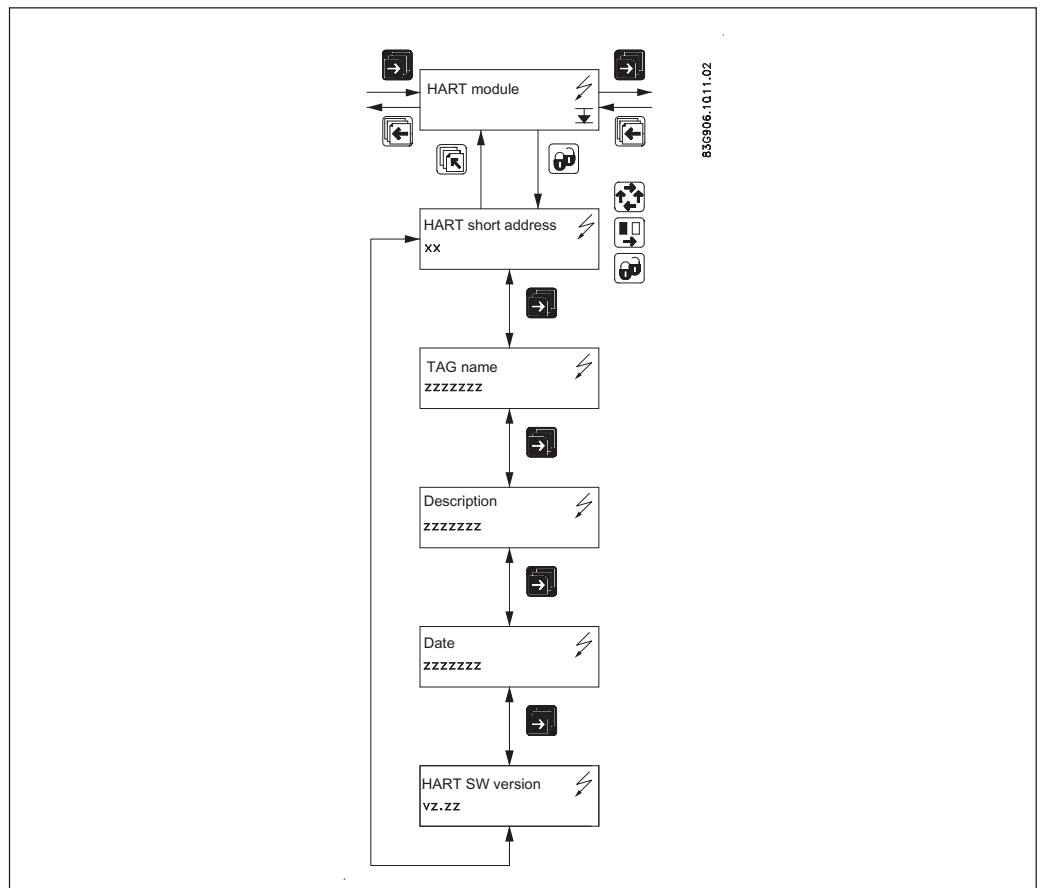
8.4.11  
Change password



8.4.12  
Language mode



8.4.13  
HART® communication  
MAG 5000 HART or as  
add-on module





### 8.6.1 Settings available

The transmitter is delivered with factory settings ready to measure the actual flow.

Parameter	Factory settings	Settings available
<b>Password</b>		
Default value	1000	
Password	1000	1000 ... 9999
<b>Basic settings</b>		
Flow direction	Positive	Positive, negative
$Q_{max}$	Dim. dependent	Dim. dependent
- Volume units	Dim. dependent	m <sup>3</sup> , ml, l, kl, hl, MI, ft <sup>3</sup> , in <sup>3</sup> , USG, USkG, USMG, UKG, UKMG, USBBL
- Time units	Dim. dependent	Sec., min., hour, day
Totalizer 1	Forward	Forward, reverse, net
- Totalizer 1 units	Dim. dependent	m <sup>3</sup> , ml, l, kl, hl, MI, ft <sup>3</sup> , in <sup>3</sup> , USG, USkG, USMG, UKG, UKMG, USBBL
Totalizer 2	Reverse	Forward, reverse, net
- Totalizer 2 units	Dim. dependent	m <sup>3</sup> , ml, l, kl, hl, MI, ft <sup>3</sup> , in <sup>3</sup> , USG, USkG, USMG, UKG, UKMG, USBBL
Low flow cut-off	1.5 %	0 ... 9.9 %
Empty pipe	Off	Off, on
Error level	Warning	Fatal, permanent, warning
<b>Output</b>		
Current output	Off	On/off, uni-/bidirectional, 0/4 - 20 mA
- Time constant	5 s	0.1 ... 30 s
Digital output	Pulse	Error, direction/limit, batch <sup>1)</sup> , frequency, pulse, error no., off
Relay output	Error	Error, direction/limit, cleaning, error no., off
Direction/limit switch	Off	1 set point/2 set points, -100 ... +100%
- Hysteresis	5%	0.0 ... 100%
Batch <sup>1)</sup>	Off	
- Batch quantity	0	Dim. dependent
- Batch compensation	0	-100 ... +100 m <sup>3</sup>
- Batch counter	Down	Up/down
- Time constant	0.1 s	0.1 ... 30 s
Frequency	Off	500 Hz, 1 kHz, 5 kHz, 10 kHz
- Time constant	5 s	0.1 ... 30 s
Pulse	On	
- Pulse polarity	Positive	Positive/negative
- Pulse width	66 ms	64 μs, 130 μs, 260 μs, 510 μs, 1.0 ms, 2.0 ms, 4.1 ms, 8.2 ms, 16 ms, 33 ms, 66 ms, 130 ms, 260 ms, 520 ms, 1.0 s, 2.1 s, 4.2 s.
- Volume/pulse	Dim. dependent	Dim. dependent
- Time constant	0.1 s	0.1 ... 30 s
Electrode cleaning	Off	Off/cleaning
- Cleaning cycle time	24 h	1 ... 240 h
<b>External input</b>		
External input	Off	Batch, reset totalizer, freeze output, forced output, off
- Batch		Start, hold/continue, stop, $Q_{max}$ , 2
<b>Sensor characteristics</b>		
Correction factor	1	0.85 ... 2.00
<b>Language</b>	English	English, German, French, Danish, Swedish, Finnish, Spanish, Russian, Italian, Portuguese and Polish
<b>Operator menu</b>		
Primary field	Flow rate	Flow rate, Totalizer 1, Totalizer 2
Title/subtitle line	Flow rate	Flow rate, Flow rate %, $Q_{max}$ , Totalizer 1, Totalizer 2, Totalizer 1 reset, Totalizer 2 reset, Batch start/paused/stop, Batch cycle counter, Batch cycle counter reset, Sensor size, Sensor type, Error pending, Status log, Tag No.

<sup>1)</sup> Batch is available on MAG 6000 only

**8.6.2**  
**50 Hz Dimension dependent factory settings**  
**MAG 1100, MAG1100F,**  
**MAG 3100, MAG 3100 P**  
**and MAG 5100W with**  
**M20 cable glands**

DN		fac.set.	Q <sub>max.</sub>				unit	Volume/ pulse	Pulse unit	Totalizer unit
mm	[inches]		MAG 5100 W (Order no. 7ME6520)		MAG 1100, MAG 1100 F, 5100W (Order no. 7ME6580) MAG 3100, 3100 P					
			min.	max.	min.	max.				
2	1/12	30	-	-	3.9	156	l/h	0.1	ml	ml
3	1/8	70	-	-	6.3	254	l/h	0.1	ml	ml
6	1/4	300	-	-	25.4	1017	l/h	1	l	l
10	3/8	900	-	-	70.6	2827	l/h	1	l	l
15	1/2	2000	-	-	159	6361	l/h	1	l	l
25	1	5000	441	17671	441	17671	l/h	10	l	l
40	1 1/2	12	1.1	45	1.1	45	m <sup>3</sup> /h	10	l	l
50	2	20	1.7	63	1.7	70	m <sup>3</sup> /h	10	l	l
65	2 1/2	30	2.9	100	2.9	119	m <sup>3</sup> /h	100	l	l
80	3	50	4.0	160	4.5	180	m <sup>3</sup> /h	100	l	l
100	4	120	6.2	250	7	282	m <sup>3</sup> /h	100	l	l
125	5	180	10.0	400	11	441	m <sup>3</sup> /h	100	l	m <sup>3</sup>
150	6	250	15.7	629	15.9	636	m <sup>3</sup> /h	100	l	m <sup>3</sup>
200	8	400	24.9	997	28.2	1130	m <sup>3</sup> /h	1	m <sup>3</sup>	m <sup>3</sup>
250	10	700	40.0	1600	44.1	1767	m <sup>3</sup> /h	1	m <sup>3</sup>	m <sup>3</sup>
300	12	1000	62.5	2500	63.6	2544	m <sup>3</sup> /h	1	m <sup>3</sup>	m <sup>3</sup>
350	14	1200	86.5	3463	86.5	3463	m <sup>3</sup> /h	1	m <sup>3</sup>	m <sup>3</sup>
400	16	1800	113	4523	113	4523	m <sup>3</sup> /h	1	m <sup>3</sup>	m <sup>3</sup>
450	18	2000	143.1	5725	143.1	5725	m <sup>3</sup> /h	1	m <sup>3</sup>	m <sup>3</sup>
500	20	3000	176.7	7068	176.7	7068	m <sup>3</sup> /h	1	m <sup>3</sup>	m <sup>3</sup>
600	24	4000	254.4	10178	254.4	10178	m <sup>3</sup> /h	10	m <sup>3</sup>	m <sup>3</sup>
700	28	4500	346.3	13854	346.3	13854	m <sup>3</sup> /h	10	m <sup>3</sup>	m <sup>3</sup>
750	30	5000	397.6	15904	397.6	15904	m <sup>3</sup> /h	10	m <sup>3</sup>	m <sup>3</sup>
800	32	7000	452.3	18095	452.3	18095	m <sup>3</sup> /h	10	m <sup>3</sup>	m <sup>3</sup>
900	36	9000	572.5	22902	572.5	22902	m <sup>3</sup> /h	10	m <sup>3</sup>	m <sup>3</sup>
1000	40	12000	706.8	28274	706.8	28274	m <sup>3</sup> /h	10	m <sup>3</sup>	m <sup>3</sup>
	42	12000	706.8	28274	706.8	28274	m <sup>3</sup> /h	10	m <sup>3</sup>	m <sup>3</sup>
1100	44	14000	855.2	34211	855.2	34211	m <sup>3</sup> /h	10	m <sup>3</sup>	m <sup>3</sup>
1200	48	15000	1017.8	40715	1017.8	40715	m <sup>3</sup> /h	10	m <sup>3</sup>	m <sup>3</sup>
1400	54	25000	-	-	1385.4	55417	m <sup>3</sup> /h	10	m <sup>3</sup>	m <sup>3</sup>
1500	60	30000	-	-	1590.4	63617	m <sup>3</sup> /h	10	m <sup>3</sup>	m <sup>3</sup>
1600	66	35000	-	-	1809.5	72382	m <sup>3</sup> /h	10	m <sup>3</sup>	m <sup>3</sup>
1800	72	40000	-	-	2290.2	91608	m <sup>3</sup> /h	10	m <sup>3</sup>	m <sup>3</sup>
2000	78	45000	-	-	2827.4	113097	m <sup>3</sup> /h	10	m <sup>3</sup>	m <sup>3</sup>



8.6.2  
60 Hz Dimension dependent factory settings  
MAG 1100, MAG1100F,  
MAG 3100, MAG 3100 P  
and MAG 5100W with  
1/2" NPT cable glands

DN		Q <sub>max.</sub>						unit	Volume/ pulse	Pulse unit	Totalizer unit
mm	[inches]	fac.set.	MAG 5100 W (Order no. 7ME6520)		MAG 1100, MAG 1100 F, 5100W (Order no. 7ME6580) MAG 3100, 3100 P						
			min.	max.	min.	max.					
	1/12	0.13	-	-	0.01717	0.68	US GPM	1	US G	US G	
	1/8	0.31	-	-	0.02801	1.12	US GPM	1	US G	US G	
	1/4	1.3	-	-	0.11	4.4	US GPM	1	US G	US G	
	3/8	4	-	-	0.31	12.4	US GPM	1	US G	US G	
15	1/2	9	-	-	0.7	28.0	US GPM	1	US G	US G	
25	1	22	1.9	77.8	1.9	77.8	US GPM	1	US G	US G	
40	1 1/2	52	4.9	199.1	4.9	199.1	US GPM	1	US G	US G	
50	2	88	6.9	277.2	7.7	311.2	US GPM	1	US G	US G	
65	2 1/2	132	11.0	440.2	13.1	525.9	US GPM	1	US G	US G	
80	3	220	17.6	705.1	19.9	796.7	US GPM	1	US G	US MG	
100	4	528	27.5	1101	31.1	1244.8	US GPM	1	US G	US MG	
125	5	793	44.0	1762.2	48.6	1945.1	US GPM	1	US G	US MG	
150	6	1101	69.3	2772.9	70	2800.9	US GPM	1	US G	US MG	
200	8	1761	109.7	4391.9	124.4	4979.5	US GPM	1	US G	US MG	
250	10	3082	176.1	7045.2	194.5	7780.5	US GPM	1	US G	US MG	
300	12	4402	275.1	11007.8	280	11203.9	US GPM	1	US G	US MG	
350	14	5283	381.2	15249.7	381.2	15249.7	US GPM	1	US G	US MG	
400	16	7925	497.9	19918.1	497.9	19918.1	US GPM	1	US G	US MG	
450	18	8806	630.2	25208.8	630.2	25208.8	US GPM	1	US G	US MG	
500	20	13209	778	31122	778	31122	US GPM	1	US G	US MG	
600	24	17611	1120.3	44815.7	1120.3	44815.7	US GPM	10	US G	US MG	
700	28	19812	1524.9	60999.1	1524.9	60999.1	US GPM	10	US G	US MG	
750	30	22014	1750.6	70024.5	1750.6	70024.5	US GPM	10	US G	US MG	
800	32	30820	1991.8	79672.4	1991.8	79672.4	US GPM	10	US G	US MG	
900	36	39626	2522.8	100835.3	2522.8	100835.3	US GPM	10	US G	US MG	
1000	40	52834	3112.2	124488.1	3112.2	124488.1	US GPM	10	US G	US MG	
	42	52834	3431.2	137248.1	3431.2	137248.1	US GPM	10	US G	US MG	
1100	44	61640	3765.7	150630.6	3765.7	150630.6	US GPM	10	US G	US MG	
1200	48	66043	4481	179262.9	4481	179262.9	US GPM	10	US G	US MG	
1400	54	110072	-	-	6099.9	243993.7	US GPM	1000	US G	US MG	
1500	60	132086	-	-	7002.4	280098.3	US GPM	1000	US G	US MG	
1600	66	154100	-	-	7967.2	318689.6	US GPM	1000	US G	US MG	
1800	72	176115	-	-	10083.5	403341.5	US GPM	1000	US G	US MG	
2000	78	198129	-	-	12448.8	497952.5	US GPM	1000	US G	US MG	

**8.6.3**  
**50 Hz Dimension dependent batch and pulse output settings MAG 1100, MAG1100F, MAG 3100, MAG 3100 P and MAG 5100W with M20 cable glands**

		Volume/pulse or batch quantity			
		MAG 5100 W (Order no. 7ME6520)		MAG 1100, MAG 1100 F, 5100W (Order no. 7ME6580) MAG 3100, 3100 P	
		min.	max.	min.	max.
mm	[inches]				
DN 2	1/12	-	-	3.6 µl	0.09 m <sup>3</sup>
DN 3	1/8	-	-	5.9 µl	0.15 m <sup>3</sup>
DN 6	1/4	-	-	24 µl	0.62 m <sup>3</sup>
DN 10	3/8	-	-	65 µl	1.72 m <sup>3</sup>
DN 15	1/2	-	-	147 µl	3.86 m <sup>3</sup>
DN 25	1	409 µl	10.7 m <sup>3</sup>	409 µl	10.7 m <sup>3</sup>
DN 40	1 1/2	1.05 ml	27.5 m <sup>3</sup>	1.05 ml	27.5 m <sup>3</sup>
DN 50	2	1.46 ml	38.2 m <sup>3</sup>	1.64 ml	42.9 m <sup>3</sup>
DN 65	2 1/2	2.31 ml	60.7 m <sup>3</sup>	2.77 ml	72.5 m <sup>3</sup>
DN 80	3	3.71 ml	97.2 m <sup>3</sup>	4.19 ml	110 m <sup>3</sup>
DN 100	4	5.79 ml	152 m <sup>3</sup>	6.54 ml	172 m <sup>3</sup>
DN 125	5	9.27 ml	243 m <sup>3</sup>	10.2 ml	268 m <sup>3</sup>
DN 150	6	14.6 ml	382 m <sup>3</sup>	14.7 ml	386 m <sup>3</sup>
DN 200	8	23.1 ml	605 m <sup>3</sup>	26.2 ml	686 m <sup>3</sup>
DN 250	10	37.0 ml	971 m <sup>3</sup>	40.9 ml	1072 m <sup>3</sup>
DN 300	12	57.9 ml	1517 m <sup>3</sup>	58.9 ml	1544 m <sup>3</sup>
DN 350	14	80.2 ml	2102 m <sup>3</sup>	80.2 ml	2102 m <sup>3</sup>
DN 400	16	105 ml	2745 m <sup>3</sup>	105 ml	2745 m <sup>3</sup>
DN 450	18	133 ml	3474 m <sup>3</sup>	133 ml	3474 m <sup>3</sup>
DN 500	20	164 ml	4289 m <sup>3</sup>	164 ml	4289 m <sup>3</sup>
DN 600	24	236 ml	6177 m <sup>3</sup>	236 ml	6177 m <sup>3</sup>
DN 700	28	321 ml	8407 m <sup>3</sup>	321 ml	8407 m <sup>3</sup>
DN 750	30	368 ml	9651 m <sup>3</sup>	368 ml	9651 m <sup>3</sup>
DN 800	32	419 ml	10981 m <sup>3</sup>	419 ml	10981 m <sup>3</sup>
DN 900	36	530 ml	13897 m <sup>3</sup>	530 ml	13897 m <sup>3</sup>
DN 1000	40	654 ml	17157 m <sup>3</sup>	654 ml	17157 m <sup>3</sup>
	42	654 ml	17157 m <sup>3</sup>	654 ml	17157 m <sup>3</sup>
DN 1100	44	792 ml	20760 m <sup>3</sup>	792 ml	20760 m <sup>3</sup>
DN 1200	48	942 ml	24706 m <sup>3</sup>	942 ml	24706 m <sup>3</sup>
DN 1400	54	-	-	1.28 l	33628 m <sup>3</sup>
DN1500	60	-	-	1.15 l	38604 m <sup>3</sup>
DN1600	66	-	-	1.68 l	43923 m <sup>3</sup>
DN1800	72	-	-	2.12 l	55590 m <sup>3</sup>
DN 2000	78	-	-	2.62 l	68629 m <sup>3</sup>

**8.6.3**  
**60 Hz Dimension dependent batch and pulse output settings MAG 1100, MAG1100F, MAG 3100, MAG 3100 P and MAG 5100W with 1/2" NPT cable glands**

mm   [inches]		Volume/pulse or batch quantity			
		MAG 5100 W (Order no. 7ME6520)		MAG 1100, MAG 1100 F, 5100W (Order no. 7ME6580) MAG 3100, 3100 P	
		US G min.	US G max.	US G min.	US G max.
DN 2	1/12	-	-	0.00000095	25
DN 3	1/8	-	-	0.00000156	41
DN 6	1/4	-	-	0.00000622	163
DN 10	3/8	-	-	0.00001729	453
DN 15	1/2	-	-	0.0000389	1019
DN 25	1	0.000108	2833	0.000108	2833
DN 40	1 1/2	0.000277	7252	0.000277	7252
DN 50	2	0.000385	10096	0.000433	11331
DN 65	2 1/2	0.000611	16028	0.000730	19149
DN 80	3	0.000979	25672	0.00111	29007
DN 100	4	0.00153	40089	0.00173	45325
DN 125	5	0.00245	64162	0.00270	70819
DN 150	6	0.00385	100961	0.00389	101980
DN 200	8	0.00610	159905	0.00691	181299
DN 250	10	0.00979	256510	0.0108	283279
DN 300	12	0.0153	400784	0.0156	407923
DN 350	14	0.0212	555228	0.0212	555228
DN 400	16	0.0277	725196	0.0277	725196
DN 450	18	0.0350	917826	0.0350	917826
DN 500	20	0.0432	1133118	0.0432	1133118
DN 600	24	0.0622	1631691	0.0622	1631691
DN 700	28	0.0847	2220912	0.0847	2220912
DN 750	30	0.0973	2549517	0.0973	2549517
DN 800	32	0.111	2900784	0.111	2900784
DN 900	36	0.140	3671304	0.140	3671304
DN 1000	40	0.173	4532475	0.173	4532475
	42	0.173	4532475	0.173	4532475
DN 1100	44	0.209	5484295	0.209	5484295
DN 1200	48	0.249	6526764	0.249	6526764
DN 1400	54	-	-	0.339	8883651
DN1500	60	-	-	0.389	10198069
DN1600	66	-	-	0.443	11603136
DN1800	72	-	-	0.560	14685219
DN 2000	78	-	-	0.692	18129900

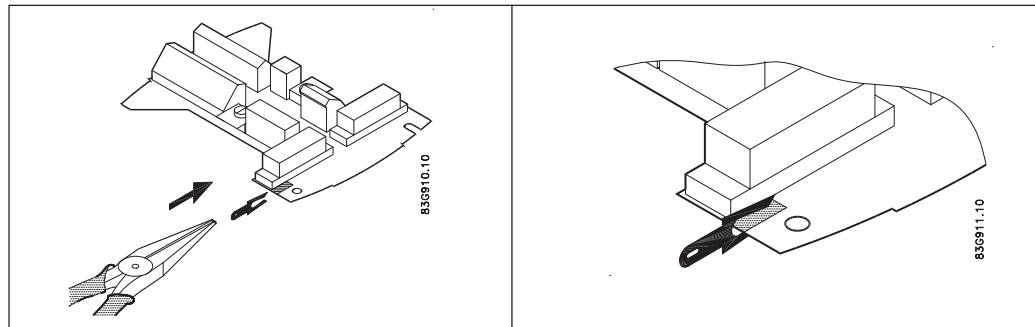
(continued)

		Volume/pulse or batch quantity			
		MAG 5100 W (Order no. 7ME6520)		MAG 1100, MAG 1100 F, 5100W (Order no. 7ME6580) MAG 3100, 3100 P	
mm	[inches]	min.	max.	min.	max.
DN 600	24	236 ml	6177 m <sup>3</sup>	236 ml	6177 m <sup>3</sup>
DN 700	28	321 ml	8407 m <sup>3</sup>	321 ml	8407 m <sup>3</sup>
DN 750	30	368 ml	9651 m <sup>3</sup>	368 ml	9651 m <sup>3</sup>
DN 800	32	419 ml	10981 m <sup>3</sup>	419 ml	10981 m <sup>3</sup>
DN 900	36	530 ml	13897 m <sup>3</sup>	530 ml	13897 m <sup>3</sup>
DN 1000	40	654 ml	17157 m <sup>3</sup>	654 ml	17157 m <sup>3</sup>
	42	654 ml	17157 m <sup>3</sup>	654 ml	17157 m <sup>3</sup>
DN 1100	44	792 ml	20760 m <sup>3</sup>	792 ml	20760 m <sup>3</sup>
DN 1200	48	942 ml	24706 m <sup>3</sup>	942 ml	24706 m <sup>3</sup>
DN 1400	54	-	-	1.28 l	33628 m <sup>3</sup>
DN1500	60	-	-	1.15 l	38604 m <sup>3</sup>
DN1600	66	-	-	1.68 l	43923 m <sup>3</sup>
DN1800	72	-	-	2.12 l	55590 m <sup>3</sup>
DN 2000	78	-	-	2.62 l	68629 m <sup>3</sup>

#### 8.6.4 MAG 5000 CT and MAG 6000 CT settings

Setting primary operating parameters such as  $Q_{max.}$ , low flow cut-off, units, approvals, etc. is blocked during normal operation. See menu setup.

These settings are made in connection with commissioning or calibration by mounting a hardware key on the connection plate of the transmitter. When the key is mounted, there is access to all menu items. When the key is removed, the primary settings are blocked in accordance with the requirements in the authorisation.



#### Internal totalizers

Depending on the type of approval it is possible to reset the internal totalizers. The type of approval is selected in the reset menu, with the hardware key mounted. It is possible to choose between:

- Hot/cold water
- Other liquids

Resetting of totalizers by electrical input is not possible.

##### Hot/cold water

- Totalizer 1 is allocated to forward flow (cannot be reset).
- Totalizer 2 is allocated to reverse flow (cannot be reset).

##### Other liquids

Both totalizer 1 and totalizer 2 are allocated to measure the net flow, i.e. any reverse flow will make the totalizers count backwards.

- Totalizer 1 cannot be reset.
- Totalizer 2 can be reset if the flow velocity in the meter pipe is  $<0.25$  m/s. When the totalizer is reset, the pulse output register will also be reset.

#### Output

- When choosing hot water, changing the output settings is not allowed and the output settings menus will not be shown in display.
- When choosing cold water or other liquids, all output settings can be changed.

### 8.7.1 Error handling

#### Error system

The transmitter system is equipped with an error and status log system with 4 groups of information.

- (I) Information without a functional error involved
- (W) Warnings which may cause malfunction in the application. The cause of the error may disappear on its own
- (P) Permanent errors which may cause malfunction in the application. The error requires an operator
- (F) Fatal error which is essential for the operation of the flowmeter

2 menus are available in service and operator menus for registration of information and errors

- Error pending
- Status log

#### Error pending

The first 9 standing errors are stored in “error pending”. When an error is removed it is removed from “error pending”.

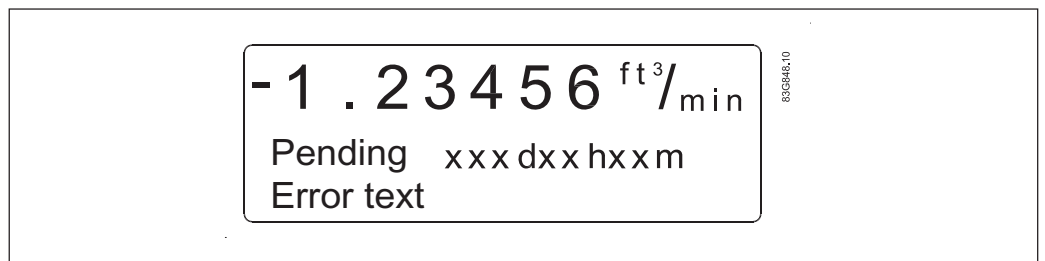
The acceptance level for “error pending” can be individually configured to a particular application. The acceptance level is set in the “basic settings” in the transmitter setup menu.

#### Acceptance levels

The following three acceptance levels are selectable

- Fatal error: Fatal errors are registered as errors
- Permanent errors: Permanent and fatal errors are registered as errors
- Warning (Default value): Warnings, permanent and fatal errors are registered as errors

Error information is displayed in title and subtitle lines, see display layout. Title line will show time since occurrence of error in days, hours and minutes. Subtitle line will flash between an error text and a remedy text. Error text will indicate type of error (I, W, P or F), error number, and error text. Remedy text will inform operator of action to take to remove error.



#### Status Log

Like “error pending” except that information, warnings, permanent and fatal errors is always stored in the “status log”. The “status log” stores the latest 9 messages received/registered during the last 180 days.

#### Alarm field

The alarm field on the display will always flash when an error is pending.

#### Error output

The digital and relay output can individually be activated error by error (error level). The relay output is default selected to error level. An output can also be selected to activate on a single error number. The alarm field, error output and error pending always operate together. The analog output turns to a 1 mA level when in the 4-20 mA mode.

#### Operator menu

Error pending and status log are as default enabled in the operator menu.

### 8.7.2 List of error numbers

Error No.	Error text Remedy text	Comment	Outputs status	Input status
1	I1 - <i>Power on</i> OK	Power-on has happened	Active	Active
2	I2 - <i>Add-on module</i> Applied	A new module has been applied to the system	Active	Active
3	I3 - <i>Add-on module</i> Install	An add-on module is defect or has been removed. This can be an internal add-on module	Active	Active
4	I4 - <i>Param. corrected</i> OK	A less vital parameter in the transmitter has been replaced by its default value	Active	Active
20	W20 - <i>Totalizer 1</i> Reset manually	During initialization the check of the saved totalizer value has failed. It is not possible to rely on the saved totalizer value anymore. The totalizer value must be reset manually in order to rely on future readings	Active	Active
20	W20 - <i>Totalizer 2</i> Reset manually	During initialization the check of the saved totalizer value has failed. It is not possible to rely on the saved totalizer value anymore. The totalizer value must be reset manually in order to rely on future readings	Active	Active
21	W21 - <i>Pulse overflow</i> Adj. pulse settings	Actual flow is too big compared with pulse width and volume/pulse	Reduced pulse width	Active
22	W22 - <i>Batch timeout</i> Check installation	Duration of batching has exceeded a predefined max. time	Batch output on zero	Active
23	W23 - <i>Batch overrun</i> Check installation	Batch volume has exceeded a predefined maximum overrun volume	Batch output on zero	Active
24	W24 - <i>Batch neg. flow</i> Check flow direction	Negative flow direction during batch	Active	Active
30	W30 - <i>Overflow</i> Adj. $Q_{max}$ .	Flow is above $Q_{max}$ . settings	Max. 120 %	Active
31	W31 - <i>Empty pipe</i>	Pipe is empty	Zero	Active
40	P40 - <i>SENSORPROM®</i> Insert/change	SENSORPROM® unit not installed	Active	Active
41	P41 - <i>Parameter range</i> Switch off and on	A parameter is out of range. The parameter could not be replaced by its default value. The error will disappear at the next power-on	Active	Active
42	P42 - <i>Current output</i> Check cables	Current loop is disconnected or the loop resistance is too big	Active	Active
43	P43 - <i>Internal error</i> Switch off and on	Too many errors occurred at the same time Some errors are not detected correctly	Active	Active
44	P44 - <i>CT SENSORPROM®</i>	SENSORPROM® unit has been used as CT version	Active	Active
60	F60 - <i>CAN comm. error</i> Transmitter/AOM	CAN bus communication error. An add-on module, the display module or the transmitter is defective	Zero	Inactive
61	F61 - <i>SENSORPROM® error</i> Replace	It is not possible to rely on the data in SENSORPROM® unit anymore	Active	Active
62	F62 - <i>SENSORPROM® ID</i> Replace	The SENSORPROM® unit ID does not comply with the product ID. The SENSORPROM® unit is from another type of product SITRANS FC, SITRANS FUS etc.	Zero	Inactive
63	F63 - <i>SENSORPROM®</i> Replace	It is not possible to read from the SENSORPROM® unit anymore.	Active	Active
70	F70 - <i>Coil current</i> Check cables	Coil excitation has failed	Active	Active
71	F71 - <i>Internal error</i> Replace transmitter	Internal conversion error in ASIC	Active	Active

9. Service

Under ideal conditions the flowmeter will operate continuously with no manual adjustment or intervention required.

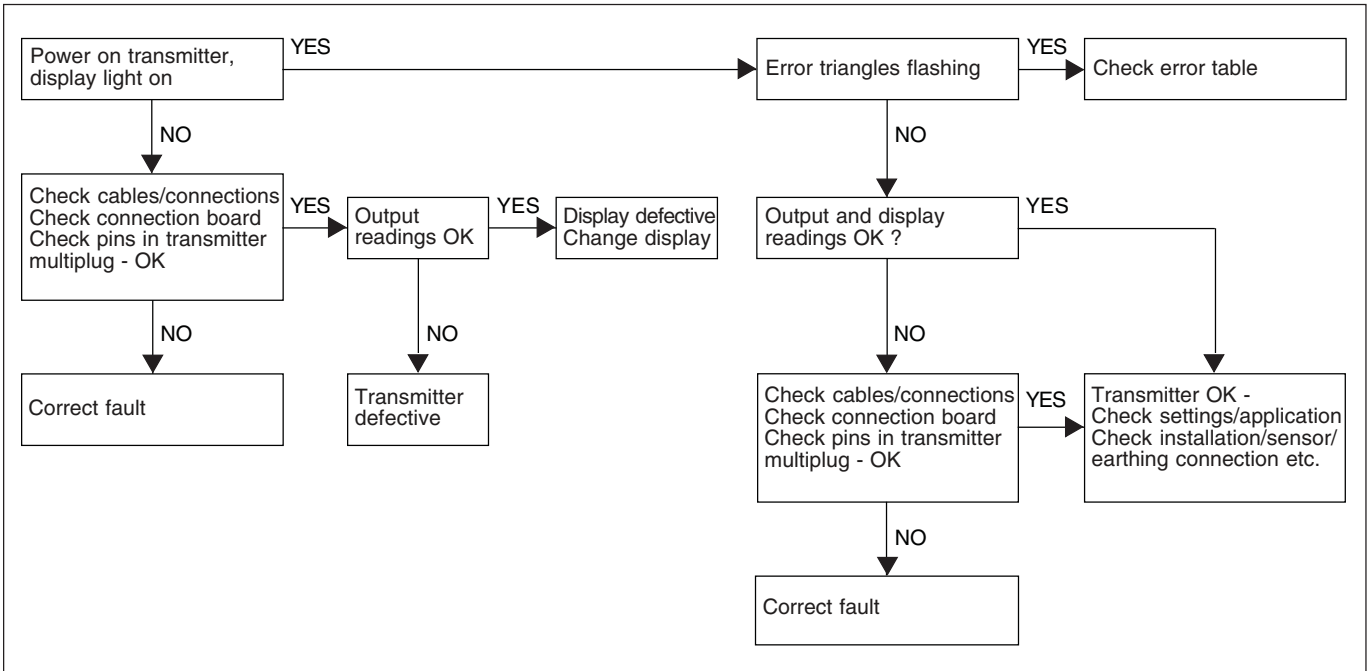
If unstable/wrong measurements occur, it is often due to insufficient/wrong earthing or potential equalization. If earthing connection is OK, check transmitter as described in Transmitter check list, and sensor as described in sensor check lists (see the respective operating instructions).

The SITRANS F M Verificator is an external tool developed for verifying the MAG 5000/6000 system, installation, and application. It is a highly advanced instrument, which carries out the complex verification of the entire flowmeter system according to unique SIEMENS patented principles. The verification test is automated and the instrument easy to use, so no human error or influence will affect the verification.

9.1 Transmitter check list

When checking SITRANS F M installations for malfunction the easiest method to check the transmitter is to replace it with another MAG 5000/6000 transmitter with a similar power supply. A replacement can easily be done as all settings are stored in and downloaded from the SENSORPROM® unit - no extra settings need to be made.

If no spare transmitter is available - then check transmitter according to check table.



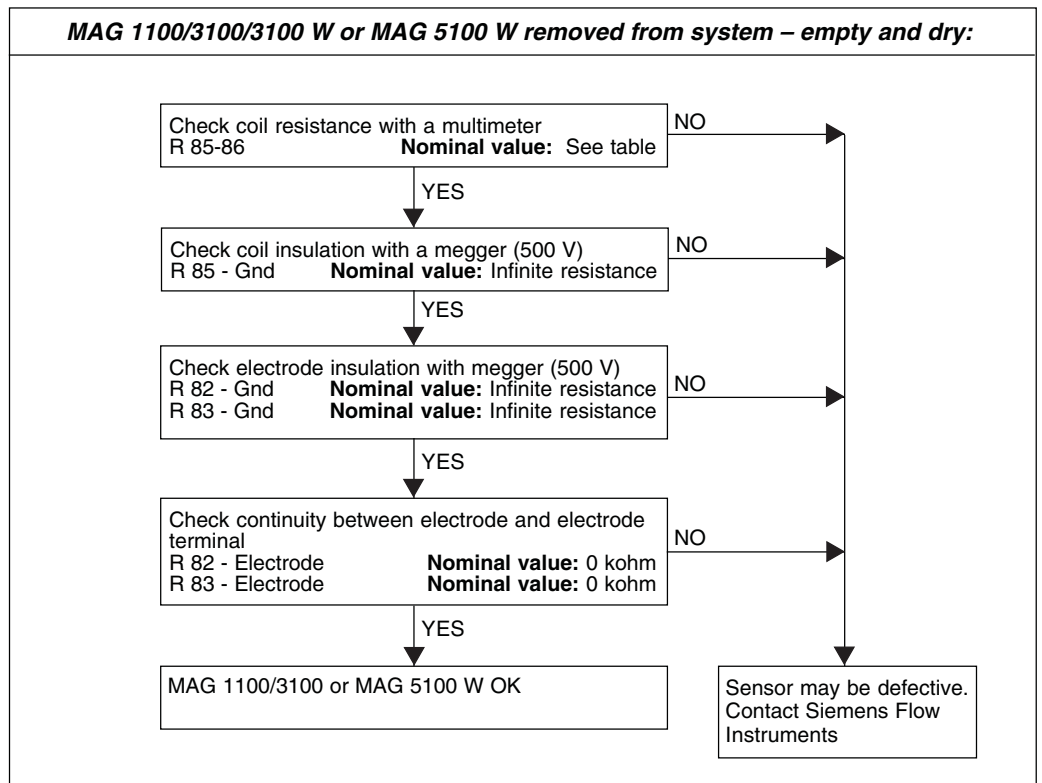
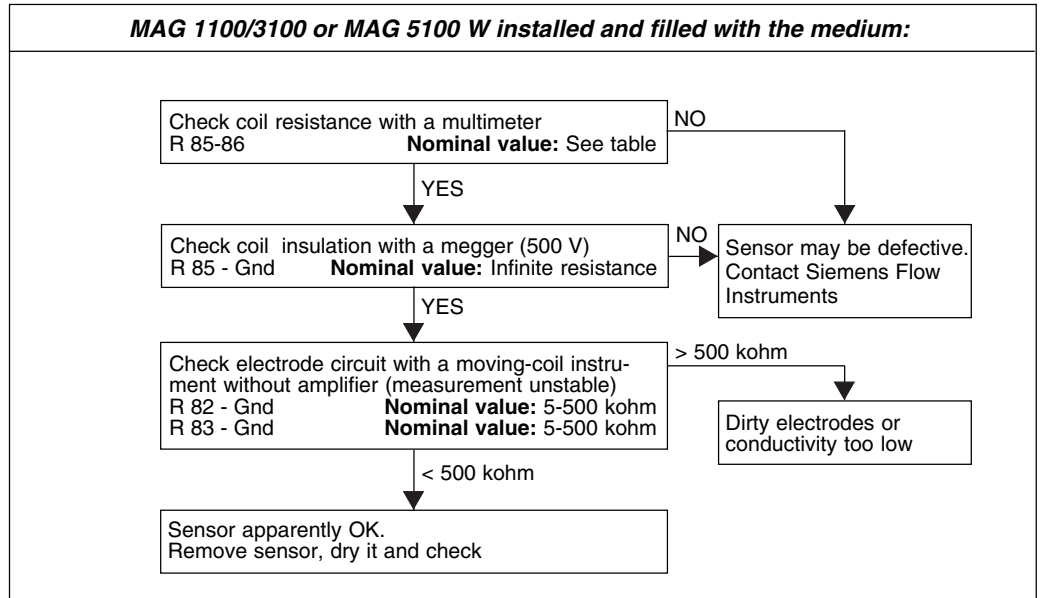
## 9.2 Trouble shooting MAG transmitter

Symptom	Output signals	Error code	Cause	Remedy	
<b>Empty display</b>	Minimum		1. No power supply	Power supply Check MAG 5000/6000 for bended pins on the connector	
			2. MAG 5000/6000 defective	Replace MAG 5000/6000	
<b>No flow signal</b>	Minimum		1. Current output disabled	Turn on current output	
			2. Digital output disabled	Turn on digital output	
			3. Reverse flow direction	Change direction	
		F70	Incorrect or no coil current	Check cables/connections	
	W31	Measuring pipe empty	Ensure that the measuring pipe is full		
	F60	Internal error	Replace MAG 5000/6000		
	Undefined	P42	1. No load on current output 2. MAG 5000/6000 defective	Check cables/connections Replace MAG 5000/6000	
P41	Initializing error	Switch off MAG 5000/6000, wait 5 s and switch on again			
<b>Indicates flow with no flow in pipe</b>	Undefined		Measuring pipe empty	Select empty pipe cut-off	
			Empty pipe cut-off is OFF	Ensure that the measuring pipe is full	
			Electrode connection missing/ electrode cable is insufficiently screened	Ensure that electrode cable is connected and sufficiently screened	
<b>Unstable flow signal</b>	Unstable		1. Pulsating flow	Increase time constant	
			2. Conductivity of medium too low	Use special electrode cable	
			3. Electrical noise potential between medium and sensor	Ensure sufficient potential equalization	
			4. Air bubbles in medium	Ensure medium does not contain air bubbles	
			5. High concentration of particles or fibres	Increase time constant	
<b>Measuring error</b>	Undefined		Incorrect installation	Check installation	
			P40	No SENSORPROM® unit	Install SENSORPROM® unit
			P44	CT SENSORPROM® unit	Replace SENSORPROM® unit or reset SENSORPROM® unit with MAG CT transmitter
			F61	Defective SENSORPROM® unit	Replace SENSORPROM® unit
			F62	Wrong type of SENSORPROM® unit	Replace SENSORPROM® unit
			F63	Defective SENSORPROM® unit	Replace SENSORPROM® unit
			F71	Loss of internal data	Replace MAG 5000/6000
	Maximum	W30	Flow exceeds 100% of $Q_{max}$ .	Check $Q_{max}$ . (Basic Settings)	
	W21	Pulse overflow • Volume/pulse too small • Pulse width too large	Change volume/pulse Change pulse width		
<b>Measuring approx. 50%</b>			Missing one electrode connection	Check cables	
<b>Loss of totalizer data</b>	OK	W20	Initializing error	Reset totalizer manually	
<b>##### Signs in display</b>	OK		Totalizer roll over	Reset totalizer or increase totalizer unit	



9.3  
Check list MAG sensor

Disconnect all leads to MAG 1100/3100 or MAG 5100 W



#### 9.4 Coil resistance

DN	Inch	Coil resistance					
		MAG 1100, MAG 1100F		MAG 3100, MAG 3100P, MAG 5100 W (Order no. 7ME6580)		MAG 5100 W (Order no. 7ME6520)	
		Resistance	Tolerance	Resistance	Tolerance	Resistance	Tolerance
2	1/12	104 Ω	+/- 5	104			
3	1/8	104 Ω	+/- 5	104			
6	1/4	99 Ω	+/- 17	104			
10	3/8	99 Ω	+/- 17	104			
15 1)	1/2	91 Ω	+/- 9	104			
25	1	91 Ω	+/- 17	104	+/- 2	104	+/- 10
40	1 1/2	91 Ω	+/- 9	92	+/- 2	92	+/- 10
50	2	91 Ω	+/- 9	92	+/- 2	119.4	+/- 10
65	2 1/2	99 Ω	+/- 17	100	+/- 2	127	+/- 10
80	3	91 Ω	+/- 17	94	+/- 2	126	+/- 10
100	4	91 Ω	+/- 9	92	+/- 2	125	+/- 10
125	5		92	+/- 2	126	+/- 10	
150	6		94	+/- 2	116	+/- 10	
200	8		90	+/- 2	109	+/- 10	
250	10		92	+/- 2	104	+/- 10	
300	12		100	+/- 2	108	+/- 10	
350	14		112	+/- 2	100	+/- 6	
400	16		100	+/- 4	100	+/- 6	
450	18		108	+/- 4	100	+/- 6	
500	20		122	+/- 4	100	+/- 6	
600	24		115	+/- 4	98	+/- 6	
700	28		128	+/- 4	98	+/- 6	
750	30		133				
800	32		128	+/- 4	98	+/- 6	
900	36		131	+/- 4	98	+/- 6	
1000	40		131	+/- 4	88	+/- 6	
1100	44		126				
1200	48		130	+/- 4	88	+/- 6	
1400	54		130				
1500	60		124				
1600	66		133				
1800	72		133				
2000	78		147				

1) On MAG 1100 DN 15 produced as from May 1999 the coil resistance must be 86 ohm, +8/-4 ohm.

All resistance values are at 20 °C.  
The resistance changes proportionally 0.4% / °C.

## 10. Ordering

### 10. Ordering



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