

## SITRANS F M MAGFLO®

*Electromagnetic flowmeters*

*Sensor types MAG 1100, MAG 3100, MAG 5100 W*

*Transmitter types MAG 5000, MAG 6000*




Technical Documentation (handbooks, instructions, manuals etc.) on the complete product range SITRANS F can be found on the internet/intranet on the following links:



English: <http://www4.ad.siemens.de/WW/view/en/10806951/133300>



**Order no.: FDK-521H0723**

SFIDK.PS.027.W4.02

Siemens Flow Instruments range of electromagnetic flowmeters

	MAG 1100 	MAG 1100 FOOD 	MAG 3100 	MAG 3100 W 	MAG 5100 W 
<b>Size [mm]</b>	DN 2-100	DN 10-100	DN 15-2000	DN 25-1200	DN 25-1200
<b>Connection</b>	Flangeless (Sandwich design)	Weld-in adapter, clamp adapter, thread adapter	Flange	Flange	Flange
<b>Pressure [bar]</b>	Max. 40	Max. 40	Max. 100	Max. 40	Max. 40
<b>Temperature [°C]</b>	-20 to 200	-30 to 150	-40 to 180	-10 to 95	-5 to 90
<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®	Neoprene and EPDM	DN 25-40 & DN 350-1200 hard elastomer DN 50-300 composite elastomer
<b>Electrodes</b>	Platinum Hastelloy C276	Platinum Hastelloy	AISI 316 Ti, Hastelloy C, Platinum/Iridium, Titanium, Tantalum, PE electrodes	AISI 316 Ti, PE electrodes	AISI 316 Ti, PE electrodes
<b>Enclosure</b>	IP 67	IP 67	IP 67/IP 68	IP 67/IP 68	IP 67/IP 68
<b>Ex-version</b>	EEx [ia] [ib] IIB T4-T6		EEx e ia IIC T3-T6 EEx d [ia] [ib] IIB T4-T6		

	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
<b>Display</b>	3 lines 20 characters (optional without display)	3 lines 20 characters (optional without display)
<b>Meter uncertainty</b>	±0,5% o.r.	±0,25% o.r.
<b>Enclosure</b>	IP 67, IP 20	IP 67, IP 20
<b>Custody transfer approval</b>	PTB (cold water)	PTB OIML R75 OIML R117
<b>Ex-version Safety barrier 19"</b>	[EEx ia] IIC	[EEx ia ib] IIB [EEx ia] IIC
<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 W 
<b>Refer to</b>	Operating manual SFIDK.PS.026.E1.02	Operating manual SFIDK.PS.026.D2.02

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### 1.1 Product introduction

SITRANS F M MAGFLO® electromagnetic flowmeters offer reliable, precise and inexpensive flow measurement on all electrically conductive liquids. Typical applications are found in all industries. E.g.:

- Water sector: Potable water, treatment of chemicals, waste water and sludge.
- Food sector: Dairy products, beer, wine, soft-drinks and fruit juices.
- Chemical sector: Detergents, pharmaceuticals, acids and alkalies.
- Other sectors: District heating, paper pulp and mining slurries.

SITRANS F M MAGFLO® electromagnetic flowmeters are characterised by simplicity:

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

SITRANS F M MAGFLO® electromagnetic flowmeters are manufactured by Siemens Flow Instruments A/S - one of the worlds leading makers of flowmeters.



All SITRANS F M MAGFLO® 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.

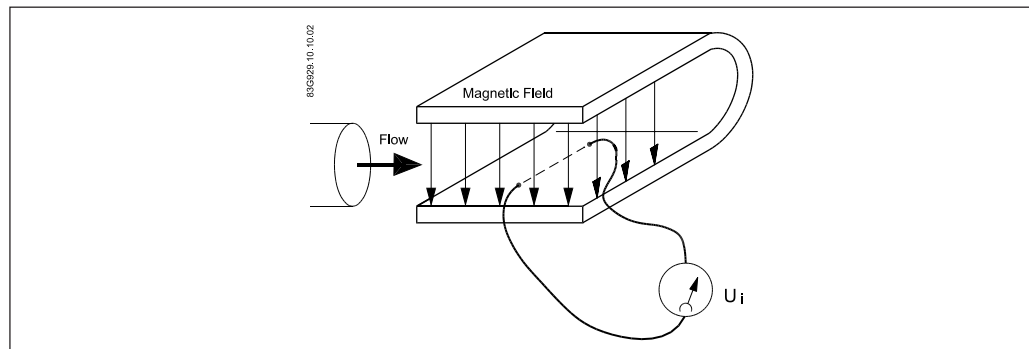


#### USM II "Plug & Play" add-on communication modules.

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. The flowmeter consists of a sensor type MAG 1100, MAG 3100 or MAG 5100 W and a transmitter type MAG 5000 or 6000.



$U_i$  = 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**

### 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

2 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 1 mS/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 internal via an internal CAN communication bus. Signals are transferred to/from a signal conditioner to the display module, 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 a 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 97/23ECs

From May 30<sup>th</sup> 2002 the "Pressure Equipment Directive" is mandatory for all pressure equipment sold within the EU and EFTA.

The approach that Siemens Flow Instruments has taken is outlined in the tables below.

#### MAG 5100 W

Flange mm	PN 10	PN 16	PN 40	150 lb	300 lb
25	N/A	N/A	SEP	SEP	N/A
40	N/A	N/A	SEP	SEP	N/A
50	N/A	SEP	N/A	SEP	N/A
65	N/A	SEP	N/A	SEP	N/A
80	N/A	SEP	N/A	SEP	N/A
100	N/A	SEP	N/A	SEP	N/A
125	N/A	SEP	N/A	PED*	N/A
150	N/A	PED	N/A	PED*	N/A
200	SEP	PED	N/A	PED*	N/A
250	LVD	PED	N/A	PED*	N/A
300	LVD	PED	N/A	PED*	N/A
350	LVD	PED	N/A	PED*	N/A
400	LVD	PED	N/A	PED*	N/A
450	LVD	PED	N/A	PED*	N/A
500	LVD	PED	N/A	PED*	N/A
600	LVD	PED	N/A	PED*	N/A
700	LVD	PED*	N/A	N/A	PED*
750	N/A	N/A	N/A	N/A	PED*
800	LVD	PED*	N/A	N/A	PED*
900	LVD	PED*	N/A	N/A	PED*
1000	LVD	PED*	N/A	N/A	PED*
1050	N/A	N/A	N/A	N/A	PED*
1100	N/A	N/A	N/A	N/A	PED*
1200	LVD	PED*	N/A	N/A	PED*

#### MAG 3100 & MAG 3100 W

Flange mm	PN 6	PN 10	PN 16	PN 25	PN 40	PN 64	PN 100	150 lb	300 lb	AWWA
25	N/A	N/A	N/A	N/A	SEP	N/A	SEP	SEP	SEP	N/A
40	N/A	N/A	N/A	N/A	SEP	N/A	PED	SEP	SEP	N/A
50	N/A	N/A	N/A	N/A	SEP	PED	PED	SEP	PED*	N/A
65	SEP	N/A	SEP	N/A	PED	PED	PED	SEP	PED*	N/A
80	SEP	N/A	SEP	N/A	PED	PED	PED	SEP	PED*	N/A
100	SEP	N/A	SEP	N/A	PED	PED	PED	SEP	PED*	N/A
125	SEP	N/A	SEP	N/A	PED	PED	PED	PED*	PED*	N/A
150	SEP	N/A	PED	N/A	PED	PED	PED	PED*	PED*	N/A
200	SEP	SEP	PED	PED	PED	PED	PED	PED*	PED*	N/A
250	SEP	LVD	PED	PED	PED	PED	PED	PED*	PED*	N/A
300	SEP	LVD	PED	PED	PED	PED	PED	PED*	PED*	N/A
350	LVD	LVD	PED	PED	PED	PED	PED	PED*	PED*	N/A
400	LVD	LVD	PED	PED	PED	PED	N/A	PED*	PED*	N/A
450	LVD	LVD	PED	PED	PED	N/A	N/A	PED*	PED*	N/A
500	LVD	LVD	PED	PED	PED	N/A	N/A	PED*	PED*	N/A
600	LVD	LVD	PED	PED	PED	N/A	N/A	PED*	PED*	N/A
700	LVD	LVD	PED*	N/A	N/A	N/A	N/A	N/A	N/A	PED*
750	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	PED*
800	LVD	LVD	PED*	N/A	N/A	N/A	N/A	N/A	N/A	PED*
900	LVD	LVD	PED*	N/A	N/A	N/A	N/A	N/A	N/A	PED*
1000	LVD	LVD	PED*	N/A	N/A	N/A	N/A	N/A	N/A	PED*
1050	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	PED*
1100	LVD	LVD	PED*	N/A	N/A	N/A	N/A	N/A	N/A	PED*
1200	LVD	LVD	PED*	N/A	N/A	N/A	N/A	N/A	N/A	PED*
1400	LVD	LVD	PED*	N/A	N/A	N/A	N/A	N/A	N/A	PED*
1500	LVD	LVD	PED*	N/A	N/A	N/A	N/A	N/A	N/A	PED*
1600	LVD	LVD	PED*	N/A	N/A	N/A	N/A	N/A	N/A	PED*
1800	LVD	LVD	PED*	N/A	N/A	N/A	N/A	N/A	N/A	PED*
2000	LVD	LVD	PED*	N/A	N/A	N/A	N/A	N/A	N/A	PED*

**MAG 3100 high temperature PTFE**

Flange mm	PN 6	PN 10	PN 16	PN 25	PN 40	150 lb	300 lb
15	N/A	N/A	N/A	N/A	SEP	SEP	SEP
25	N/A	N/A	N/A	N/A	SEP	SEP	SEP
40	N/A	N/A	N/A	N/A	PED	LVD	PED*
50	N/A	N/A	N/A	N/A	PED	PED*	PED*
65	LVD	N/A	PED	N/A	PED	PED*	PED*
80	LVD	N/A	PED	N/A	PED	PED*	PED*
100	LVD	N/A	PED	N/A	PED	PED*	PED*
125	PED	N/A	PED	N/A	PED	PED*	PED*
150	PED	N/A	PED	N/A	PED	PED*	PED*
200	PED	PED	PED	PED	PED	PED*	PED*
250	PED	PED	PED	PED	PED	PED*	PED*
300	PED	PED	PED	PED	PED	PED*	PED*
350	PED	PED	PED	PED	PED	PED*	PED*
400	PED	PED	PED	PED	PED	PED*	N/A
450	PED	PED	PED	PED	PED	PED*	N/A
500	PED	PED	PED	PED	PED	PED*	N/A
600	PED	PED	PED	PED		PED*	

**MAG 1100**

Flange mm	Ceramic 150°	Ceramic 200°	Ceramic Ex	Ceramic Ex-d	Ceramic FOOD	PFA	PFA Ex	PFA FOOD
2	SEP	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3	SEP	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	SEP	N/A	SEP	SEP	N/A	N/A	N/A	N/A
10	SEP	N/A	SEP	SEP	SEP	SEP	SEP	SEP
15	SEP	SEP	SEP	SEP	SEP	SEP	SEP	SEP
25	SEP	SEP	SEP	SEP	SEP	SEP	SEP	SEP
40	PED	PED	PED	PED	PED	LVD	LVD	LVD
50	PED	PED	PED	PED	PED	PED	PED	PED
65	PED	N/A	PED	PED	PED	PED	PED	PED
80	PED	PED	PED	PED	PED	PED	PED	PED
100	PED	PED	PED	PED	PED	PED	PED	PED

The key to the above tables is as follows.

<b>PED</b>	Product covered by PED and only available as fully PED conforming
<b>PED*</b>	Product covered by PED but available as either conforming or non conforming to PED
<b>SEP</b>	Excluded from PED under <b>S</b> ound <b>E</b> ngineering <b>P</b> ractice
<b>LVD</b>	Excluded from PED under the <b>L</b> ow <b>V</b> oltage <b>D</b> irective

### 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 also 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




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

CE0086: This indicates that the product conforms to PED 97/23/EC, LVD 73/23/EEC + Amendment 93/68/EEC & EMC 89/336 EEC

CE: This indicates that the product conforms to LVD 73/23/EEC + Amendment 93/68/EEC & EMC 89/336 EEC



## 2. Technical data

## 2.1 Sensor MAG 1100 and MAG 1100 Ex

	MAG 1100	MAG 1100 PFA	MAG 1100 Ex & Ex-d
			
<b>Type</b>	Flangeless sensor (Sandwich design)		
<b>Nominal size</b> <i>mm</i>	DN 2,3,6,10,15,25,40,50,65,80,100	DN 10,15,25,40,50,65,80,100	DN 2,3,6,10,15,25,40,50,65,80,100
<b>Operating pressure</b>	DN 2-65: 40 bar, DN 80: 37.5 bar, DN 100: 30 bar Vacuum: $1 \times 10^{-6}$ bar	20 bar Vacuum: 0.02 bar	DN 2-65: 40 bar, DN 80: 37.5 bar, DN 100: 30 bar Vacuum: $1 \times 10^{-6}$ bar
<b>Temperature of medium</b>	<i>PFA</i>	-30°C to +130°C	
	<i>Ceramic</i>		-20°C to +120°C
	<i>High temp.</i>	Suitable for steam sterilization at 150°C	
<b>Temperature shock</b> (Ceramic liner)	(Duration > 1 min.): DN 2, 3: Max. $\Delta T \leq 20^\circ\text{C}/\text{min.}$ DN 6, 10, 15, 25: Max. $\Delta T \leq 15^\circ\text{C}/\text{min.}$ DN 40, 50, 65: Max. $\Delta T \leq 10^\circ\text{C}/\text{min.}$ DN 80, 100: Max. $\Delta T \leq 5^\circ\text{C}/\text{min.}$ (Duration $\leq 1$ min., followed by 10 min. rest): DN 2, 3: Max. $\Delta T \leq 100^\circ\text{C}$ DN 6, 10, 15, 25: Max. $\Delta T \leq 80^\circ\text{C}$ DN 40, 50, 65: Max. $\Delta T \leq 70^\circ\text{C}$ DN 80, 100: Max. $\Delta T \leq 60^\circ\text{C}$	Max. $\pm 100^\circ\text{C}$ momentarily	(Duration > 1 min.): DN 2, 3: Max. $\Delta T \leq 20^\circ\text{C}/\text{min.}$ DN 6, 10, 15, 25: Max. $\Delta T \leq 15^\circ\text{C}/\text{min.}$ DN 40, 50, 65: Max. $\Delta T \leq 10^\circ\text{C}/\text{min.}$ DN 80, 100: Max. $\Delta T \leq 5^\circ\text{C}/\text{min.}$ (Duration $\leq 1$ min., followed by 10 min. rest): DN 2, 3: Max. $\Delta T \leq 100^\circ\text{C}$ DN 6, 10, 15, 25: Max. $\Delta T \leq 80^\circ\text{C}$ DN 40, 50, 65: Max. $\Delta T \leq 70^\circ\text{C}$ DN 80, 100: Max. $\Delta T \leq 60^\circ\text{C}$
<b>Ambient temperature</b>	Remote transmitter: -40°C to +100°C Compact transmitter: -20°C to +50°C		
<b>Liner</b>	DN 2 - 3 Zirconium oxide $ZrO_2$		Zirconium oxide $ZrO_2$
	DN 6 - 100 Aluminium oxide $Al_2O_3$ (ceramics)	Reinforced PFA (Teflon)	Aluminium oxide $Al_2O_3$ (ceramics)
<b>Electrodes</b>	DN 2 - 3 Platinum sintered		Platinum sintered
	DN 6 - 100 Platinum with gold/titanium brazing alloy	Hastelloy C-276	Platinum with gold/titanium brazing alloy
<b>Enclosure</b>	Stainless steel AISI 316 L (1.4404)	Stainless steel AISI 316 (1.4404)	Stainless steel AISI 316 L (1.4404)
<b>Terminal box</b>	<i>Standard</i> Fibre glass-reinforced polyamide	Fibre glass-reinforced polyamide	Stainless steel AISI 316 (1.4436)
	<i>High temp.</i> Stainless steel AISI 316 (1.4436)	Stainless steel AISI 316 L (1.4436)	
<b>Fixing studs</b>	Stainless steel AISI 304 (1.4301)		Stainless steel AISI 304 (1.4301)
	Number and size to EN 1092-1:2001		Number and size to EN 1092-1:2001
<b>Mating flanges</b>	EN 1092-1:2001, ANSI B16.5 class 150 and 300 or equivalent		EN 1092-1:2001, ANSI B16.5 class 150 and 300 or equivalent
	<i>Option</i> DN 2-10: ½" pipe connection adapters thread: G½" tapered ISO 7-1 or ½" NPT thread		
<b>Gaskets</b>	<i>Standard</i> EPDM (max. 150°C, PN 40)		EPDM (max. 150°C, PN 40)
	<i>Option</i> Graphite (max. 200°C, PN 40)		Graphite (max. 200°C, PN 40)
	<i>Option</i> PTFE (max. 130°C, PN 25)		PTFE (max. 130°C, PN 25)
<b>Cable entries</b>	4 Pg 13.5		
<b>Enclosure rating</b>	<i>Standard</i> IP 67 to EN 60529 (NEMA 4x) (1 m w.g for 30 min.)		
	<i>Option</i> IP 68 to EN 60529 (NEMA 6) (10 m w.g. cont.)		
<b>Mechanical load (vibration)</b>	18-1000 Hz random, 3.17 G rms in all directions to EN 60068-2-36		18-1000 Hz random in all directions to EN 60068-2-36 Sensor: 3.17 G/Compact Ex-d: 1.14 G
<b>Test pressure</b>	80 bar (2 × PN)	40 bar (2 × PN)	80 bar (2 × PN)
<b>Approvals</b>		3A	EEx ia/ib IIB T4-T6/ DEMKO, No. 97D.121909X EEx de [ia/ib] IIB T4-T6/ DEMKO 94C.115327X
<b>Excitation frequency</b>	DN 2-65: 12.5 Hz DN 80-100: 6.25 Hz	DN 10-65: 12.5 Hz DN 80-100: 6.25 Hz	DN 2-65: 6.25 Hz DN 80-100: 3.125 Hz
<b>Conforms to PED, LVT, EMC</b>	PED - 97/23EC, LVD - 73/23 EEC + amendment 93/68/EEC, EMC - 89/336 EEC		



## 2.2 Sensor MAG 1100 FOOD

	MAG 1100 FOOD	MAG 1100 FOOD PFA
		
<b>Type</b>	Hygienic sensor	
<b>Nominal size</b> <i>mm</i>	DN 10, 15, 25, 40, 50, 65, 80, 100	
<b>Process connection</b>	Hygienic adapters available for: ◆ Direct welding into dairy pipe ◆ Clamp fitting ◆ Threaded fitting	
<b>Operating pressure</b>	DN 10-65: 40 bar, DN 80: 37.5 bar, DN 100: 30 bar	20 bar
<i>Vacuum</i>	$1 \times 10^{-6}$ bar	0.02 bar
<b>Temperature of medium</b>	-20°C to +150°C	-30°C to +130°C
	Suitable for steam sterilization	Suitable for steam sterilization at 150°C
<b>Temperature shock</b>	(Duration > 1 min.): DN 10, 15, 25      Max. $\Delta T \leq 15^\circ\text{C}/\text{min.}$ DN 40, 50, 65      Max. $\Delta T \leq 10^\circ\text{C}/\text{min.}$ DN 80, 100      Max. $\Delta T \leq 5^\circ\text{C}/\text{min.}$ (Duration $\leq 1$ min., followed by 10 min. rest): DN 10, 15, 25      Max. $\Delta T \leq 80^\circ\text{C}$ DN 40, 50, 65      Max. $\Delta T \leq 70^\circ\text{C}$ DN 80, 100      Max. $\Delta T \leq 60^\circ\text{C}$	Max. $\pm 100^\circ\text{C}$ momentarily
<b>Ambient temperature</b>	Remote transmitter: -40°C to +100°C Compact transmitter: -20°C to +50°C	Remote transmitter: -40°C to +100°C Compact transmitter: -20°C to +50°C
<b>Liner</b>	Aluminium oxide $\text{Al}_2\text{O}_3$ (ceramic)	Reinforced PFA (Teflon)
<b>Electrodes</b>	Platinum with gold/titanium brazing alloy	Hastelloy C-276
<b>Enclosure</b>	Stainless steel AISI 316 L (1.4404)	Stainless steel AISI 316 L (1.4404)
<b>Terminal box</b> <i>Standard</i>	Fibre glass-reinforced polyamide	Fibre glass-reinforced polyamide
<i>(not compact)</i> <i>Option</i>	Stainless steel AISI 316 (1.4436)	Stainless steel AISI 316 (1.4436)
<b>Cable entries</b>	4 Pg 13.5	4 Pg 13.5
<b>Enclosure rating</b> <i>Standard</i>	IP 67 to EN 60529 (NEMA 4x) (1 m w.g for 30 min.)	IP 67 to EN 60529 (NEMA 4x) (1 m w.g for 30 min.)
<i>Option</i>	IP 68 to EN 60529 (NEMA 6) (10 m w.g. cont.)	IP 68 to EN 60529 (NEMA 6) (10 m w.g. cont.)
<b>Mechanical load (vibration)</b>	18-1000 Hz random, 3.17 G rms in all directions to EN 60068-2-36	18-1000 Hz random, 3.17 G rms in all directions to EN 60068-2-36
<b>Test pressure</b>	80 bar (2 × PN)	40 bar (2 × PN)
<b>Approvals</b>	3A, EHEDG	3A
<b>Excitation frequency</b>	DN 10-65: 12.5 Hz DN 80-100: 6.25 Hz	DN 10-65: 12.5 Hz DN 80-100: 6.25 Hz
<b>Conforms to PED, LVT, EMC</b>	PED - 97/23EC, LVD - 73/23 EEC + amendment 93/68/EEC, EMC - 89/336 EEX	




Accessories  
MAG 1100 FOOD

Adapter	Stainless steel AISI 316	Pressure	
<b>Pipe connection/ Operating pressure</b>	<b>Adapter for direct welding into dairy pipe:</b> <i>Tri-Clover</i> ISO 2037, DIN 11850, SMS 3008, BS 4825-1		
	DN 10, 15, 25, 40, 50, 65, 80	PN 40	
	DN 100	PN 25	
	<b>Clamp adapter:</b> <i>Tri-Clamp</i> ISO 2852, DIN 32676, SMS 3016, BS 4825-3		
	DN 10, 15, 25, 40, 50	PN 16	
	DN 65, 80, 100	PN 10	
<b>Thread adapter:</b> DIN 11851:	DN 10, 15, 25, 40	PN 40	
	DN 50, 65, 80, 100	PN 25	
	ISO 2853, SS 3351, BS 4825-4:	DN 10, 15, 25, 40, 50, 65, 80	PN 16
	SMS 1145:	DN 25, 40, 50, 65, 80	PN 6
<b>Gasket</b> <i>Standard</i>	EPDM (-20 °C to 150 °C)		
	<i>Option</i> NBR (-20 °C to 100 °C)		
<b>Clamp</b>	Stainless steel AISI 304, ISO 2852		

**Note**

When combined sensor and adapter, the working pressure is the lower rated of the pair.

## 2.3 Sensor MAG 3100, MAG 3100 Ex and MAG 3100 W




	MAG 3100	MAG 3100 Ex / Ex-d	MAG 3100 W
			
<b>Type</b>	Sensor with flanges	Sensor with flanges	Sensor with flanges
<b>Nominal size</b> <i>mm</i>	DN 15-2000	DN 15-2000 / 15-300	DN 25-1200
<b>Temperature of medium</b>		Temperature classification	
<b>Liner:</b>		T3 + T4	T5 T6
Neoprene (standard)	0 to 70°C	0 to 70°C	0 to 70°C
EPDM <sup>1)</sup>	-10 to 95°C	-10 to 95°C	-10 to 95°C
Linatex <sup>®</sup> rubber	-40 to 70°C <sup>2)</sup>	-20 to 70°C	-20 to 70°C
Ebonite <sup>1)</sup>	0 to 95°C	0 to 95°C	0 to 75°C
PTFE	-20 to 100°C	-20 to 100°C	-20 to 75°C
PTFE high temperature	-20 to 180°C ( <i>remote only</i> )		
<b>Ambient temperature</b>			
Remote transmitter	-40°C to 100°C	-20°C to 50°C	-40°C to 100°C
Compact transmitter	-20°C to 50°C	-20°C to 50°C	-20°C to 50°C
<b>Operating pressure<sup>3)</sup> [abs.bar]</b>			
<b>Liner:</b>			
Neoprene	0.01 to 100 bar	0.01 to 100 bar	0.01 to 40 bar
EPDM	0.01 to 40 bar	0.01 to 40 bar	0.01 to 40 bar
Linatex <sup>®</sup>	0.01 to 40 bar	0.01 to 40 bar	
Ebonite	0.01 to 100 bar	0.01 to 100 bar	
<b>PTFE teflon:</b>			
DN 15 to 600	Max. 100°C: 0.3 to 50 bar	0.3 to 40 bar	
DN 15 to 300	Max. 180°C: 0.6 to 50 bar		
<b>Excitation frequency</b>	DN 15 - 65: 12.5 Hz	DN 15 - 65: 6.25 Hz	All sizes 3.125 Hz
	DN 80 - 150: 6.25 Hz	DN 80/100: 3.125 Hz	
	DN 200 - 1200: 3.125 Hz	DN 125 - 300: 1.5625 Hz	
	DN 1400 - 2000: 1.5625 Hz	DN 350 - 1200: 3.125 Hz	
<b>Enclosure rating</b> <i>Standard</i>	IP 67 to EN 60529 (NEMA 4x) (1 m w.g for 30 min.)		
<i>Option</i>	IP 68 to EN 60529 (NEMA 6) (10 m w.g. cont.)		
<b>Cable entries</b>	4 Pg 13.5		
<b>Mechanical load</b>	18-1000 Hz random, 3.17 G rms in all directions to EN 60068-2-36		
<b>Test pressure</b>	1.5 × PN		
<b>Conforms to PED, LVT, EMC</b>	PED - 97/23EC, LVD - 73/23 EEC + amendment 93/68/EEC, EMC - 89/336 EEX		

1) With WRAS drinking water approval, approved to BS 6920 by WRC (Water Research Council, UK)

2) For temperature below -20°C AISI 304 or 316 flanges must be used

3) Maximum operating pressure decreases with increasing operating temperature and with stainless steel flanges

## 2.3 Sensor MAG 3100, MAG 3100 Ex and MAG 3100 W (continued)

		MAG 3100	MAG 3100 Ex / Ex-d	MAG 3100 W	
					
<b>Flanges</b> EN 1092-1:2001 <sup>1)</sup> Raised face	<i>Standard</i>	DN 15-50: PN 40		DN 25-50: PN 40	
		DN 65-150: PN 16		DN 65-150: PN 16	
		DN 200-1000: PN 10		DN 200-1200: PN 10	
		DN 1100 -2000: PN 6			
	<i>Option</i>	DN 65-1000: PN 6		DN 200-600: PN 16	
		DN 1200-2000: PN 10			
		DN 200-2000: PN 16			
		DN 200-600: PN 25			
		DN 65-600: PN 40			
		DN 50-400 PN 63			
		DN 25-350 PN 100			
	ANSI B 16.5 (-BS 1560)		3/4"-24": Class 150 (20 bar)		3/4"-24": Class 150 (20 bar)
			3/4"-24": Class 300 (50 bar)		
AS 2129		3/4"-48": Table D (7 bar) / E (14 bar)			
AS 4087		Class 14 (DN 50 - 1200, 14 bar)			
		Class 21 (DN 50 - 600, 21 bar)			
		Class 35 (DN 50 - 600, 35 bar)			
AWWA C-207		28"-78": Class D (10 bar)		28"-48": Class D (10 bar)	
<b>Electrodes</b>	<i>Standard</i>	AISI 316 Ti (1.4571)		AISI 316 Ti (1.4571)	
	<i>Option</i>	Hastelloy C-276, Platinum / Iridium, Titanium, AISI 316 Ti Ceramic Coated, Tantalum			
<b>PE - electrodes</b>	<i>Standard</i>	As measuring electrodes (except PTFE)		AISI 316 Ti (1.4571)	
<b>Measuring pipe</b>	<i>Standard</i>	AISI 304 (1.4301)		AISI 304 (1.4301)	
	<i>Option</i>	AISI 316 L (1.4436)			
<b>Flange and housing material</b>	<i>Standard</i>	Carbon steel Corrosion-resistant two-component coating (min. 150 µm)		Carbon steel Corrosion-resistant two-component coating (min. 150 µm)	
	<i>Option</i>	AISI 304 (1.4301) flanges and carbon steel housing. Coating as above			
	<i>Option</i>	AISI 316 L (1.4404) flanges and housing			
<b>Colour</b>		Siemens 700 light basic		Siemens 700 light basic	
<b>Ex-approval</b>	<i>Remote</i>	DN 15-300 EEx d [ia] [ib] IIB T4-T6			
		DN 350-2000 EEx e ia IIC T3-T6			
	<i>Compact</i>	EEx d e [ia] ia IIB T6			
		MAG 6000 I Ex-d			
<b>Conforms to PED, LVT, EMC</b>		PED - 97/23EC, LVD - 73/23 EEC + amendment 93/68/EEC, EMC - 89/336 EEX			

<sup>1)</sup> EN 1092-1, DIN 2501 & BS 4504 have the same mating dimensions

## 2.4 Sensor MAG 5100 W


			
<b>Type</b>	Sensor with flanges		
<b>Design</b>	Straight	Coned 1 DN reduction	Straight
<b>Nominal size</b> mm	25-40	50-300	350-1200
<b>Liner</b>	Hard elastomer (hard rubber) <sup>3)</sup>	Composite elastomer (hard & soft rubber) <sup>3)</sup>	Hard elastomer (hard rubber) <sup>3)</sup>
<b>Liner approvals</b>	WRc	WRc	WRc
<b>Medium temperature</b>	-5 to 70°C <sup>1)</sup>		
<b>Ambient temperature</b>			
Remote transmitter	-40 to 100°C		
Compact transmitter	-20 to 50°C		
<b>Operating pressure</b>	0.01 to 40 bar	0.03 to 20 bar	0.01 to 16 bar
<b>Excitation frequency</b>	12.5 Hz	50-65 mm: 12.5 Hz 80-150 mm: 6.25 Hz 200-300 mm: 3.125 Hz	3.125 Hz
<b>Enclosure rating</b> <i>Standard</i>	IP 67 to EN 60529 1 m w.g. for 30 minutes		
<i>Option</i>	IP 68 to EN 60529 10 m w.g. continuously		
<b>Cable entries</b>	4 Pg 13.5		
<b>Mechanical load</b>	18-1000 Hz random, 3.17 G rms in all directions to EN 60068-2-36		
<b>Test pressure</b>	1.5 × nominal pressure		
<b>Flanges</b>			
EN 1092-1 <i>Standard</i>	PN 40	50-150 mm: PN 16 200-300 mm: PN 10	PN 10
<i>Option</i>		200-300 mm: PN 16	PN 16
ANSI B16.5 <i>Standard</i>	Class 150 lb	Class 150 lb	14"-24": Class 150 lb
AWWA C-207 <i>Standard</i>			28"-48": Class D
<b>Pressure drop at 3 m/sec.</b>	As straight pipe	Max. 25 mbar	As straight pipe
<b>Electrodes</b>	AISI 316 Ti (1.4571)		
<b>PE/grounding electrodes</b> <i>Standard</i>	AISI 316 Ti (1.4571)		
<b>Measuring pipe/meter body</b>	AISI 304 (1.4301)	Composite elastomer	AISI 304 (1.4301)
<b>Flanges</b>	Carbon steel		
<b>Housing</b>	Carbon steel		
<b>Surface finish</b>	Two component epoxy min. 150 microns	Polyester powder coat min. 100 microns	Two component epoxy min. 150 microns
<b>Colour</b>	Siemens 700 light basic		
<b>Approvals</b> <i>Conforms to</i>	PED - 97/23EC, LVD - 73/23 EEC + amendment 93/68/EEC, EMC - 89/336 EEX <sup>2)</sup>		

1) Peak temperature up to +90°C (194°F) in periods &lt; 1 hour

2) For sizes greater than 600 mm PED conformity is available as a cost added option, the basic unit will only carry the LVD (Low Voltage Directive) and EMC approval.


3) Nitrile, NBR

## 2.5.1 Transmitter MAG 5000 (DN 2 to DN 1200)

		<b>Accuracy 0.5%</b>
<b>Current output</b>		
Current	0-20 mA, 4-20 mA or 4-20 mA + alarm	
Load	< 800 ohm	
Time constant	0.1-30 s adjustable	
<b>Digital output</b>		
Frequency	0-10 kHz, 50% duty cycle	
Time constant	0.1-30 s adjustable	
Active	24 V DC, 30 mA, $1\text{ K}\Omega \leq R_{\text{load}} \leq 10\text{ K}\Omega$ , short-circuit-protected	
Passive	3-30 V DC, max. 110 mA, $200\ \Omega \leq R_{\text{load}} \leq 10\text{ K}\Omega$	
<b>Relay</b>		
Time constant	Changeover relay, time constant same as current time constant	
Load	42 V AC/2 A, 24 V DC/1A	
<b>Digital input</b>		
Activation time	50 ms	
Current	$I_{11\text{ V DC}} = 2.5\text{ mA}$ , $I_{30\text{ V DC}} = 7\text{ mA}$	
<b>Functions</b>		
Flow rate, 2 totalizers, low flow cut-off, empty pipe cut-off <sup>1)</sup> , flow direction, error system, operating time, uni/bidirectional flow, limit switches, pulse output, control for cleaning unit		
<b>Galvanic isolation</b>		
All inputs and outputs are galvanically isolated		
<b>Cut-off</b>		
Low flow	0-9.9% of maximum flow	
Empty pipe	Detection of empty pipe, special cable required in separate mounted installation	
<b>Totalizer</b>		
Two eight-digit counters for forward, net or reverse flow		
<b>Display</b>		
Background illumination with alphanumeric text, 3 x 20 characters to indicate flow rate, totalized values, settings and faults		
Reverse flow indicated by negative sign		
Time constant	Time constant as current output time constant	
<b>Zero point adjustment</b>		
Automatic		
<b>Electrode input impedance</b>		
$> 1 \times 10^{14}\ \Omega$		
<b>Excitation frequency</b>		
Sensor size depending pulsating DC current (125 mA)		
<b>Ambient temperature</b>		
Display version during operation: -20 to +50°C		
Blind version during operation: -20 to +60°C		
During storage: -40 to +70°C (RH max. 95%)		
<b>Custody transfer approval</b>		
MAG 5000 CT	PTB (cold water)	
	6.221	
	99.19	
<b>Communication</b>		
Standard	Without serial communication	
Optional	HART®	
<b>Compact</b>		
Enclosure material	Fibre glass-reinforced polyamide	
Enclosure rating	IP 67 to EN 60529 and DIN 40050 (1 m w.g. for 30 minutes)	
Mechanical load	18-1000 Hz random, 3.17 G rms in all directions to EN 60068-2-36	
<b>19" insert</b>		
Enclosure material	Standard 19" insert of aluminium/steel (DIN 41494)	
	Width: 21 TE	
	Height: 3 HE	
Enclosure rating	IP 20 to EN 60529 and DIN 40050	
Mechanical load	Version: 1 G, 1-800 Hz sinusoidal in all directions to EN 60068-2-36	
<b>EMC performance</b>		
Emission: EN 50081-1 (Light industry)		
Immunity: EN 50082-2 (Industry)		
<b>Supply voltage</b>		
115-230 V AC +10% to -15%, 50-60 Hz		
11-30 V DC or 11-24 V AC		
<b>Power consumption</b>		
230 V AC: 17 VA		
24 V DC: 9 W, $I_N = 380\text{ mA}$ , $I_{ST} = 8\text{ A}$ (30 ms)		
12 V DC: 11 W, $I_N = 920\text{ mA}$ , $I_{ST} = 4\text{ A}$ (250 ms)		

1) Not remote Ex, not DN 2, 3

## 2.5.2 Transmitter MAG 6000

		<b>Accuracy 0.25%</b>	
<b>Current output</b>			
Current	0-20 mA, 4-20 mA or 4-20 mA + alarm		
Load	< 800 ohm		
Time constant	0.1-30 s adjustable		
<b>Digital output</b>			
Frequency	0-10 kHz, 50% duty cycle		
Time constant	0.1-30 s adjustable		
Active	24 V DC, 30 mA, $1\text{ K}\Omega \leq R_{\text{load}} \leq 10\text{ K}\Omega$ , short-circuit-protected		
Passive	3-30 V DC, max. 110 mA, $200\ \Omega \leq R_{\text{load}} \leq 10\text{ K}\Omega$		
<b>Relay</b>			
Time constant	Changeover relay, time constant same as current time constant		
Load	42 V AC/2 A, 24 V DC/1A		
<b>Digital input</b>		11-30 V DC, $R_i = 4.4\text{ K}\Omega$	
Activation time	50 ms		
Current	$I_{11\text{ V DC}} = 2.5\text{ mA}$ , $I_{30\text{ V DC}} = 7\text{ mA}$		
<b>Functions</b>		Flow rate, 2 totalizers, low flow cut-off, empty pipe cut-off <sup>1)</sup> , flow direction, error system, operating time, uni/bidirectional flow, limit switches, pulse output, control for cleaning unit and batch	
<b>Galvanic isolation</b>		All inputs and outputs are galvanically isolated	
<b>Cut-off</b>			
Low flow	0-9.9% of maximum flow		
Empty pipe	Detection of empty pipe, special cable required in separate mounted installation		
<b>Totalizer</b>		Two eight-digit counters for forward, net or reverse flow	
<b>Display</b>		Background illumination with alphanumerical text, 3 x 20 characters to indicate flow rate, totalized values, settings and faults	
	Reverse flow indicated by negative sign		
Time constant	Time constant as current output time constant		
<b>Zero point adjustment</b>		Automatic	
<b>Electrode input impedance</b>		$> 1 \times 10^{14}\ \Omega$	
<b>Excitation frequency</b>		Sensor size depending pulsating DC current (125 mA)	
<b>Ambient temperature</b>		Display version during operation: -20 to +50°C	
		Blind version during operation: -20 to +60°C	
		During storage: -40 to +70°C (RH max. 95%)	
<b>Custody transfer approval</b>			
MAG 6000 CT	PTB (cold water)	DANAK OIML R75 (hot water)	DANAK OIML R117 (cold water/milk, beer etc.)
	6.221		
	99.19		
<b>Communication</b>			
Standard	Prepared for client mounted add-on modules		
Add-on	HART, Profibus PA & DP, Modbus RTU, CANopen, DeviceNet		
<b>Compact</b>			
Enclosure material	Fibre glass-reinforced polyamide		
Enclosure rating	IP 67 to EN 60529 and DIN 40050 (1 m w.g. for 30 minutes)		
Mechanical load	18-1000 Hz random, 3.17 G rms in all directions to EN 60068-2-36		
<b>19" insert</b>			
Enclosure material	Standard 19" insert of aluminium/steel (DIN 41494)		
	Width: 21 TE		
	Height: 3 HE		
Enclosure rating	IP 20 to EN 60529 and DIN 40050		
Mechanical load	Version: 1 G, 1-800 Hz sinusoidal in all directions to EN 60068-2-36		
<b>EMC performance</b>		Emission: EN 50081-1 (Light industry)	
		Immunity: EN 50082-2 (Industry)	
<b>Supply voltage</b>		115-230 V AC +10% to -15%, 50-60 Hz	
		11-30 V DC or 11-24 V AC	
<b>Power consumption</b>		230 V AC: 17 VA	
		24 V DC: 9 W, $I_N = 380\text{ mA}$ , $I_{ST} = 8\text{ A}$ (30 ms)	
		12 V DC: 11 W, $I_N = 920\text{ mA}$ , $I_{ST} = 4\text{ A}$ (250 ms)	

1) Not remote Ex, not DN 2, 3

### 2.5.3 Safety barrier (ia/ib) DN ≤ 300



<b>Application</b>	As combined unit with MAG 6000 only and MAG 1100 Ex/3100 Ex in the size range DN 6-300		
<b>Ex approval</b>	[EEEx ia/ib] IIB		
<b>Cable parameter</b>	Group	Capacity in $\mu\text{F}$	Inductance in mH
	Electrode cable	≤ 31	≤ 80
	Coil cable	≤ 0.5	≤ 8
<b>Ambient temperature</b>	During operation: -20 to +50°C		
	During storage: -20 to +70°C		
<b>19" insert</b>	Enclosure material	Standard 19" insert in aluminium/steel (DIN 41494)	
		Width: 21 TE	
		Height: 3 HE	
	Enclosure rating	IP 20 to EN 60529 and DIN 40050	
Mechanical load	1 G, 1-800 Hz sinusoidal in all directions to EN 60068-2-36		
<b>EMC performance</b>	Emission	EN 50081-1 (Light industry)	
	Immunity	EN 50082-2 (Industry)	

### 2.5.4 Safety barrier (ia) DN ≥ 350



<b>Application</b>	For use with MAG 5000/6000 19 insert and MAG 3100 Ex in the size range DN 350-2000		
<b>Ex approval</b>	[EEEx ia] IIC		
<b>Cable parameter</b>	Group	Capacity in $\mu\text{F}$	Inductance in mH
	IIC	≤ 4.1	≤ 1.5
	IIB	≤ 45	≤ 87
	IIA	≤ 45	≤ 87
<b>Ambient temperature</b>	During operation: -20 to +50°C		
	During storage: -20 to +70°C		
<b>19" insert</b>	Enclosure material	Standard 19" insert in aluminium/steel (DIN 41494)	
		Width: 21 TE	
		Height: 3 HE	
	Enclosure rating	IP 20 to EN 60529 and DIN 40050	
Mechanical load	1 G, 1-800 Hz sinusoidal in all directions to EN 60068-2-36		
<b>EMC performance</b>	Emission	EN 50081-1 (Light industry)	
	Immunity	EN 50082-2 (Industry)	

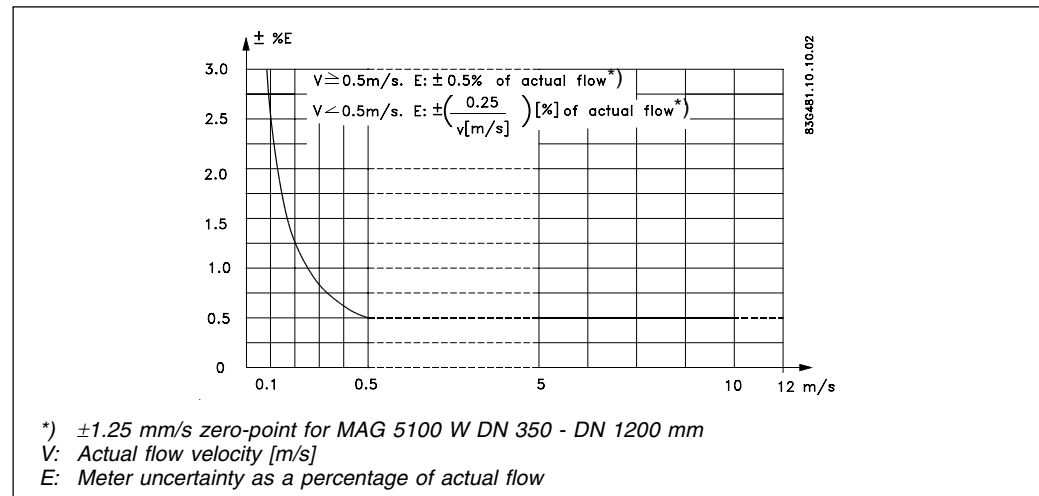
### 2.5.5 Cleaning unit



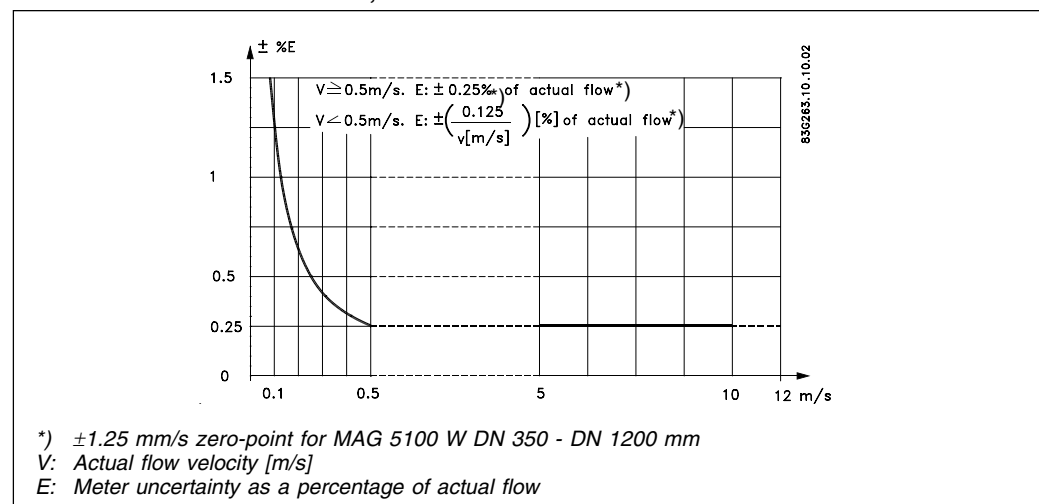
<b>Application</b>	For use together with MAG 5000 and 6000 19" insert to clean the electrodes on MAG 1100, MAG 3100 or MAG 5100 W. <b>NB</b> Must <b>not</b> be used with intrinsically safe systems		
<b>Cleaning voltage (unloaded)</b>	AC cleaning	60 V AC	
	DC cleaning	30 V DC	
<b>Cleaning period</b>	60 sec. + 60 sec. pause period		
<b>Relay</b>	Switch relay activated when cleaning is in progress		
	Load	42 V/2 A	
<b>Operation</b>	Automatic	Yes	
	Manual	No	
<b>Indicator lamps</b>	LEDs: "ON" and "CLEANING"		
<b>Supply voltage and power consumption</b>	115-230 V AC +10% to -15%, 50-60 Hz, 7 VA cleaning, 5 VA stand by		
<b>Ambient temperature</b>	During operation: -20 to +50°C		
	During storage: -20 to +70°C		
<b>19" insert</b>	Enclosure material	Standard 19" insert in aluminium/steel (DIN 41494)	
		Width: 21 TE	
		Height: 3 HE	
	Enclosure rating	IP 20 to EN 60529 and DIN 40050	
Mechanical load	1 G, 1-800 Hz sinusoidal in all directions to EN 60068-2-36		

## 2.6 Meter uncertainty

### MAG 5000 or MAG 6000 used with MAG 3100 W or MAG 1100 PFA



### MAG 6000 used with MAG 3100, MAG 1100 Ceramic or MAG 5100 W



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

Temperature of medium	20°C $\pm$ 5 K
Ambient temperature	20°C $\pm$ 5 K
Supply voltage	Un $\pm$ 1%
Warming-up time	30 minutes
Incorporation in pipe section	Inlet section 10×DN (DN $\leq$ 1200), 5×DN (DN > 1200) Outlet section 5×DN (DN $\leq$ 1200), 3×DN (DN > 1200)
Flow conditions	Fully developed flow profile

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

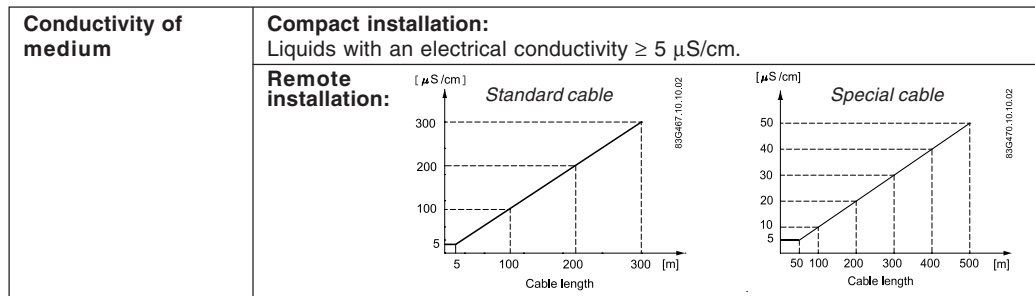
Current output	As pulse output $\pm$ (0.1% of actual flow +0.05% FSO)
Effect of ambient temperature	Display/frequency/pulse output: < $\pm$ 0.003% / K act. Current output: < $\pm$ 0.005% / K act.
Effect of supply voltage	< 0.005% of measuring value on 1% change
Repeatability	$\pm$ 0.1% of actual flow for $V \geq 0.5$ m/s Conductivity $\geq 10$ $\mu$ S/cm <sup>3</sup>



2.7  
Output characteristics  
MAG 5000 and MAG 6000

Output characteristics 0-20 mA	Bidirectional mode		Unidirectional mode		
4-20 mA					
Frequency					
Pulse output					
Relay	Power down		Active		
Error relay	No error		Error		
Limit switch or direction switch	1 set point			2 set points	
	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 Sensor cables and conductivity of medium

**Note**

For detection of empty sensor the min. conductivity must always be  $\geq 20 \mu\text{S/cm}$  and the max. length of electrode cable when remote mounted is 50 metres. Special cable must be used.

For remote mounting in Ex applications special cable cannot be used, empty sensor cannot be detected and the electrical conductivity must be  $\geq 30 \mu\text{S/cm}$ .

For remote mounted CT installations the max. cable length is 200 metres.

For Ex installations with safety barriers, 25 meters of cable can be used in order to obtain  $\pm 0,25\%$ , and 50 meters to obtain  $\pm 0.5\%$ .

**Note**

Empty pipe detection function not available with DN 2, 3 sizes.

### 2.8.2 Minimum accept data for cable

		<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>	0.2 mm <sup>2</sup>
	Screen	Yes	Yes
	Max. capacitance	N.A.	350 pF/m
<b>Max. cable loop resistance</b>	Media temperature: < 100°C	40 Ω	N.A.
	< 200°C	6 Ω	N.A.

### 2.9 HART® communication add-on module

<b>Application</b>	MAG 6000 Optional available as factory mounted in MAG 5000
<b>Communication standard</b>	Bell 202 frequency shift keying (f.s.k.) standard
<b>Communication modes</b>	<ul style="list-style-type: none"> <li>• Single loop mode</li> <li>• Multi-drop mode, 15 slave devices</li> </ul>
<b>Communicator</b>	Rosemount Hand-held communicator type 275

### Cable specification

	<b>Communication mode / Single loop</b>
<b>Q [mm<sup>2</sup>] CU</b>	$\geq 0.2 \text{ mm}^2/\text{AWG } 24$
<b>Screen</b>	Yes (Overall screen)
<b>Loop resistance</b>	<i>Min.</i> 230 Ω
	<i>Max.</i> 800 Ω
<b>Cable capacity</b>	$\leq 400 \text{ pF/m}$
<b>Cable length</b>	1500 m
<b>Twisted pair</b>	Yes

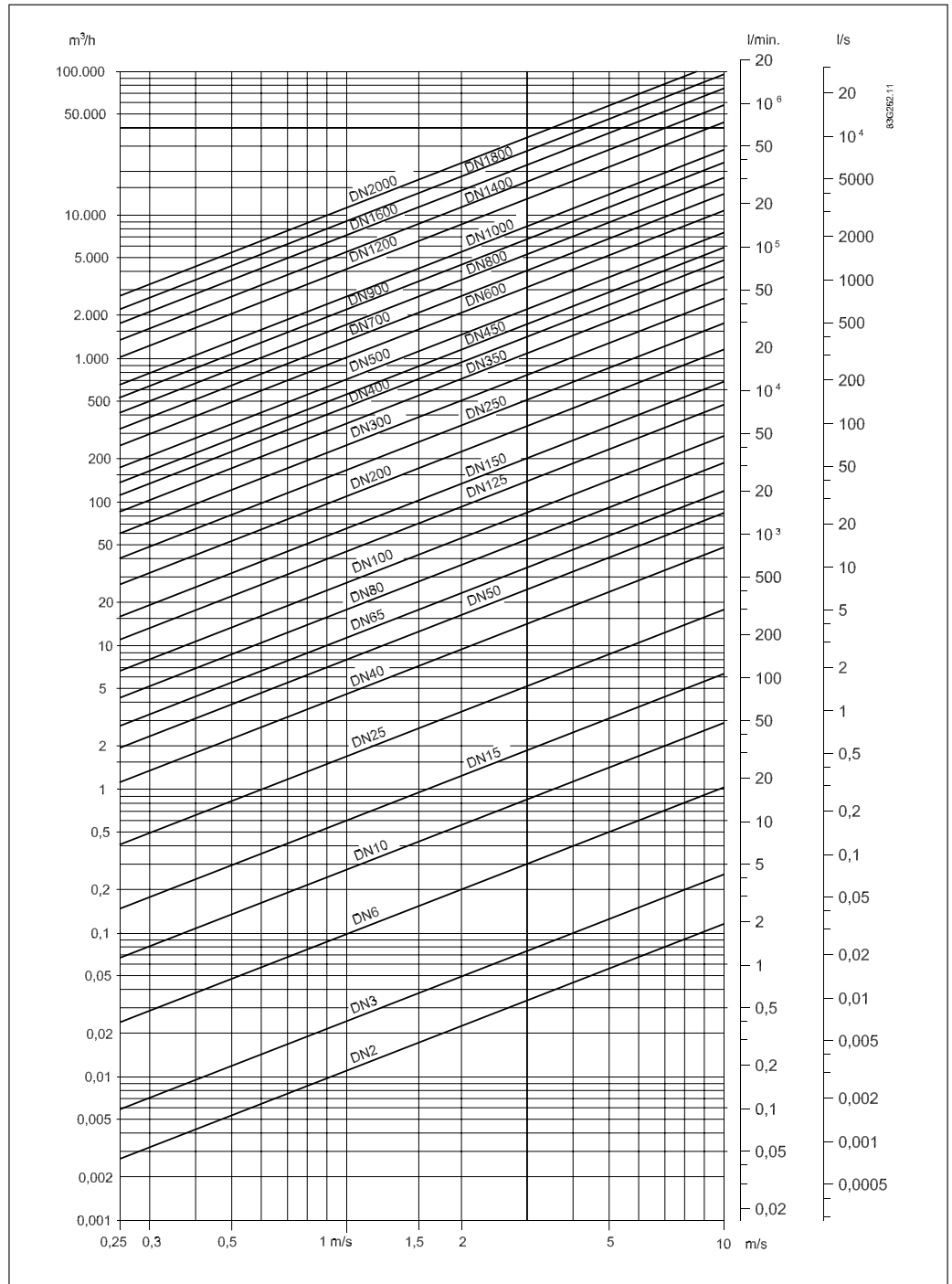
HART® is a registered trademark of the HART Communication Foundation.

### 2.10 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>	0.25 mm <sup>2</sup>
	Screen	Yes	Double
	Color code	Brown, blue, black	Brown, blue, black
	Outside color	Grey	Grey
	Ext. diameter	7.8 mm	8.1 mm
	Conductor	Flexible CU	Flexible CU
	Isolation material	PVC	PVC
<b>Amb. temperature</b>	• Flexible installation	-5 to 70°C	-5 to 70°C
	• Non flexible installation	-30 to 70°C	-30 to 70°C
<b>Cable parameter</b>	Capacity	161.50 pF/m	N.A.
	Inductance	0.583 μH/m	N.A.
	L/R	43.83 μH/Ω	N.A.

3. Project guidance

3.1  
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 is selected so that V lies within the measuring range 1-2 m/s.

Flow velocity calculation formula:

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

### 3.2.1 Minimum conductivity

Applications	Min. conductivity	
<b>Compact/remote</b>	DN 2 & 3	30 $\mu\text{S/cm}$
	DN $\geq$ 6	5 $\mu\text{S/cm}$
<b>With empty pipe detection</b>		20 $\mu\text{S/cm}$
<b>Ex-installations</b> (Remote mounted only)		30 $\mu\text{S/cm}$
<b>District heating systems</b> (Without DC cleaning unit)		250 $\mu\text{S/cm}$

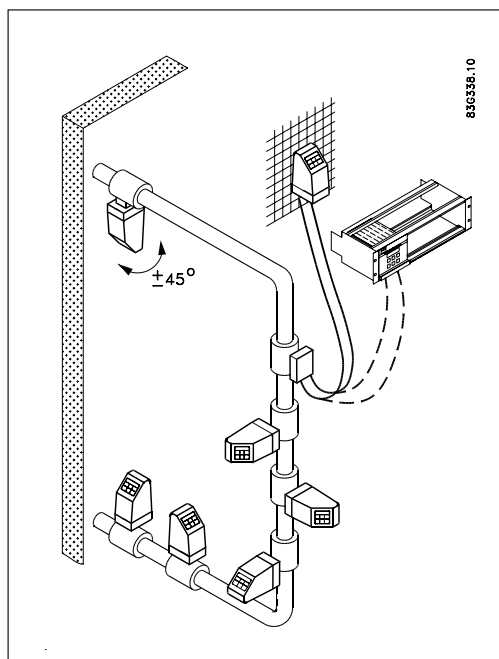
### 3.2.2 Liner selection guide

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, aggressive chemicals
<b>PFA</b>	General purpose, dairy, food and beverage
<b>Neoprene</b>	General purpose, sewage
<b>EPDM</b>	Drinking water, sea water
<b>PTFE</b>	Aggressive chemicals, paper and pulp, high temperature applications
<b>Linatex®</b>	Abrasive media and mining slurries
<b>Ebonite</b>	Drinking water

### 3.2.3 Electrode selection guide

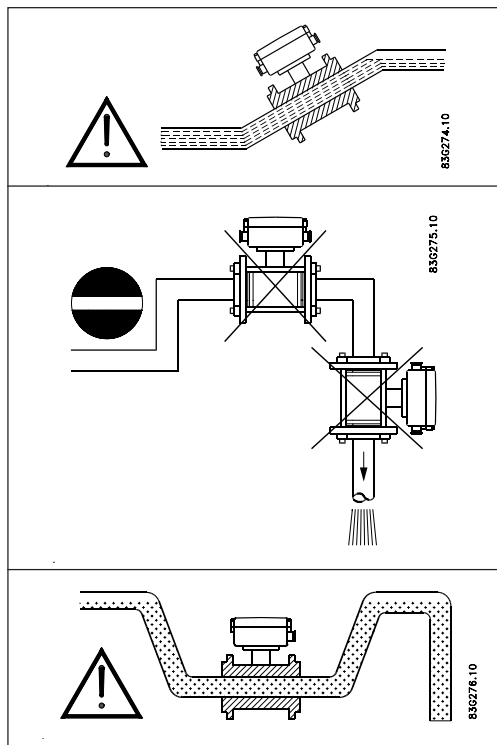
Electrodes	Applications
<b>AISI 316 Ti</b>	General purpose, water, sewage and district heating
<b>AISI 316 Ti Ceramic coated</b>	High content of fibres, paper pulp
<b>Hastelloy C-276</b>	Good chemical properties, sea water
<b>Titanium</b>	Chlorine, chlorite, nitric and chromic acids
	Textile bleaching industry
<b>Tantalum</b>	Almost any acid solution
<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)



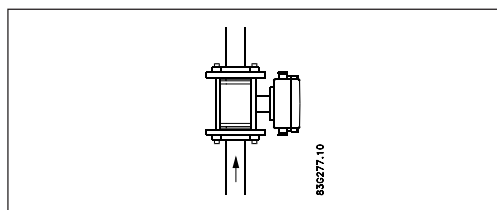
The sensor must always be completely full with liquid.

Therefore avoid:

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

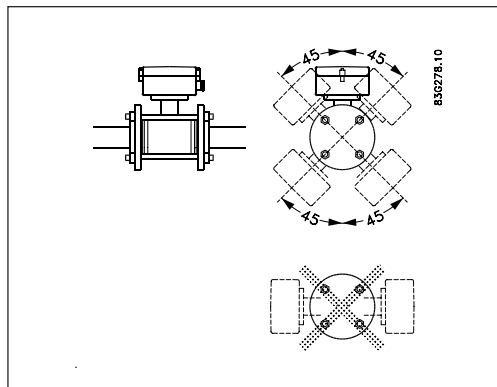
For partially filled pipes or pipes with downward flow and free outlet the flowmeter should be located in a U-tube.

**Installation in vertical pipes**



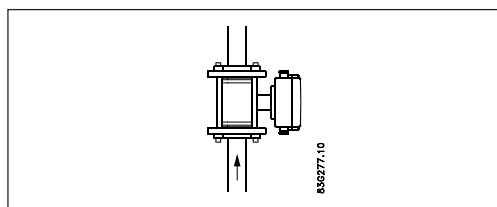
Recommended flow direction: upwards. This minimizes the effect on the measurement of any gas/air bubbles in the liquid.

**Installation in horizontal pipes**



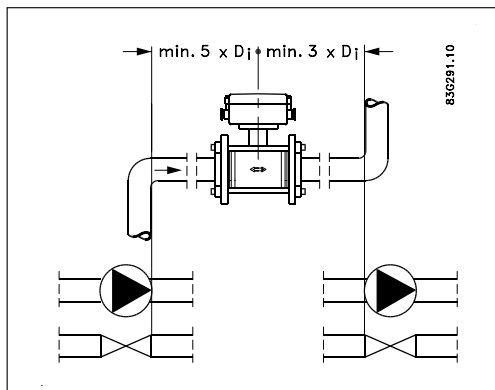
The sensor must be mounted as shown in the upper figure. Do not mount the sensor as shown in the lower figure. This will position the electrodes at the top where there is possibility for air bubbles and at the bottom where there is possibility for mud, sludge, sand etc. If using empty pipe detection,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

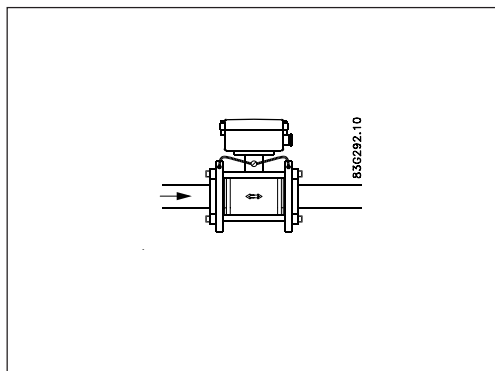
**Inlet and outlet conditions**



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.

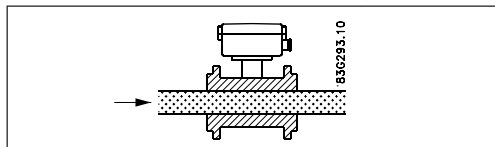
**Potential equalization**



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:

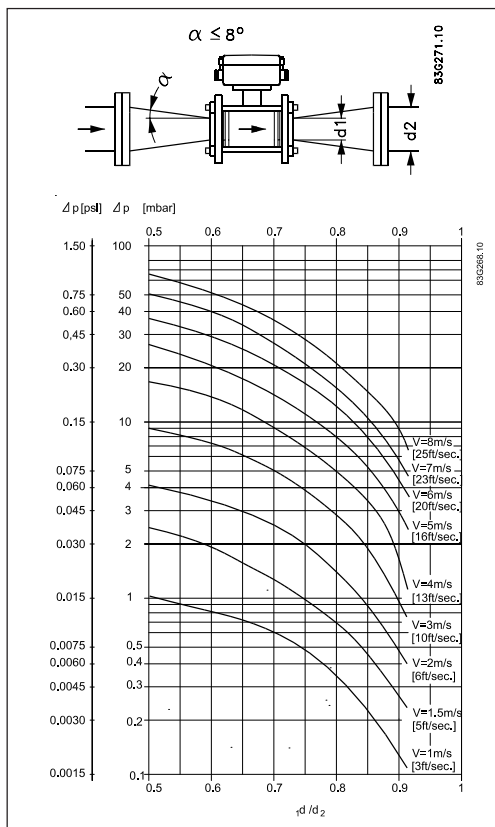
- A. Wire jumper between sensor and adjacent flanges. (MAG 1100 and MAG 3100).
- B. Direct metallic contact between sensor and fittings. (MAG 1100 FOOD).
- C. Built-in earthing electrodes. (MAG 3100 and MAG 3100 W).
- D. Optional earthing/protection flanges/rings. (MAG 1100 and MAG 3100).
- E. Optional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

**Vacuum**



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

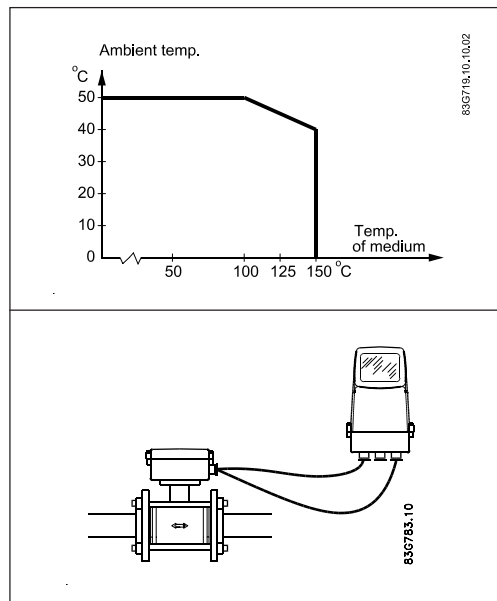
**Installation in large pipes**



The flowmeter can be installed between two reducers (e.g. DIN 28545). Assuming that at 8° the following pressure drop curve applies. The curves are applicable to water.

**Example:**

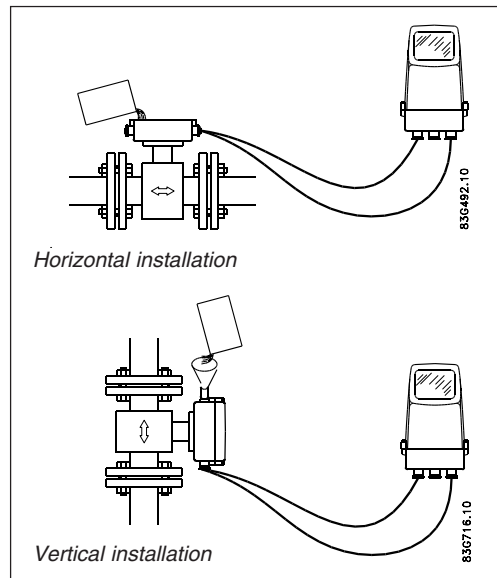
A flow velocity of 3 m/s (V) in a sensor with a diameter reduction from DN 100 to DN 80 ( $d_1/d_2 = 0.8$ ) gives a pressure drop of 2.9 mbar.

**Compact/remote installation**

The sensor and transmitter can be installed either compact or remote.

With **compact** installation the temperature of medium must be according to 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. The gel can be penetrated with test instruments or be removed in case of cable replacement.

**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 we would suggest the following precautions are observed.

The SENSORPROM® unit should be removed from the terminal box on the sensor and relocated in the transmitter remote mounting prior to burying the sensor. (See product manual LS.27.V2.02).

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 IP 68 and suitable coil and electrode cables used prior to burying.

The use of pea gravel at least 300 mm all around the sensor. This provides some drainage and also avoids caking the sensor with earth. It also helps located 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

The cleaning unit **cannot** be used for inflammable or explosive media!

#### Mode of operation

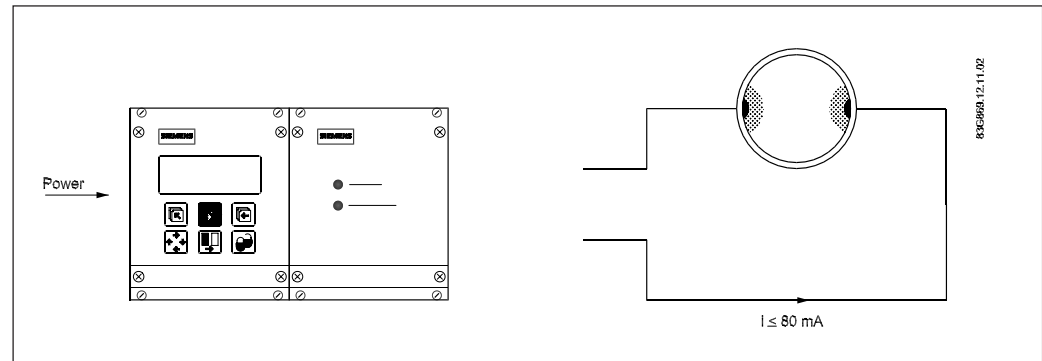
The cleaning unit cleans the electrodes electro-chemically by applying a voltage to the electrodes for approx. 60 sec. While cleaning, the transmitter stores and holds the latest measured flow reading on the display and also the signal outputs. After an additional pausing period of 60 sec. the flowmeter 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 function. It is therefore recommended to select "empty pipe detection" ON when using the cleaning unit.

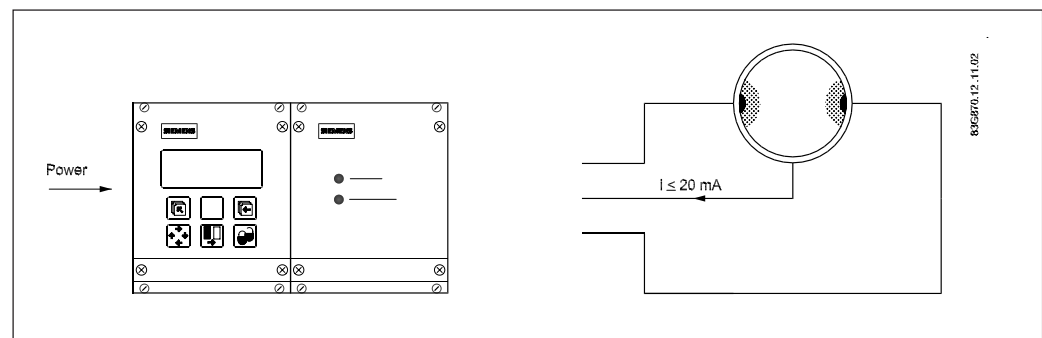
The cleaning sequence can also be controlled manually through the electrical input of the transmitter. Before this is done, ensure that the measuring pipe is full.

#### AC-cleaning



AC-cleaning is used to remove fatty deposits on the electrodes. These fatty deposits are seen in waste water 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  $\mu\text{S}/\text{cm}$ .

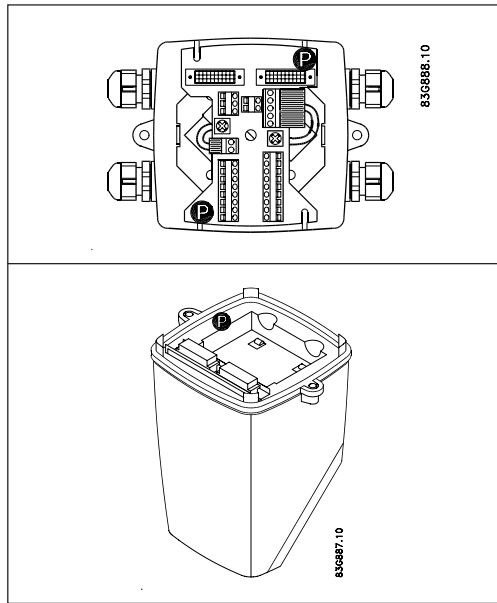
During DC-cleaning, electrolysis takes place where the flow of electrons removes the particle deposits from the electrode area.

#### Note

Do **not** use DC-cleaning on sensors with tantalum electrodes.



**3.5**  
Custody transfer approval

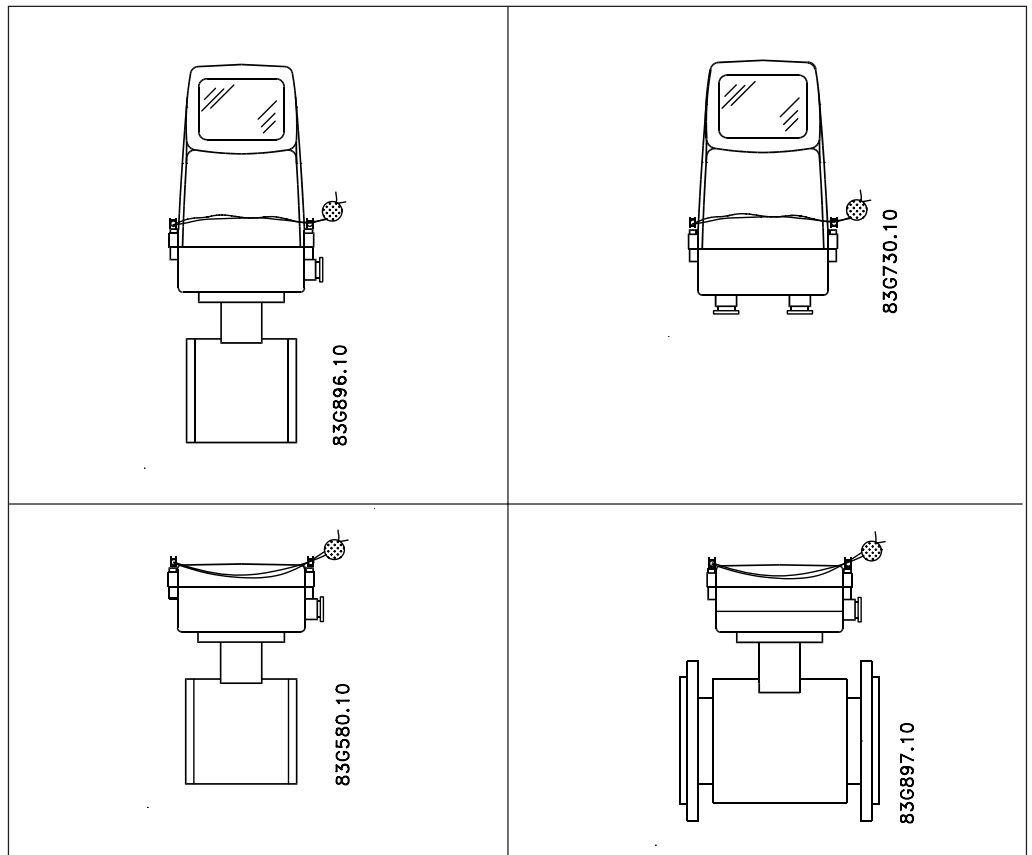


A transmitter can be supplied in a version tested and approved for custody transfer (CT). The internal counter can accordingly be used for charging. This requires verification, sealing and setting of the transmitter together with the sensor for a specific flow range. After sealing the data on the transmitter 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.

**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
300°C	572°F
200°C	392°F
135°C	275°F
100°C	212°F
85°C	185°F

EN 50014

## 3.8 Approvals


**SITRANS F M MAGFLO® sensors carry the following approvals****MAG 1100 Ex for mounting in Ex areas****DN 6 - DN 100**

EEx [ia] [ib] IIB T4...T6,  II 2 (1)(2)  
SIRA 03 ATEX 1423X CE 0518

**Temperature ratings are as follows:**

T4 (max. surface < 135°C) for liquid temperatures lower than 117°C  
T5 (max. surface < 100°C) for liquid temperatures lower than 82°C  
T6 (max. surface < 85°C) for liquid temperatures lower than 67°C  
For an ambient temperature of -20°C to + 50°C

**MAG 3100 Ex for mounting in Ex areas****DN 15 - DN 300**

EEx-d [ia] [ib] IIB T4...T6,  II 2 (1)(2)  
SIRA 03 ATEX 1442X CE 0518

**Temperature ratings are as follows\*):**

T4 (max. surface < 135°C) for liquid temperatures lower than 120°C  
T5 (max. surface < 100°C) for liquid temperatures lower than 87°C  
T6 (max. surface < 85°C) for liquid temperatures lower than 72°C  
For an ambient temperature of -20°C to +50°C

**DN 350 - DN 2000**

EEx e ia IIC T3...T6,  II 2 GD IP 65 T(\*\*) °C  
SIRA 03 ATEX 3339X CE 0518

where (\*) represents the pipeline temperature + 5K for the purposes of the dust approval

**Temperature ratings are as follows\*):**

T3 (max. surface < 200°C) for liquid temperatures lower than 190°C  
T4 (max. surface < 135°C) for liquid temperatures lower than 125°C  
T5 (max. surface < 100°C) for liquid temperatures lower than 90°C  
T6 (max. surface < 85°C) for liquid temperatures lower than 75°C  
For an ambient temperature of -20°C to +40°C

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

For use with **MAG 1100 Ex (all sizes) and MAG 3100 Ex sizes DN 15 - DN 300** for mounting in the safe area

[EEx ia ib] IIB,  II 2 G  
DEMKO 03 ATEX 135255X CE539

For use with **MAG 3100 Ex sizes DN 350 - DN 2000**, for mounting in the safe area

[EEx ia] IIC,  II 2 G  
DEMKO 03 ATEX 135254X CE539

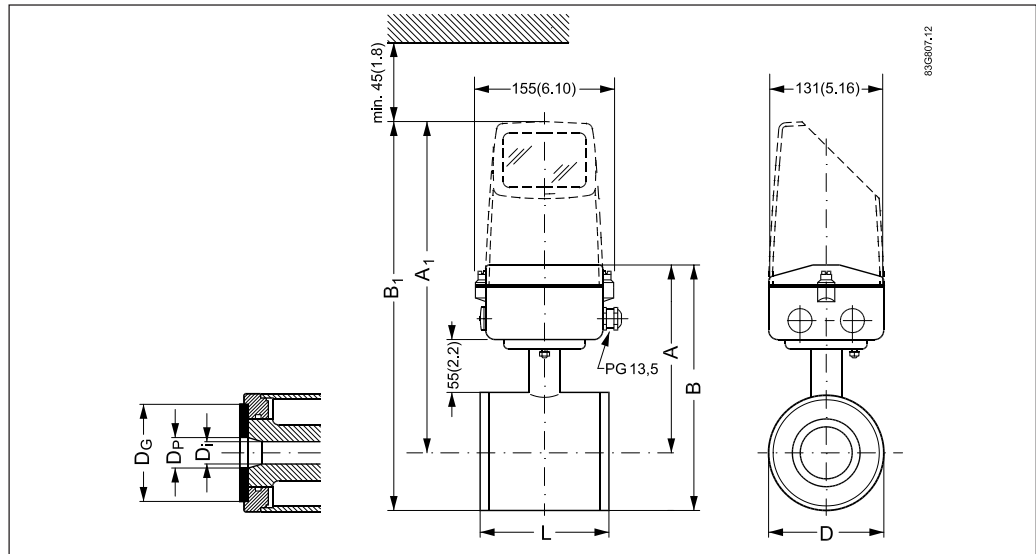
**\*) Note**

Temperature ratings may be limited by the lining selected, see section 4.2.2.

## 4. Dimensions and weight

4.1  
Sensor MAG 1100

## MAG 1100, compact/separate



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> <sup>2)</sup> [mm]	D <sub>i</sub> (PFA) [mm]	D <sub>p</sub> [mm]	D <sub>G</sub> [mm]	Weight <sup>3)</sup> [kg]
2	161	186	314	339	48.3	2	N/A	17.3	34	2.2
3	161	186	314	339	48.3	3	N/A	17.3	34	2.2
6	161	186	314	339	48.3	6	N/A	17.3	34	2.2
10	161	186	314	339	48.3	10	10	13.6	34	2.2
15	161	186	314	339	48.3	15	16	17.3	40	2.2
25	169	201	322	354	63.4	25	26	28.5	56	2.7
40	181	223	334	376	84.0	40	38	43.4	75	3.4
50	189	240	342	393	101.6	50	50	54.5	90	4.2
65	199	259	352	412	120.0	65	66	68.0	112	5.5
80	205	271	358	424	133.0	80	81	82.5	124	7.0
100	218	297	371	450	159.0	100	100	107.1	145	10.0

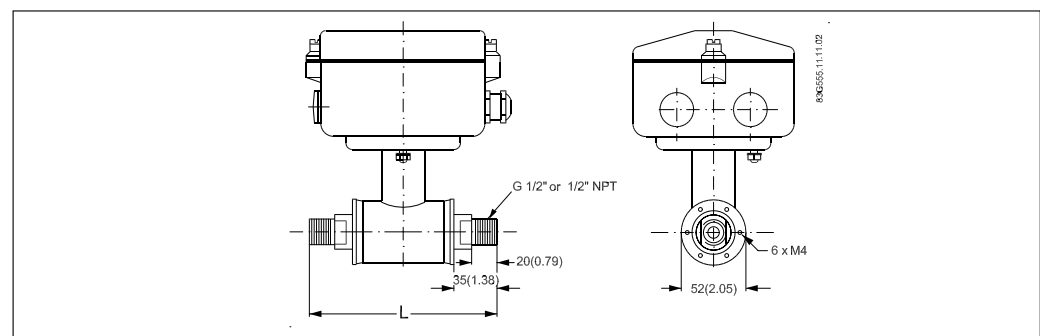
<sup>1)</sup> 13 mm shorter when the AISI terminal box is used. (Ex and high temperature 200°C).

<sup>2)</sup> DN 2-3 Zirconium (ZrO<sub>2</sub>), DN 6-100 Ceramic (Al<sub>2</sub>O<sub>3</sub>)

<sup>3)</sup> With transmitter MAG 5000 or MAG 6000 installed, weight is increased by approx. 0.8 kg.

The total built-in length "L" [mm] before assembling depends on the gasket selected.

DN	EPDM	Graphite	PTFE(Teflon)	Without gasket	Earthing ring
2 - 10	64	66	70	64	77
15	65	66	70	64	77
25	80	81	85	79	92
40	95	96	100	94	107
50	105	106	110	104	117
65	130	131	135	129	142
80	155	156	160	154	167
100	185	186	190	184	197



The MAG 1100 DN 2 to DN 10 are prepared for assembly with the 1/2" pipe connection.

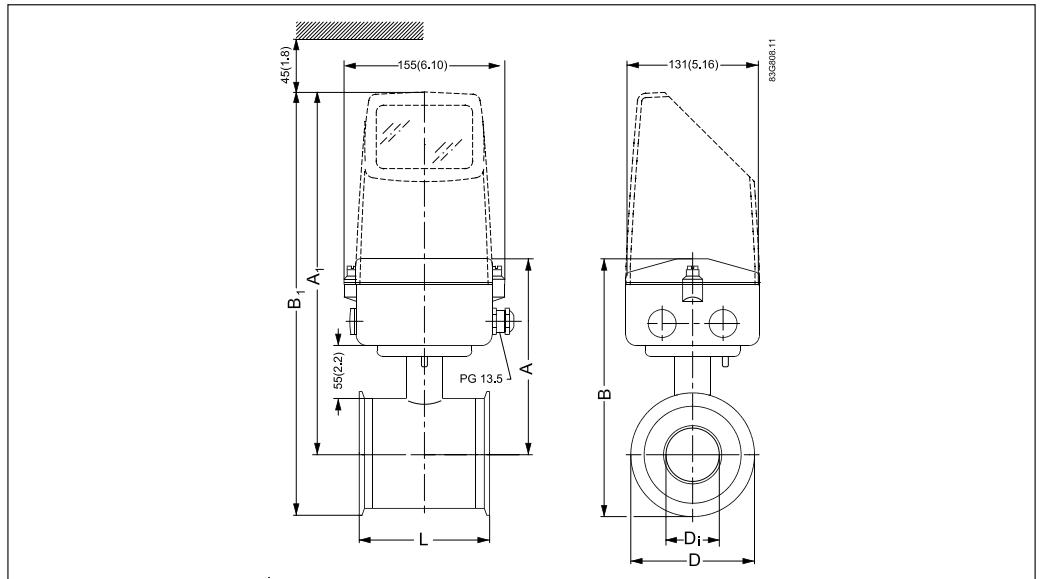
The length "L" varies dependent on the gasket choice:

	Without gasket	EPDM	Graphite	Teflon
L [mm]	150	150	152	156

4.2  
Sensor MAG 1100 FOOD



MAG 1100 FOOD, compact and separate

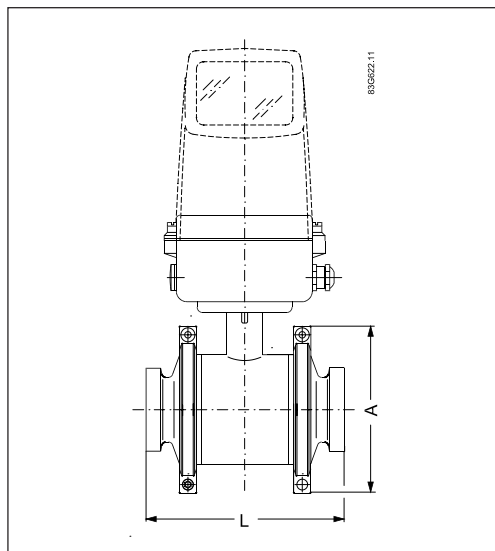


DN	L [mm]	A <sup>1)</sup> [mm]	A <sub>1</sub> [mm]	B <sup>1)</sup> [mm]	B <sub>1</sub> [mm]	D [mm]	D <sub>i</sub> (Al <sub>2</sub> O <sub>3</sub> ) [mm]	D <sub>i</sub> (PFA) [mm]	Weight <sup>2)</sup> [kg]
10	64	161	305	193.0	346.0	64.0	10	10	2.2
15	64	161	314	193.0	346.0	64.0	15	16	2.2
25	79	169	322	207.8	360.8	77.5	25	26	2.7
40	94	181	334	226.5	379.5	91.0	40	38	3.4
50	104	189	342	248.5	401.5	119.0	50	50	4.2
65	131	199	352	264.0	417.0	130.0	65	66	5.5
80	156	205	358	282.5	435.5	155.0	80	81	7.0
100	186	218	371	309.5	462.5	183.0	100	100	10.0

1) 13 mm shorter when the AISI terminal box is used. (Ex and high temperature 200°C).

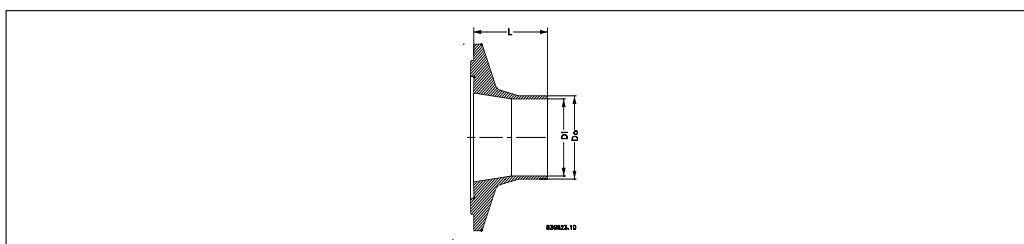
2) With transmitter MAG 5000 or MAG 6000 installed, weight is increased by approx. 0.8 kg.

Built-in length

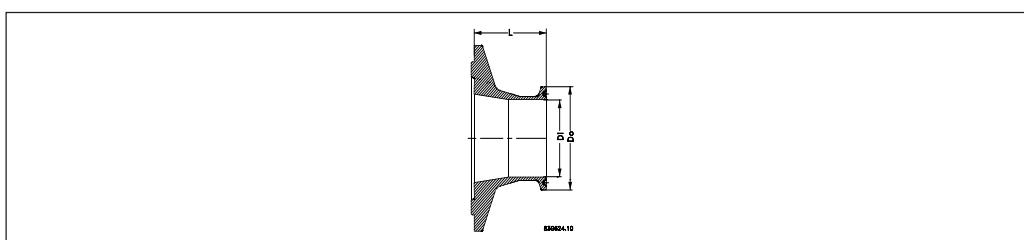


DN	A [mm]	L <sup>1)</sup> [mm]
10	99	146
15	99	146
25	113	161
40	126	176
50	154	186
65	165	223
80	200	258
100	225	288

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

Accessories  
MAG 1100 FOOD

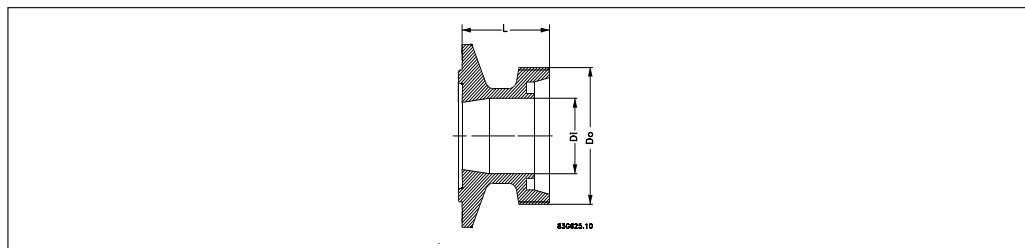
Adapter DN [mm]	Sensor DN [mm]	L [mm]	Weld-in type									
			DIN 11850		DS/ISO 2037		SMS 3008		BS4825-1		Tri-Clover®	
			Di [mm]	Do [mm]	Di [mm]	Do [mm]	Di [mm]	Do [mm]	Di [mm]	Do [mm]	Di [mm]	Do [mm]
10	10	40	10.0	13.0	10.0	13.0	10.0	13.0	10.0	13.0	9.4	12.7
15	15	40	16.0	19.0	16.0	19.0	16.0	19.0	16.0	19.0	-	-
15.9	15	40	-	-	-	-	-	-	-	-	15.75	19.05
20	15	40	20.0	23.0	20.0	23.0	20.0	23.0	20.0	23.0	-	-
25	25	40	-	-	22.6	25.6	22.6	25.6	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	-	-	-	-	29.6	32.0	-	-	-	-
32	25	40	32.0	35.0	-	-	-	-	-	-	-	-
33.7	25	40	-	-	31.3	34.3	31.3	34.3	-	-	-	-
38	40	40	-	-	35.6	38.6	35.6	38.6	35.6	38.6	34.8	38.1
40	40	40	-	-	37.6	40.6	-	-	-	-	-	-
40	40	40	38.0	40.0	-	-	-	-	-	-	-	-
50	50	40	-	-	48.6	51.6	48.6	51.6	48.6	51.6	47.5	50.8
50	50	40	50.0	53.0	-	-	-	-	-	-	-	-
63.5	65	45	-	-	60.3	64.1	60.3	64.1	60.3	64.1	60.2	63.5
65	65	45	66.0	70.0	-	-	-	-	-	-	-	-
70	65	45	-	-	66.8	70.6	-	-	-	-	-	-
76	65	45	-	-	-	-	72.0	76.0	-	-	-	-
76.1	80	50	-	-	72.9	76.7	72.9	76.7	72.9	76.7	72.9	76.2
80	80	50	81.0	85.0	-	-	-	-	-	-	-	-
88.9	80	50	-	-	84.9	89.8	84.9	89.8	-	-	-	-
100	100	50	100	104	-	-	-	-	-	-	-	-
101.6	100	50	-	-	97.6	102.5	97.6	102.5	97.6	102.6	97.38	101.6
114.3	100	50	-	-	110.3	115.6	110.3	115.6	110.3	115.6	-	-



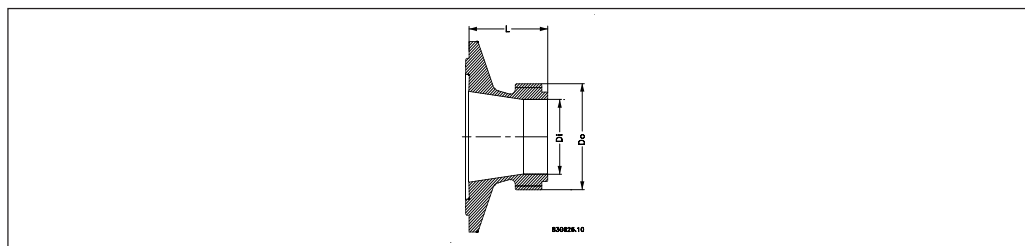
Adapter DN [mm]	Sensor DN [mm]	L [mm]	Clamp type									
			DIN 32676		ISO 2852		SMS 3016		BS4825-3		Tri-Clamp®	
			Di [mm]	Do [mm]	Di [mm]	Do [mm]	Di [mm]	Do [mm]	Di [mm]	Do [mm]	Di [mm]	Do [mm]
10	10	40	10.0	34.0	10.0	34.0	10.0	34.0	-	-	9.4	25.0
15	15	40	16.0	34.0	16.0	34.0	16.0	34.0	-	-	15.75	25.0
20	15	40	20.0	34.0	20.0	34.0	-	-	-	-	-	-
25	25	40	-	-	22.6	50.5	22.6	50.5	22.6	50.5	22.1	50.5
25	25	40	26.0	50.5	26.0	50.5	-	-	-	-	-	-
33.7	25	40	31.3	50.5	31.3	50.5	31.3	50.5	-	-	-	-
38	40	40	-	-	35.6	50.5	35.6	50.5	35.6	50.5	34.8	50.5
40	40	40	38.0	50.5	38.0	50.5	-	-	-	-	-	-
50	50	40	50.0	64.0	-	-	-	-	-	-	-	-
51	50	40	-	-	48.6	64.0	48.6	64.0	48.6	64.0	47.5	64.0
63.5	65	45	-	-	60.3	77.5	60.3	77.5	60.3	77.5	60.2	77.5
65	65	45	66.0	91.0	-	-	-	-	-	-	-	-
76.1	80	50	-	-	72.9	91.0	72.9	91.0	72.9	91.0	72.9	91.0
80	80	50	81.0	106.0	-	-	-	-	-	-	-	-
100	100	50	100	119.9	-	-	-	-	-	-	-	-
101.6	100	50	-	-	97.6	119.0	97.6	119.0	97.6	119.0	97.38	119.0

Tri-Clover® and Tri-Clamp® are registered trademarks for Ladish Co.

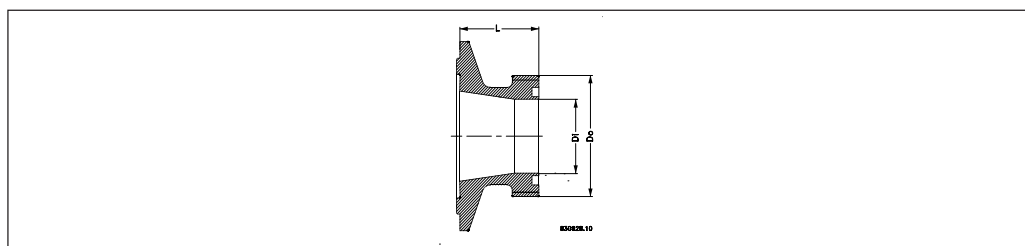
**Accessories**  
**MAG 1100 FOOD**  
(continued)



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



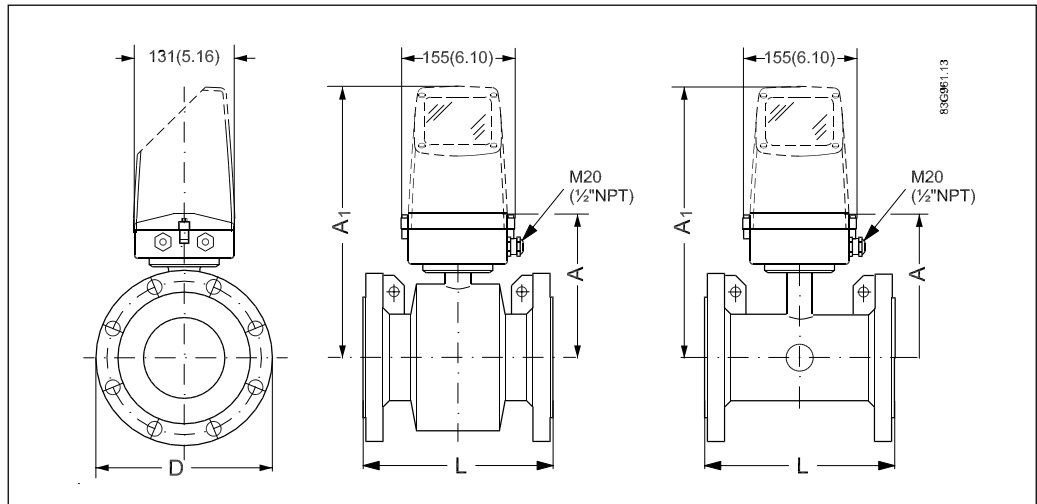
Adapter DN [mm]	Sensor DN [mm]	L [mm]	Threaded type					
			ISO 2853		SS 3351		BS 4825-4 (IDF)	
			Di [mm]	Do [mm]	Di [mm]	Do [mm]	Di [mm]	Do [mm]
25	25	40	22.6	37.0	22.6	37.0	22.6	37.0
38	40	40	35.6	51.0	35.6	51.0	35.6	51.0
51	50	40	48.6	64.0	48.6	64.0	48.6	64.0
63.5	65	45	60.3	78.0	60.3	78.0	60.3	78.0
76.1	80	50	72.9	91.0	72.9	91.0	72.9	91.0
101.6	100	50	-	-	-	-	97.6	126.0
101.6	100	50	97.6	118.0	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
32	25	40	29.6	48.0
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

D & W

4.3  
Sensor MAG 5100 W



Nominal size		A		L									
				PN 10		PN 16		PN 40		Class 150		AWWA	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
25	1"	187	7.4	N/A	N/A	N/A	N/A	200	7.9	200	7.9	N/A	N/A
40	1½"	197	7.8	N/A	N/A	N/A	N/A	200	7.9	200	7.9	N/A	N/A
50	2"	188	7.4	N/A	N/A	200	7.9	N/A	N/A	200	7.9	N/A	N/A
65	2½"	194	7.6	N/A	N/A	200	7.9	N/A	N/A	200	7.9	N/A	N/A
80	3"	200	7.9	N/A	N/A	200	7.9	N/A	N/A	200	7.9	N/A	N/A
100	4"	207	8.1	N/A	N/A	250	9.8	N/A	N/A	250	9.8	N/A	N/A
125	5"	217	8.5	N/A	N/A	250	9.8	N/A	N/A	250	9.8	N/A	N/A
150	6"	232	9.1	N/A	N/A	300	11.8	N/A	N/A	300	11.8	N/A	N/A
200	8"	257	10.1	350	13.8	350	13.8	N/A	N/A	350	13.8	N/A	N/A
250	10"	284	11.2	450	17.7	450	17.7	N/A	N/A	450	17.7	N/A	N/A
300	12"	310	12.2	500	19.7	500	19.7	N/A	N/A	500	19.7	N/A	N/A
350	14"	382	15.0	550	21.7	550	21.7	N/A	N/A	550	21.7	N/A	N/A
400	16"	407	16.0	600	23.6	600	23.6	N/A	N/A	600	23.6	N/A	N/A
450	18"	438	17.2	600	23.6	600	23.6	N/A	N/A	600	23.6	N/A	N/A
500	20"	463	18.2	600	23.6	600	23.6	N/A	N/A	600	23.6	N/A	N/A
600	24"	514	20.2	600	23.6	600	23.6	N/A	N/A	600	23.6	N/A	N/A
700	28"	564	22.2	700	27.6	700	27.6	N/A	N/A	N/A	N/A	700	27.6
750	30"	591	23.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	750	29.5
800	32"	616	24.3	800	31.5	800	31.5	N/A	N/A	N/A	N/A	800	31.5
900	36"	663	26.1	900	35.4	900	35.4	N/A	N/A	N/A	N/A	900	35.4
1000	40"	714	28.1	1000	39.4	1000	39.4	N/A	N/A	N/A	N/A	1000	39.4
	42"	714	28.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1000	39.4
1100	44"	765	30.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1100	43.3
1200	48"	820	32.3	1200	47.2	1200	47.2	N/A	N/A	N/A	N/A	1200	47.2

New dimension from  
DN 350 to DN 1200

Will be discontinued

350	14"	362	14.3	550	21.7	550	21.7	N/A	N/A	550	21.7	N/A	N/A
400	16"	387	15.2	600	23.6	600	23.6	N/A	N/A	600	23.6	N/A	N/A
450	18"	418	16.5	600	23.6	600	23.6	N/A	N/A	600	23.6	N/A	N/A
500	20"	443	17.4	625	24.6	625	24.6	N/A	N/A	680	26.8	N/A	N/A
600	24"	494	19.4	750	29.5	750	29.5	N/A	N/A	820	32.3	N/A	N/A
700	28"	544	21.4	875	34.4	875	34.4	N/A	N/A	N/A	N/A	875	34.4
750	30"	571	22.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	937	36.9
800	32"	606	23.9	1000	39.4	1000	39.4	N/A	N/A	N/A	N/A	1000	39.4
900	36"	653	25.7	1125	44.3	1125	44.3	N/A	N/A	N/A	N/A	1125	44.3
1000	40"	704	27.7	1250	49.2	1250	49.2	N/A	N/A	N/A	N/A	1250	49.2
	42"	704	27.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1250	49.2
1100	44"	755	29.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1375	54.1
1200	48"	810	31.9	1500	59.1	1500	59.1	N/A	N/A	N/A	N/A	1500	59.1

D = Outside diameter of flange, see flange tables

D & W



**MAG 5100 W weight**

Nominal size		PN 10		PN 16		PN 40		Class 150		AWWA	
mm	inch	kgs	lbs	kgs	lbs	kgs	lbs	kgs	lbs	kgs	lbs
25	1"	N/A	N/A	N/A	N/A	4	9	4	9	N/A	N/A
40	1½"	N/A	N/A	N/A	N/A	7	15	6	13	N/A	N/A
50	2"	N/A	N/A	9	20	N/A	N/A	8	20	N/A	N/A
65	2½"	N/A	N/A	10.7	24	N/A	N/A	11	24	N/A	N/A
80	3"	N/A	N/A	11.6	26	N/A	N/A	13	28	N/A	N/A
100	4"	N/A	N/A	15.2	33	N/A	N/A	19	41	N/A	N/A
125	5"	N/A	N/A	20.4	45	N/A	N/A	24	52	N/A	N/A
150	6"	N/A	N/A	26	57	N/A	N/A	29	64	N/A	N/A
200	8"	48	106	48	106	N/A	N/A	56	124	N/A	N/A
250	10"	64	141	69	152	N/A	N/A	79	174	N/A	N/A
300	12"	76	167	86	189	N/A	N/A	110	243	N/A	N/A
350	14"	104	229	125	274	N/A	N/A	139	307	N/A	N/A
400	16"	119	263	143	314	N/A	N/A	159	351	N/A	N/A
450	18"	136	299	173	381	N/A	N/A	182	400	N/A	N/A
500	20"	163	359	223	491	N/A	N/A	225	495	N/A	N/A
600	24"	236	519	338	744	N/A	N/A	320	704	N/A	N/A
700	28"	270	595	314	692	N/A	N/A	N/A	N/A	273	602
750	30"	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	329	725
800	32"	346	763	396	873	N/A	N/A	N/A	N/A	365	804
900	36"	432	951	474	1043	N/A	N/A	N/A	N/A	495	1089
1000	40"	513	1130	600	1321	N/A	N/A	N/A	N/A	583	1282
	42"	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	687	1512
1100	44"	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	763	1680
1200	48"	643	1415	885	1948	N/A	N/A	N/A	N/A	861	1896

**New weight from  
DN 350 to DN 1200**

**Will be discontinued**

350	14"	100	220	116	255	N/A	N/A	131	289	N/A	N/A
400	16"	127	280	144	317	N/A	N/A	165	364	N/A	N/A
450	18"	152	335	178	393	N/A	N/A	176	388	N/A	N/A
500	20"	184	405	232	512	N/A	N/A	235	518	N/A	N/A
600	24"	258	568	343	736	N/A	N/A	345	761	N/A	N/A
700	28"	315	693	350	772	N/A	N/A	N/A	N/A	309	681
750	30"	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	480	1058
800	32"	410	904	442	975	N/A	N/A	N/A	N/A	421	928
900	36"	512	1129	550	1213	N/A	N/A	N/A	N/A	539	1188
1000	40"	650	1433	732	1614	N/A	N/A	N/A	N/A	670	1477
	42"	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	700	1544
1100	44"	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1100	2426
1200	48"	990	2183	1106	2439	N/A	N/A	N/A	N/A	1030	2271

**The effect of temperature on  
working pressure  
MAG 5100 W**

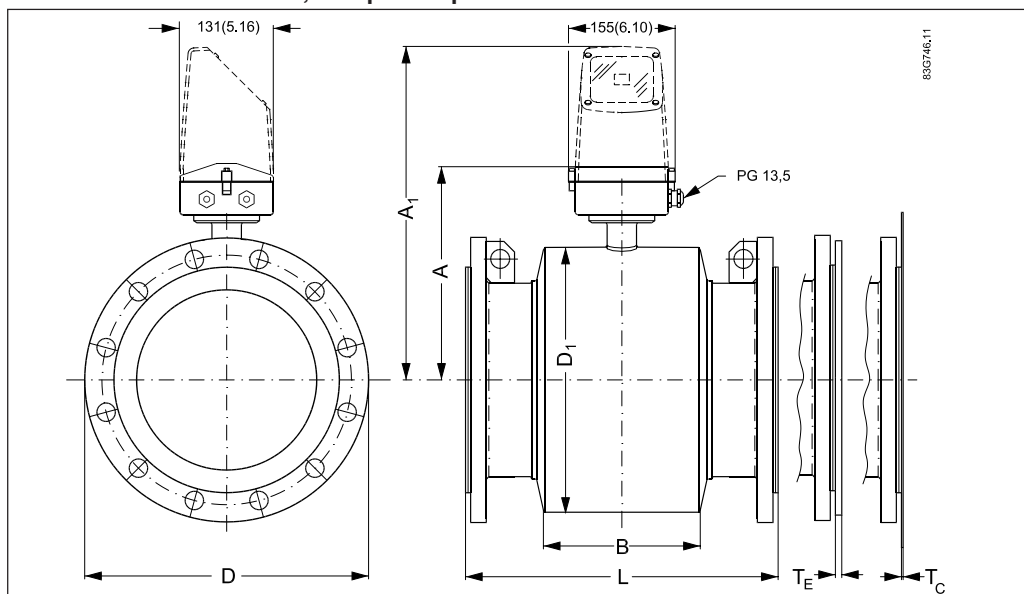
Metric (Pressures in bar)					
Sizes 25 mm, 40 mm & > 300 mm					
Flange spec.	Flange rating	Temperature °C			
		-5	10	50	90
EN 1092-1	PN 10	10.0	10.0	9.7	9.4
	PN 16	16.0	16.0	15.5	15.1
	PN 40	40.0	40.0	38.7	37.7
ANSI B16.45	150 lb	19.7	19.7	19.3	18.0
AWWA C-207	Class D	10.3	10.3	10.3	10.3
Sizes 50 mm to 300 mm					
EN 1092-1	PN 10	10.0	10.0	10.0	8.2
	PN 16	10.0	16.0	16.0	13.2
	PN 40	10.0	40.0	40.0	32.9
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" to 12"					
EN 1092-1	PN 10	145	145	145	119
	PN 16	145	232	232	191
	PN 40	145	580	580	477
ANSI B16.45	150 lb	145	286	286	235

#### 4.4 Sensor MAG 3100 and MAG 3100 W



#### MAG 3100 & MAG 3100 W, compact/separate



DN	A <sup>1)</sup>	A <sub>1</sub>	B	D <sub>1</sub>	L <sup>2)</sup>								AS 2129 E, AS 4087	AWWA C-207 Class D	T <sub>C</sub> <sup>3)</sup>	T <sub>E</sub> <sup>3)</sup>	Weight <sup>4)</sup>	
					EN 1092-1-2001					BS 1560/ ANSI 16.5		Class 14- 21- 35						Class D
					PN 6, 10, 16	PN 25	PN 40	PN 64	PN 100	Class 150	Class 300							
[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		-	6	4		
25	187	338	59	104	200	200	200	-	260	200	200	200		1.2	6	5		
40	197	348	82	124	200	200	200	-	280	200	200	200		1.2	6	8		
50	205	356	72	139	200	200	200	276	300	200	200	200		1.2	6	9		
65	212	363	72	154	200	200	200	320	350	200	272	200		1.2	6	11		
80	222	373	72	174	200	272	272	323	340	272	272	200		1.2	6	12		
100	242	393	85	214	250	250	250	380	400	250	310	250		1.2	6	16		
125	255	406	85	239	250	250	250	420	450	250	335	250		1.2	6	19		
150	276	427	85	282	300	300	300	415	450	300	300	300		1.2	6	27		
200	304	455	137	338	350	350	350	480	530	350	350	350		1.2	8	40		
250	332	483	137	393	450	450	450	550	620	450	450	450		1.2	8	60		
300	357	508	137	444	500	500	500	600	680	500	500	500		1.6	8	80		
350	362	513	270	462	550	550	550	700	800	550	550	550	-	1.6	8	110		
400	387	538	270	512	600	600	600	750	-	600	600	600	-	1.6	10	125		
450	418	569	310	563	600	600	600	-	-	600	640	600	-	1.6	10	175		
500	443	594	350	614	625	625	680	-	-	680	730	625	-	1.6	10	200		
600	494	645	430	715	750	750	750	-	-	820	860	750	-	1.6	10	300		
700	544	695	500	816	875	-	-	-	-	-	-	875	875	2.0	-	350		
750	571	722	556	869	-	-	-	-	-	-	-	937	937	2.0	-	380		
800	606	757	560	939	1000	-	-	-	-	-	-	1000	1000	2.0	-	475		
900	653	804	630	1042	1125	-	-	-	-	-	-	1125	1125	2.0	-	560		
1000	704	906	670	1146	1250	-	-	-	-	-	-	1250	1250	2.0	-	700		
1100	755	906	770	1248	1375	-	-	-	-	-	-	-	-	2.0	-	1200		
1200	810	961	792	1348	1500	-	-	-	-	-	-	1500	1500	2.0	-	1250		
1400	925	1076	1000	1675	1750	-	-	-	-	-	-	-	-	3.0	-	1753		
1500	972	1123	1020	1672	-	-	-	-	-	-	-	1875	1875	3.0	-	2600		
1600	1025	1176	1130	1915	2000	-	-	-	-	-	-	-	-	3.0	-	2341		
1800	1123	1274	1250	1974	2250	-	-	-	-	-	-	-	-	3.0	-	3253		
2000	1223	1374	1375	2174	2500	-	-	-	-	-	-	-	-	3.0	-	4060		

1) 13 mm shorter with AISI terminal box (Ex and high temperature)

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

3) T<sub>C</sub> = Type C grounding ring, T<sub>E</sub> = Type E grounding ring

4) Weights are approx. and for PN 16 without transmitter

D = Outside diameter of flange, see flange tables

**Earthing/protection flange**

Type C

DN	t <sub>1</sub> [mm]	t <sub>2</sub> [mm]	Weight [kg]
25-250	1.2	15	0.03-0.4
300-600	1.6	20	0.6-2.6
700-1200	2.0	25	3-5
1400-2000	3.0	40	9-16

Type E

DN	t <sub>1</sub> [mm]	Weight [kg]
15	6	0.07
25-150	6	0.3-1.4
200-350	8	1.7-4.1
400-600	10	6.5-13.0

Type C flanges for liners of neoprene, EPDM, Linatex® and ebonite.  
 Type E flanges for liners of PTFE.

**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

Transmitter installed remote

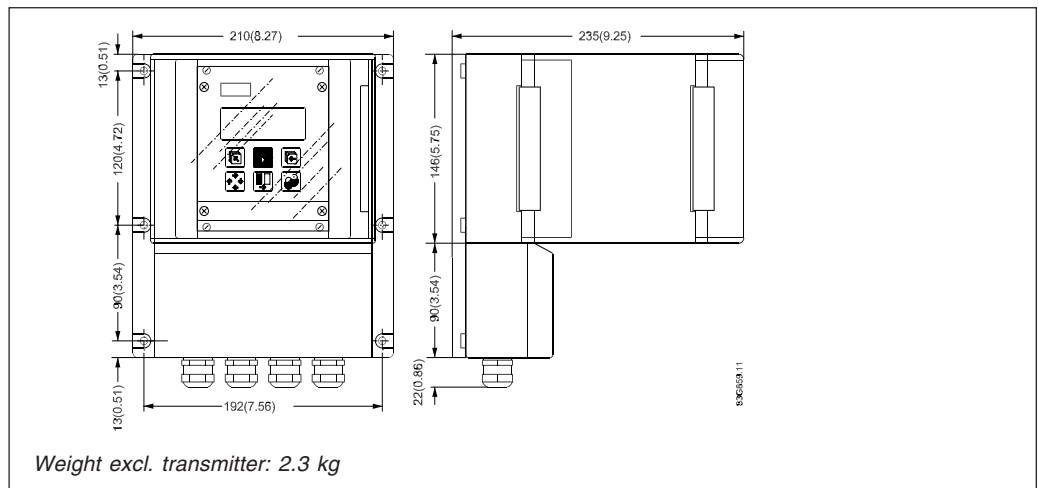
Weight: Wall bracket: 0.9 kg

**19"insert, standard unit**

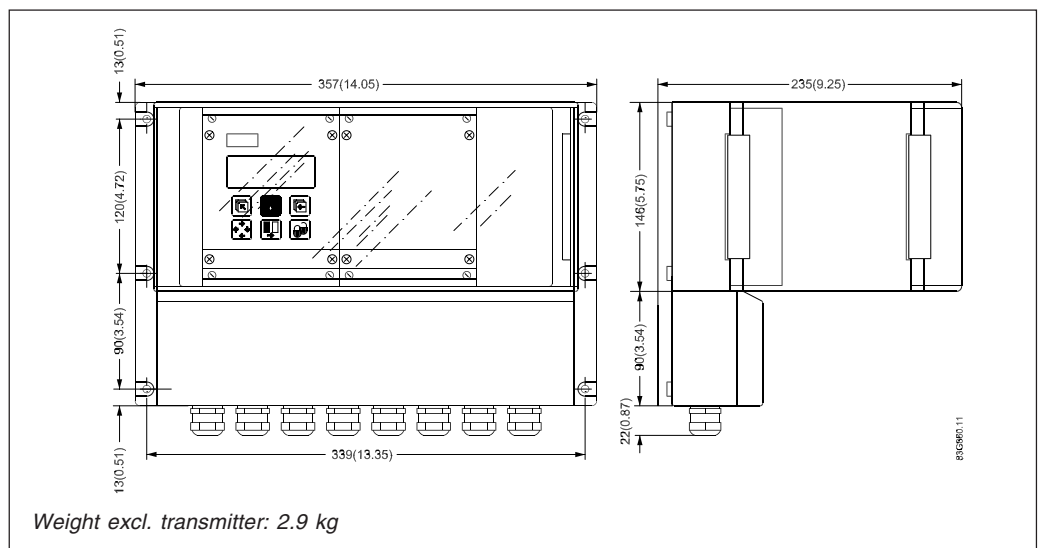
Weight incl. back print:

MAG 5000:	0.8 kg
MAG 6000:	0.8 kg
Safety barrier (ia/ib):	1.0 kg
Safety barrier (ia):	0.8 kg
Cleaning unit:	0.9 kg

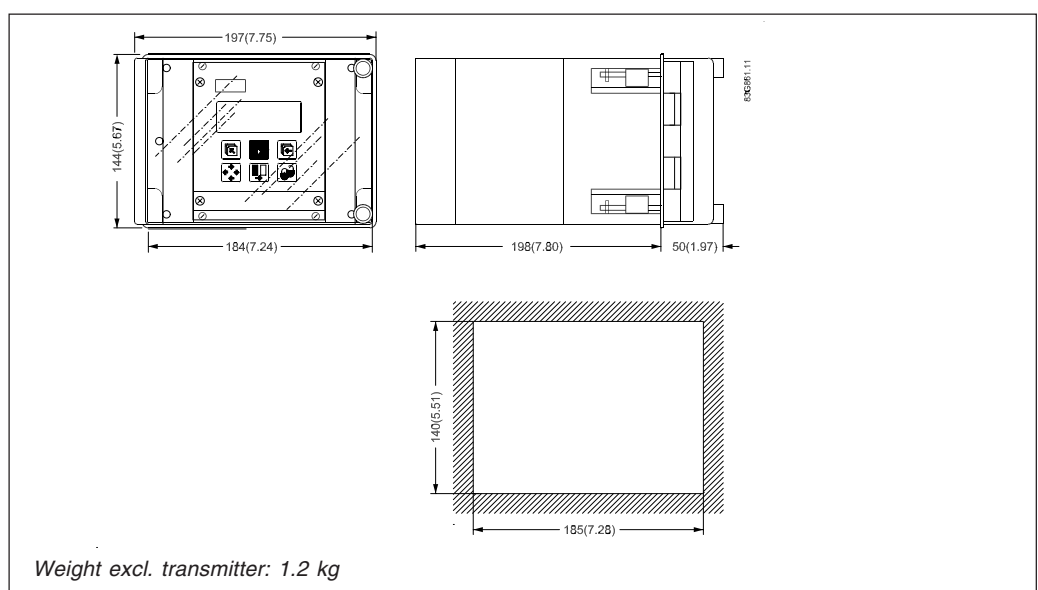
Wall mounting box 21 TE



Wall mounting box 42 TE

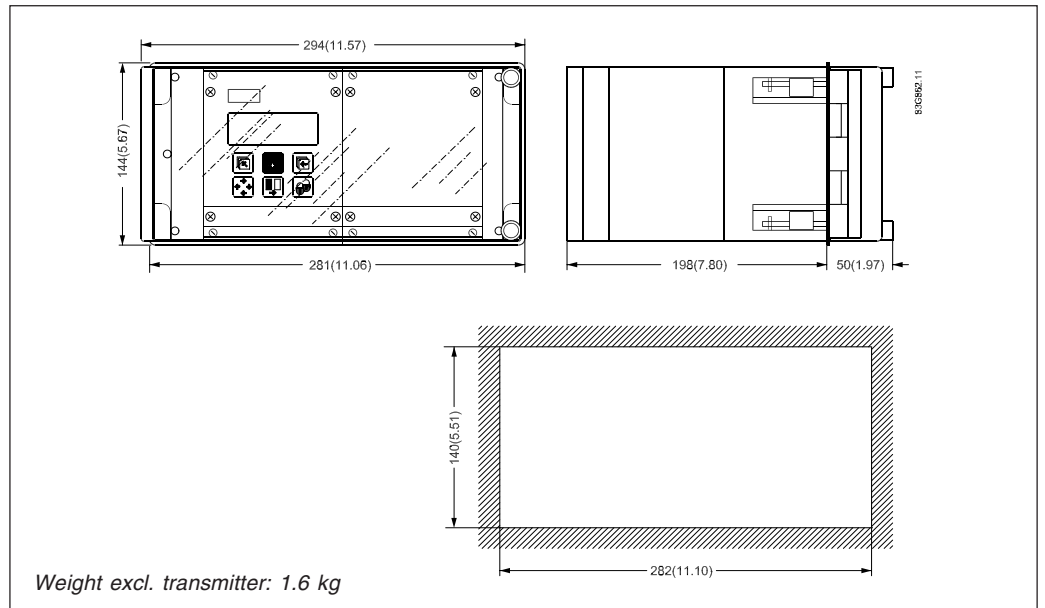


Panel front unit 21 TE

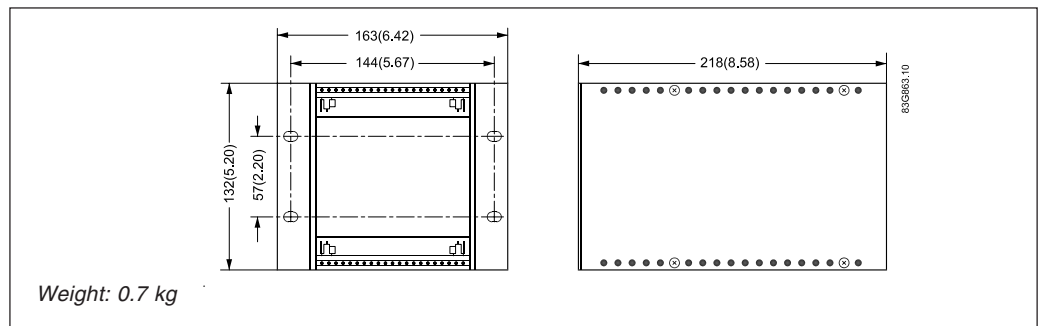


D & W

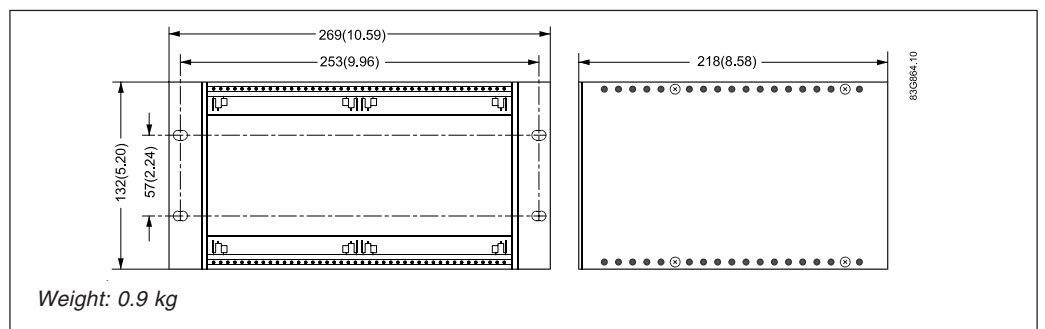
**Panel front unit 42 TE**



**Back of panel unit 21 TE**



**Back of panel unit 42 TE**



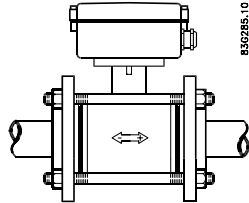
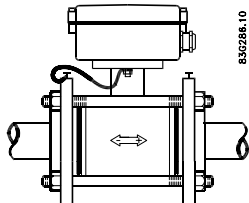
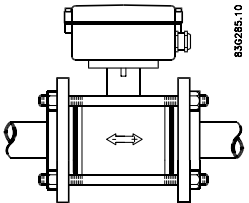
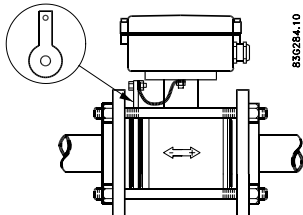
D & W

5. Installation of sensor

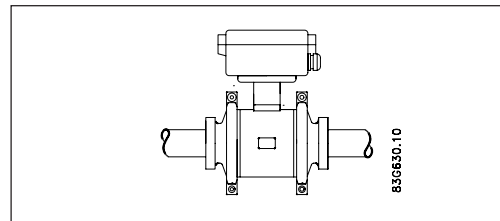
To obtain optimum results from the measuring system, the chassis body of the sensor must have the same electrical potential as the liquid being measured.

5.1 Potential equalization

MAG 1100

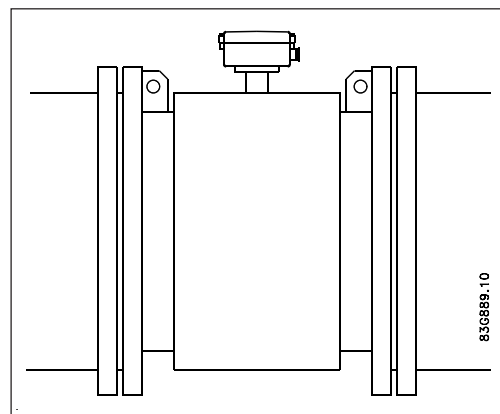
	Graphite gaskets	EPDM or PTFE gaskets
Electrically conductive piping	 <p><b>A:</b> Potential equalization with electrically conductive graphite gaskets</p>	 <p><b>B:</b> Potential equalization using earth strap supplied.</p>
Electrically non-conductive piping	 <p><b>C:</b> Potential equalization with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

MAG 1100 FOOD



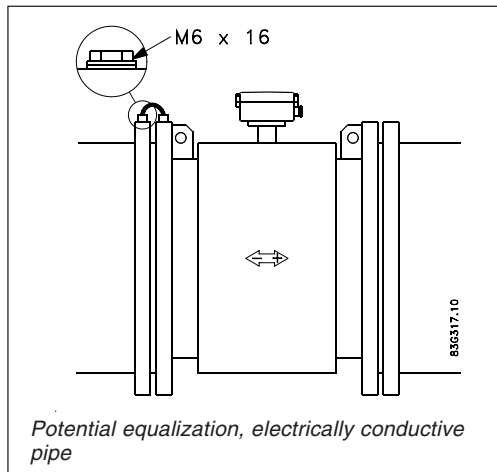
The sensor must be installed between two adapters. Potential equalization with the liquid occurs automatically via these adapters and through the adjacent pipe.

MAG 3100 W / MAG 3100 (except PTFE liner)

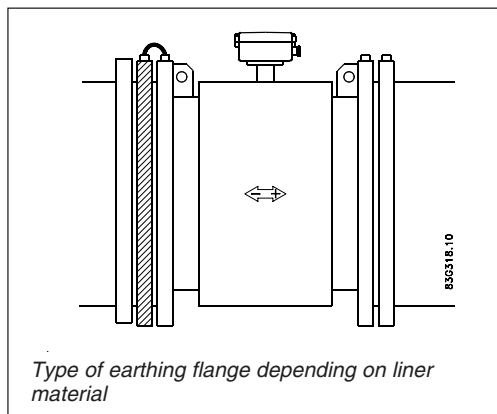


Potential equalization is carried out with the built-in earthing electrodes. No further action need to be taken.

**MAG 3100  
(PTFE liner)**



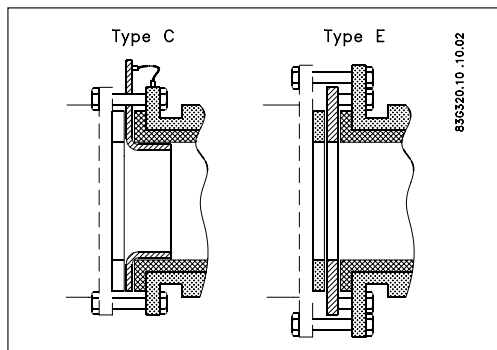
**Electrically conductive piping**  
Use an earth straps on one side.



**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.

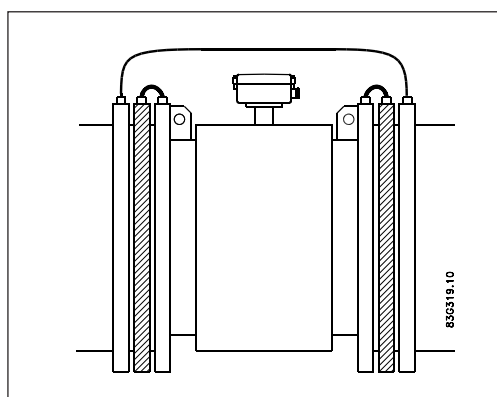
Liner material	Suitable earthing flange
PTFE	Type E

**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) is clamped between the flanges. Type E (for PTFE 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**



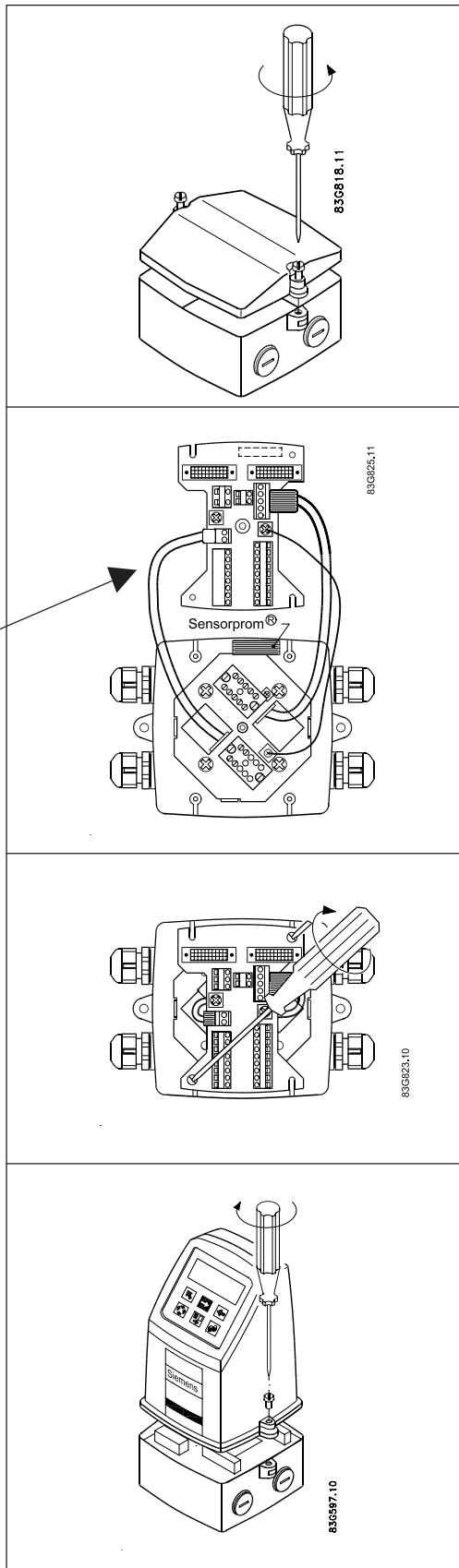
Special attention must be given to systems with cathodic protection.  
**Compact installation:**  
The transmitter must be supplied through an isolation transformer. The terminal "PE" must never be connected.  
**Remote installation:**  
The screen must only be connected at the sensor end via a 1.5 µF 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.

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 PG 13.5 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 an earth wire between PE on connection board and 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.

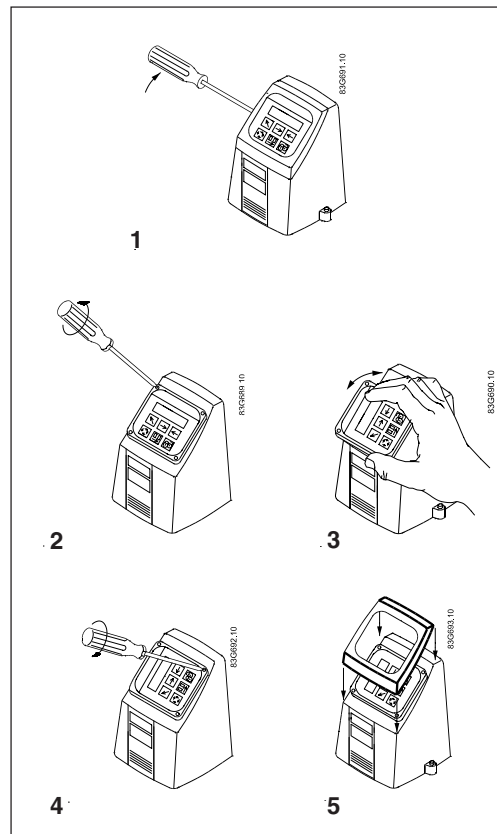
**Step 4**  
Mount the connection plate in the terminal box. The SENSORPROM® unit connections will be established automatically when the connection plate is mounted in the terminal box.

**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.

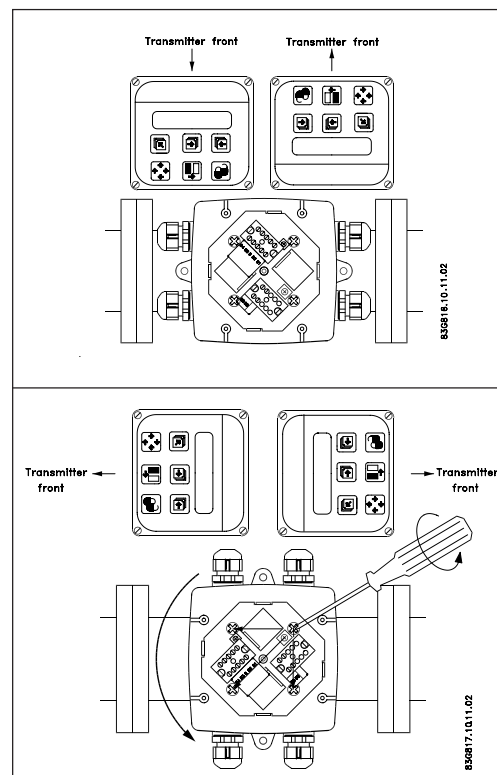
**Step 5**  
Fit the supply and output cables respectively and tighten the cable glands to obtain optimum sealing. Please refer to the wiring diagram in chapter 7 for the electrical connections.

Mount the transmitter on the terminal box.



**Turning the control pad**

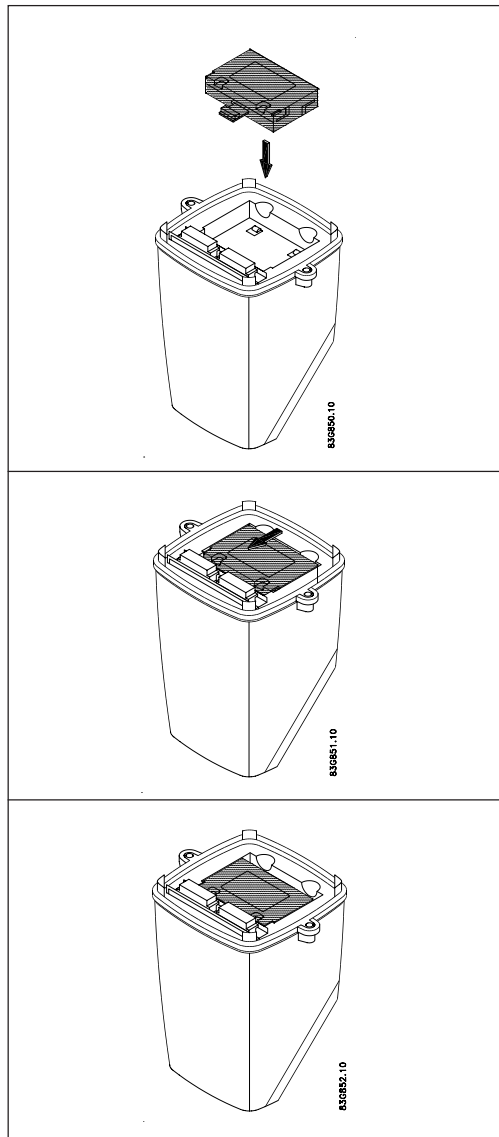
1. Use a screw driver to remove the outer frame.
2. Loosen the 4 screws retaining the control pad.
3. Withdraw the control pad and turn it to the required orientation.
4. Tighten the 4 screws until a mechanical stop is felt in order to obtain IP 67 enclosure rating.
5. Snap-lock the outer frame onto 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 terminal box can be rotated  $\pm 90^\circ$  in order to optimize the viewing angle of the transmitter display/keypad:  
Unscrew the four screws in the bottom of the terminal box. Turn the terminal box to the required position and retighten the screws firmly.

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



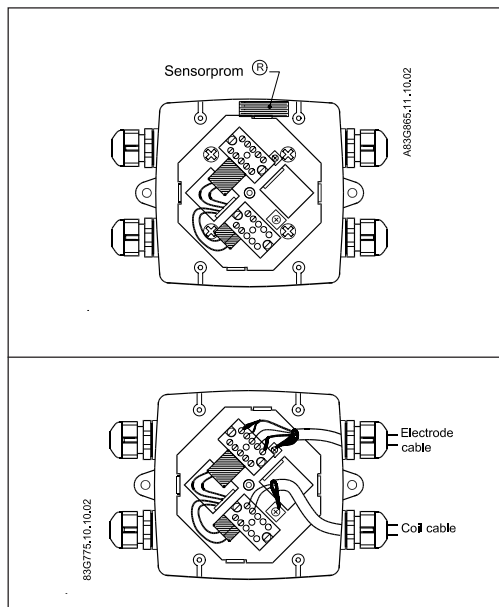
Locate the add-on module in the bottom of the MAG 6000 transmitter.

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.

Installation of transmitter

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

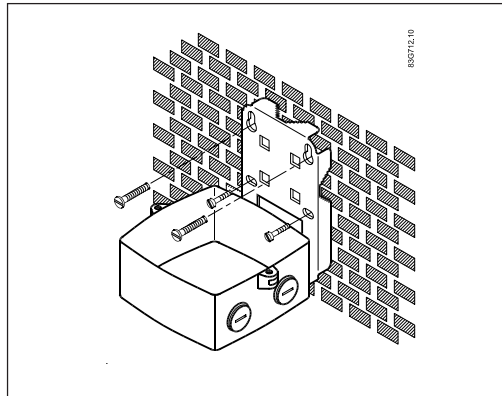


Remove the SENSORPROM® unit from the sensor and mount it on the connection plate in the transmitter.

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.

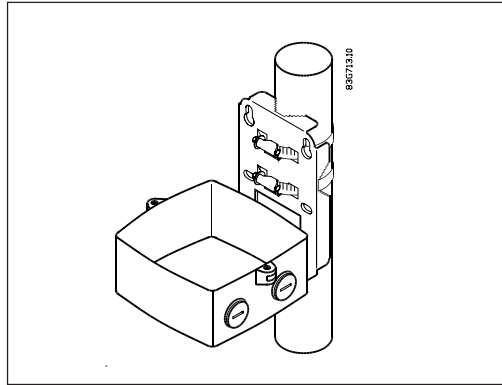
6.2.3 Remote installation -  
Wall mounting

MAG 6000



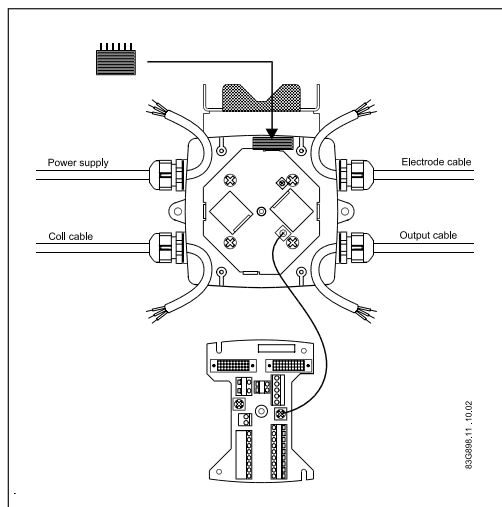
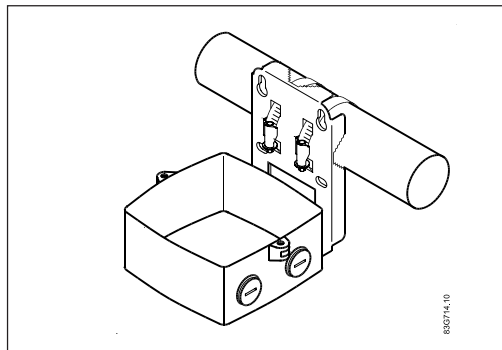
Mount wall bracket on a wall or into the back of a panel.

Vertical pipe mounting



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

Horizontal pipe mounting

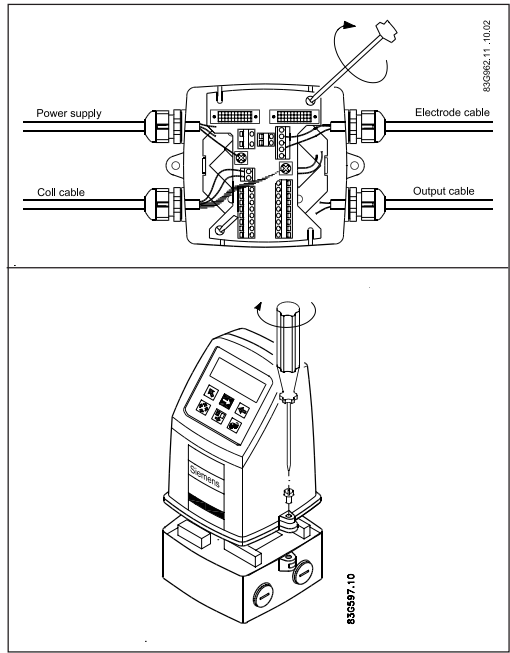


Take the SENSORPROM® memory unit from the sensor. Mount the SENSORPROM® unit in the wall mounting unit as shown. The text on the SENSORPROM® unit **must** face towards the wall bracket.

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

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

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



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

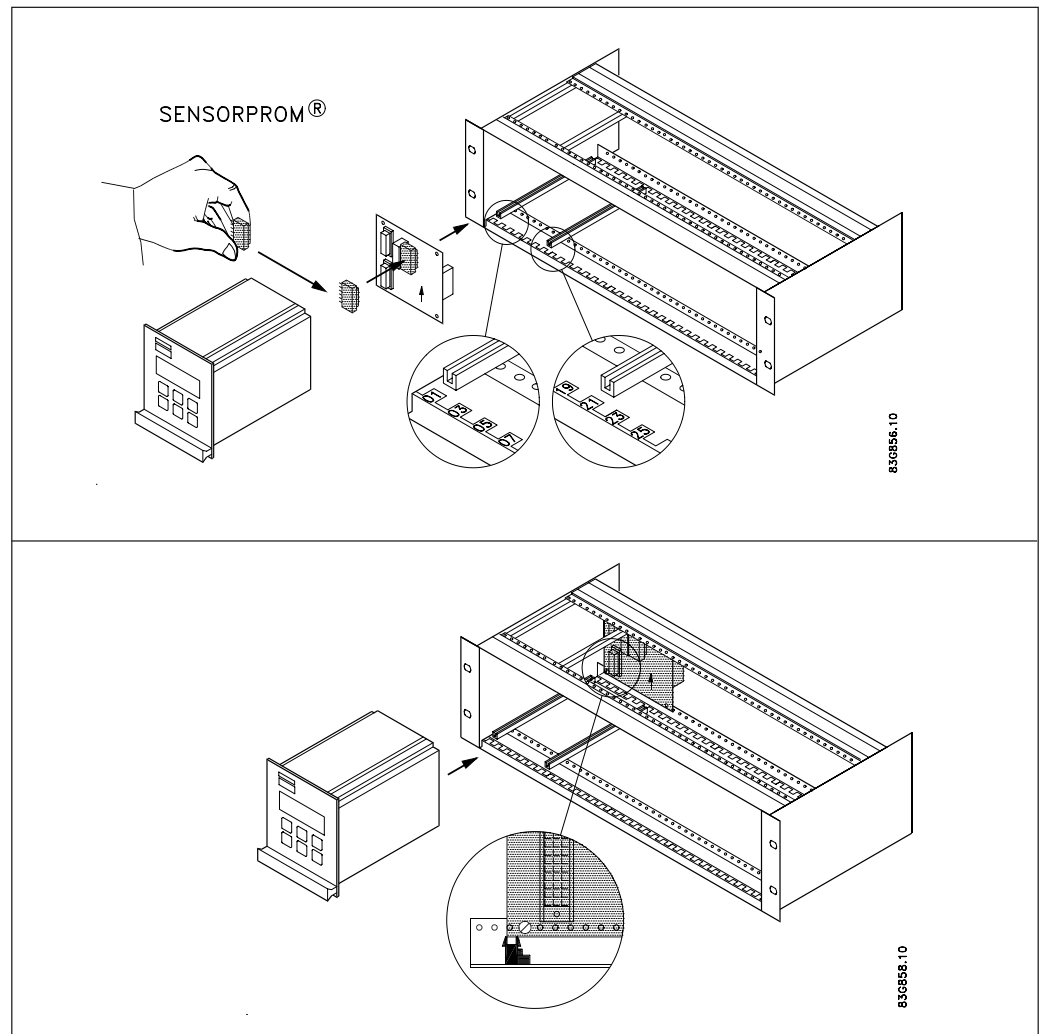
Fit the coil, electrode, supply and output cables respectively and tighten the cable glands to obtain optimum sealing. Please see the wiring diagram in "Electrical connections".

Mount the transmitter on the terminal box.

**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.

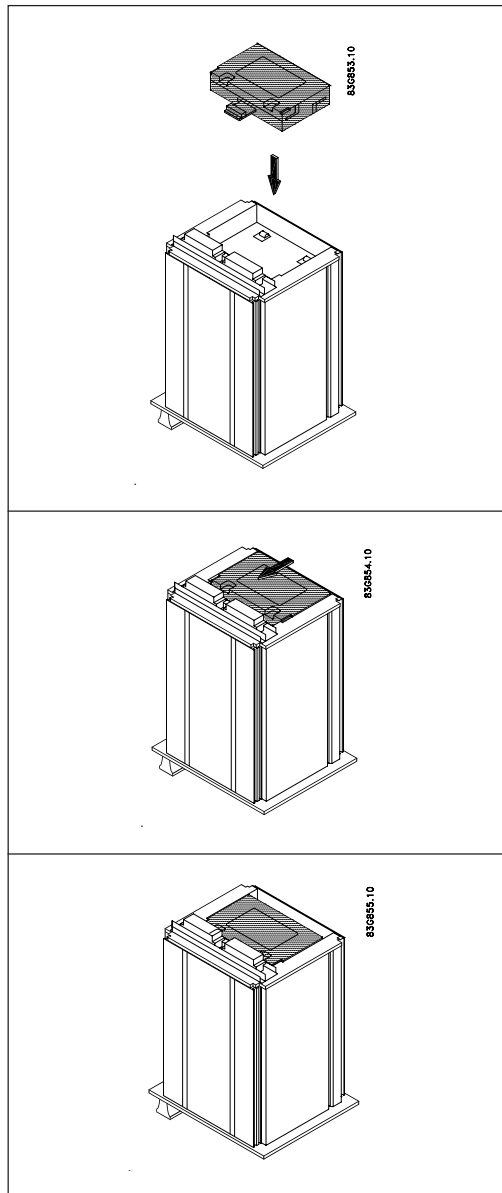
## 6.2.4

## 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

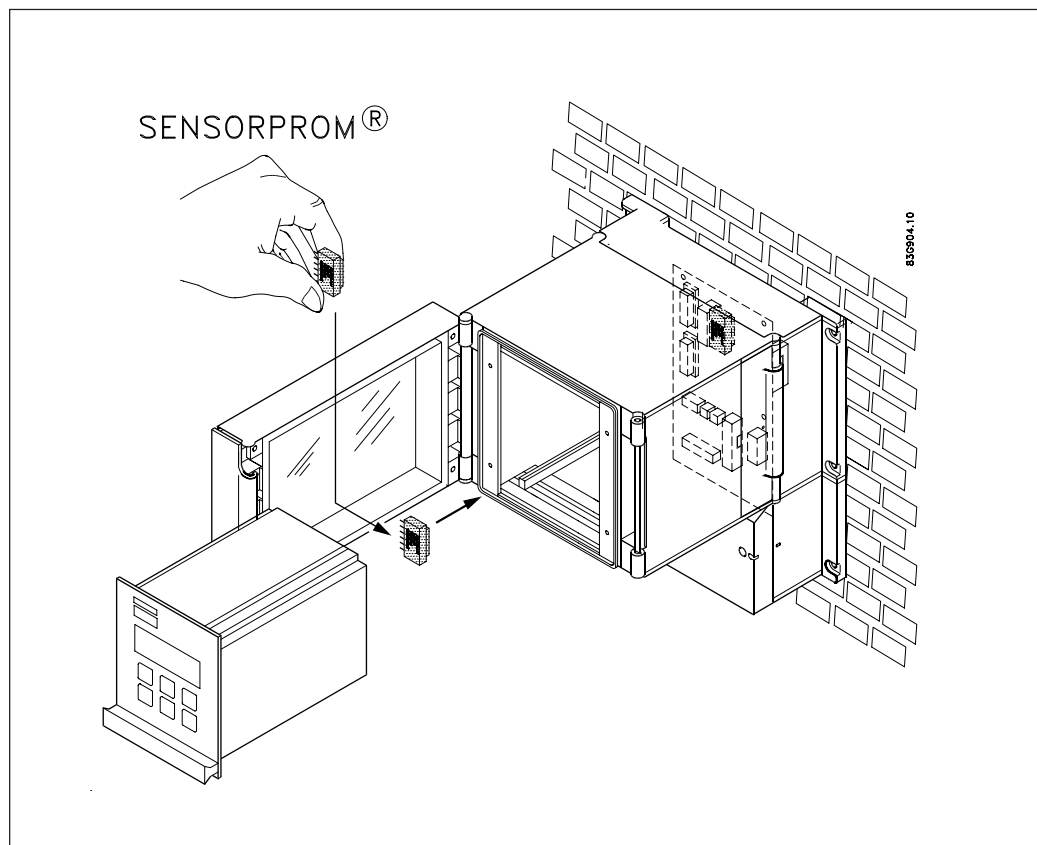


Locate the add-on module in the bottom of the MAG 6000 transmitter.

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

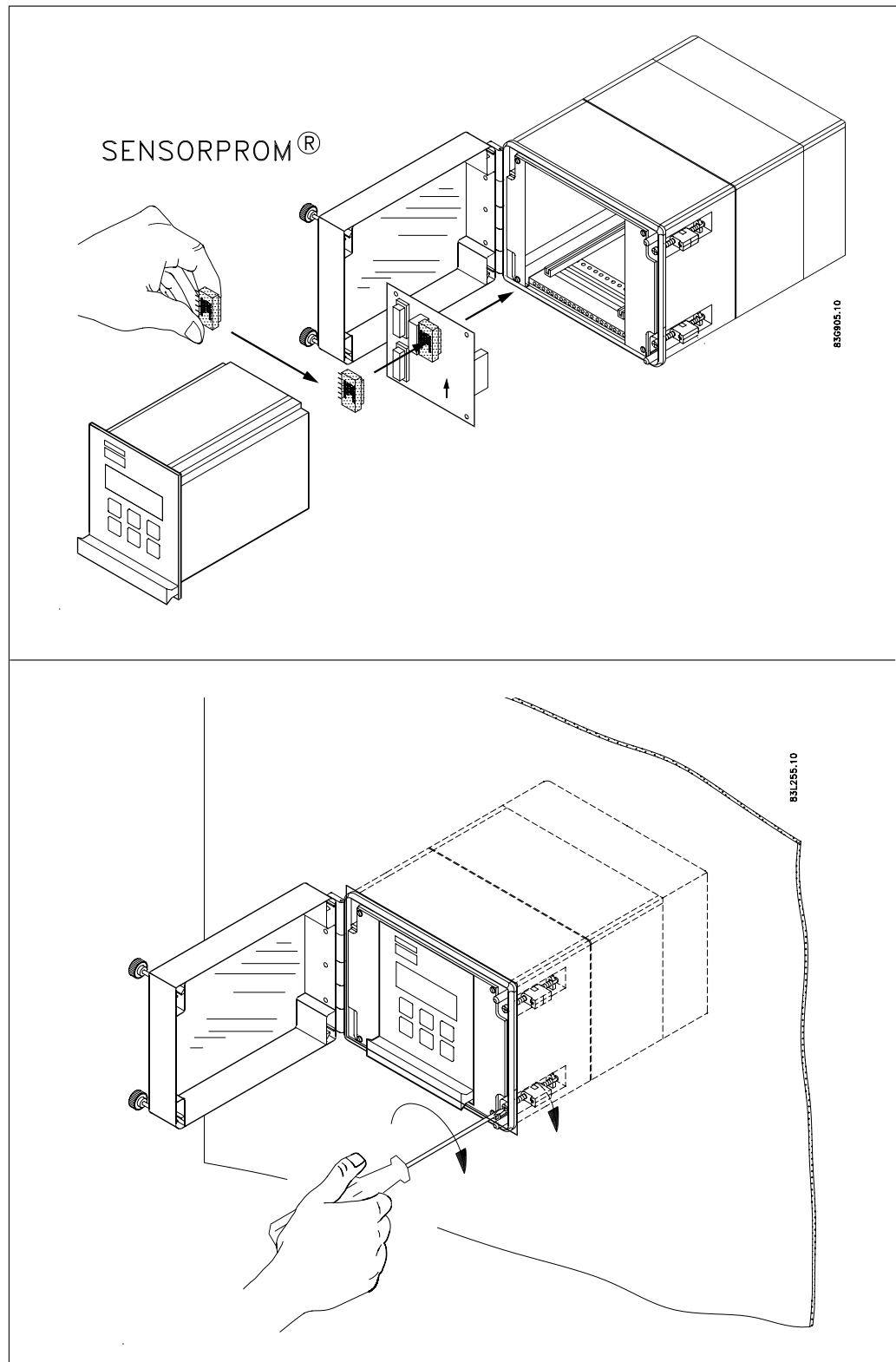
The add-on module has now been installed and the transmitter is ready to be installed on the terminal box. Communication to the operator menu and electrically inputs and outputs is automatically established by power on.

### 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.

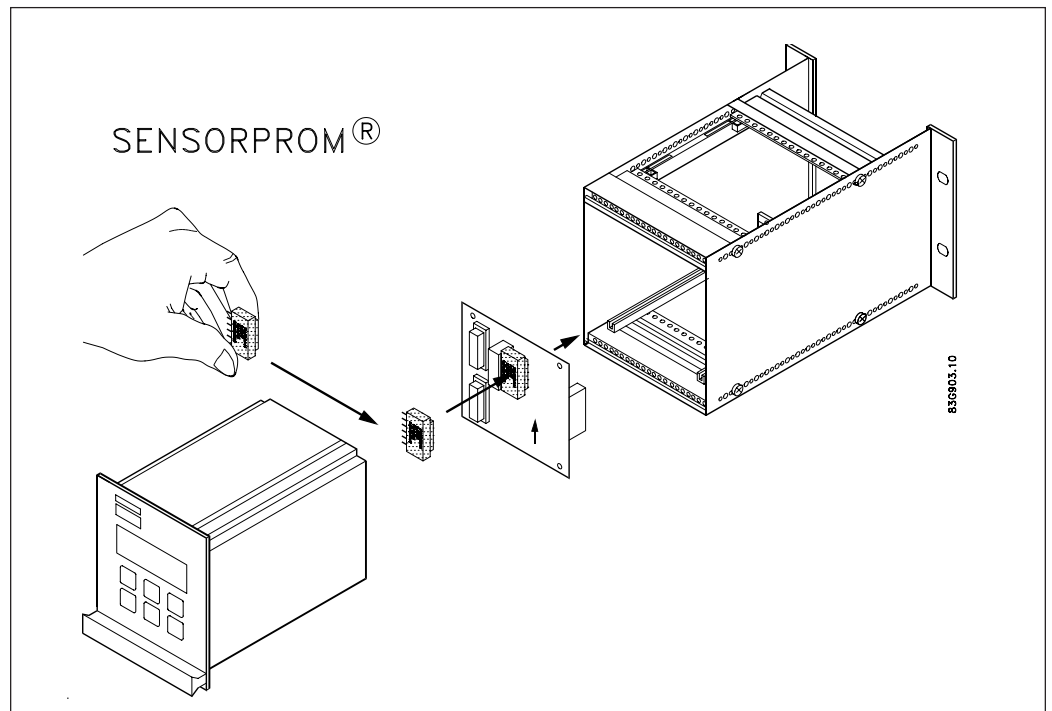
6.2.7  
Installation in IP 65 panel  
mounting enclosure  
(front of panel)



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.

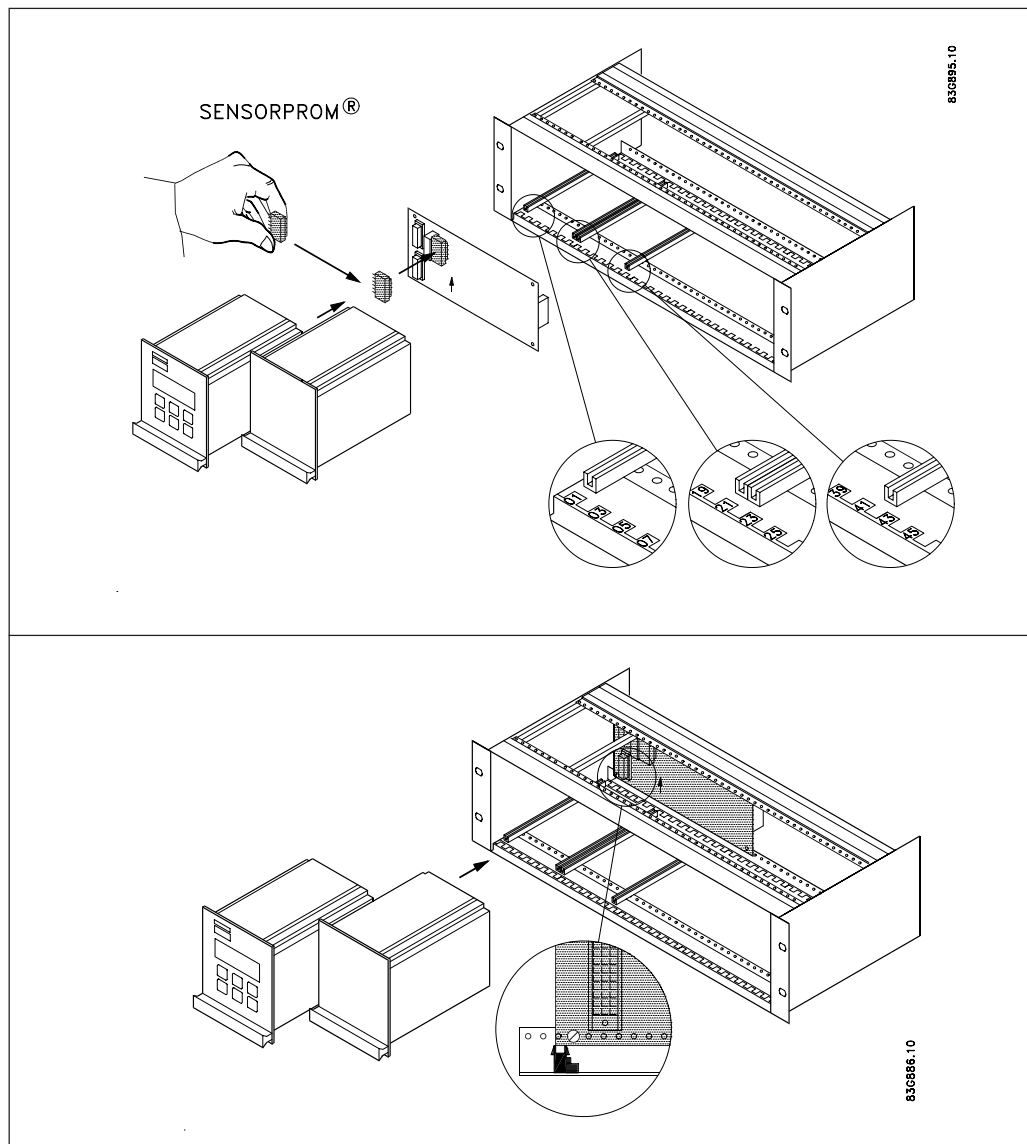


### 6.2.8 Installation into the back of a panel



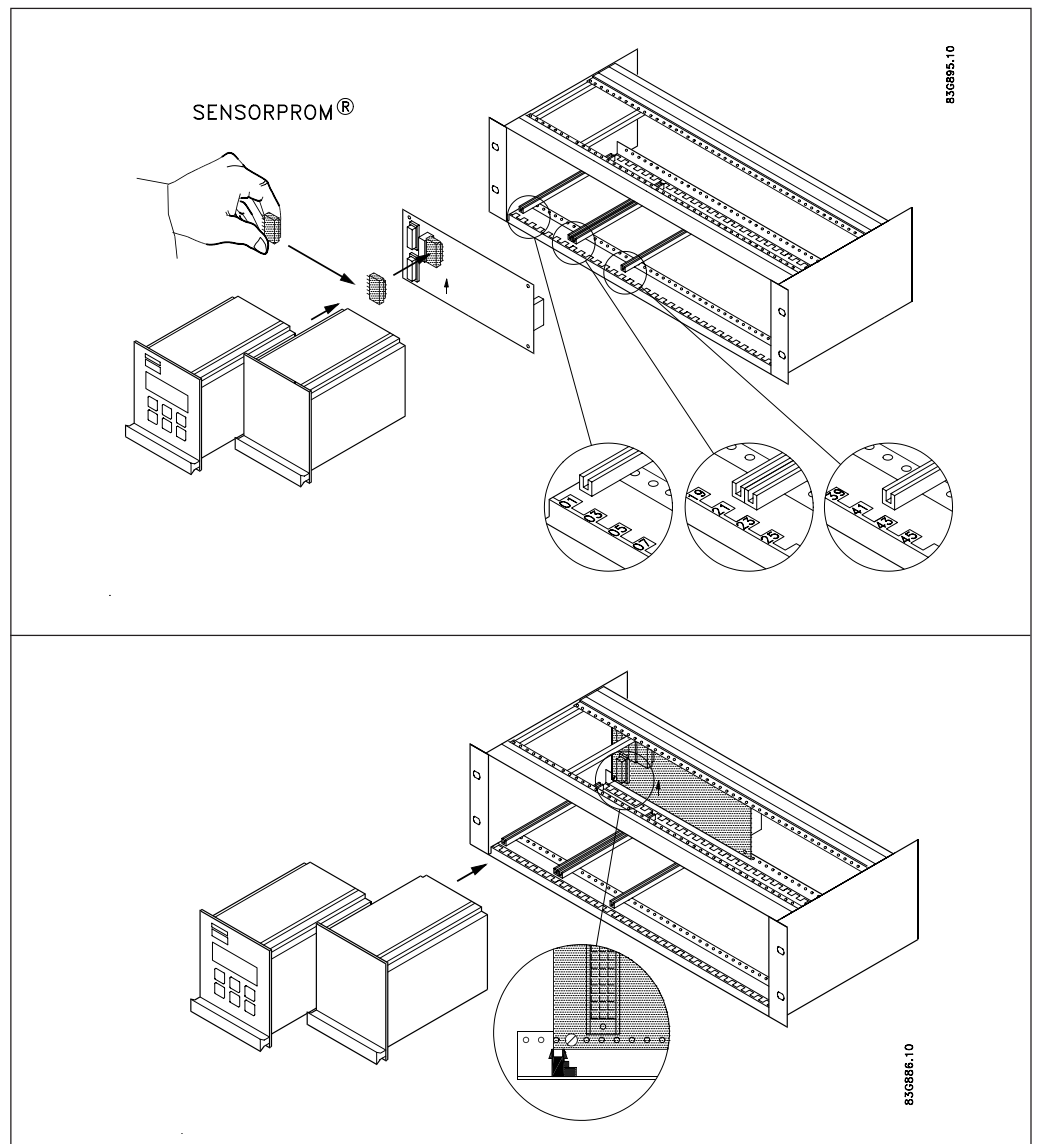
1. Mount the SENSORPROM® memory unit on the connection board as shown. The SENSORPROM® unit is supplied with the sensor in the terminal box.
2. Mount the connection board into the back of the enclosure.
3. Connect the cables as shown under "Electrical connection", chapter 7.
4. Mount the enclosure into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

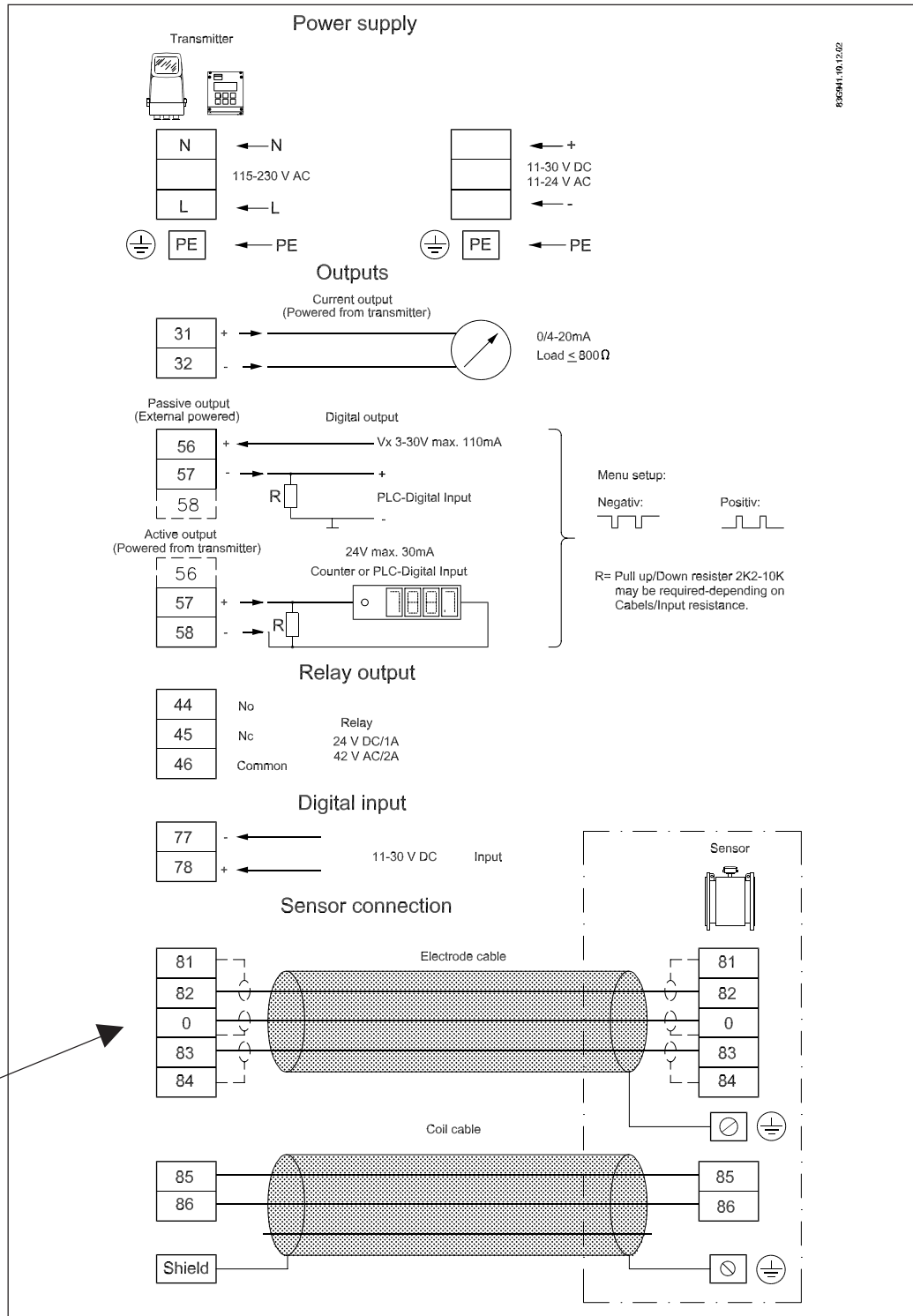
### 6.4 Transmitter Cleaning unit



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**

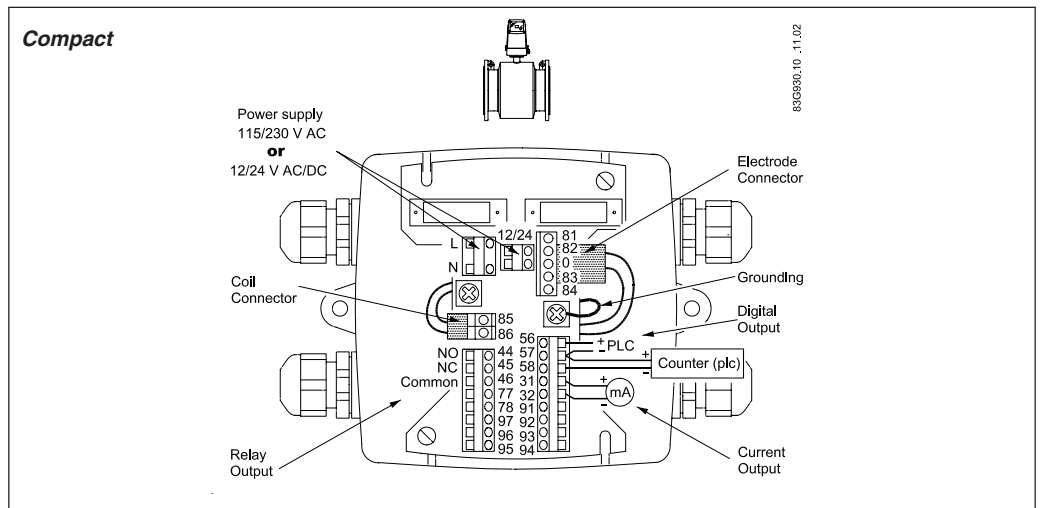
If long cables in noise environment, we recommend to use screened cable.

**Electrodes cables**

Dotted connections only to be when using special electrode cable.

7.2 Wiring diagram for transmitter 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:

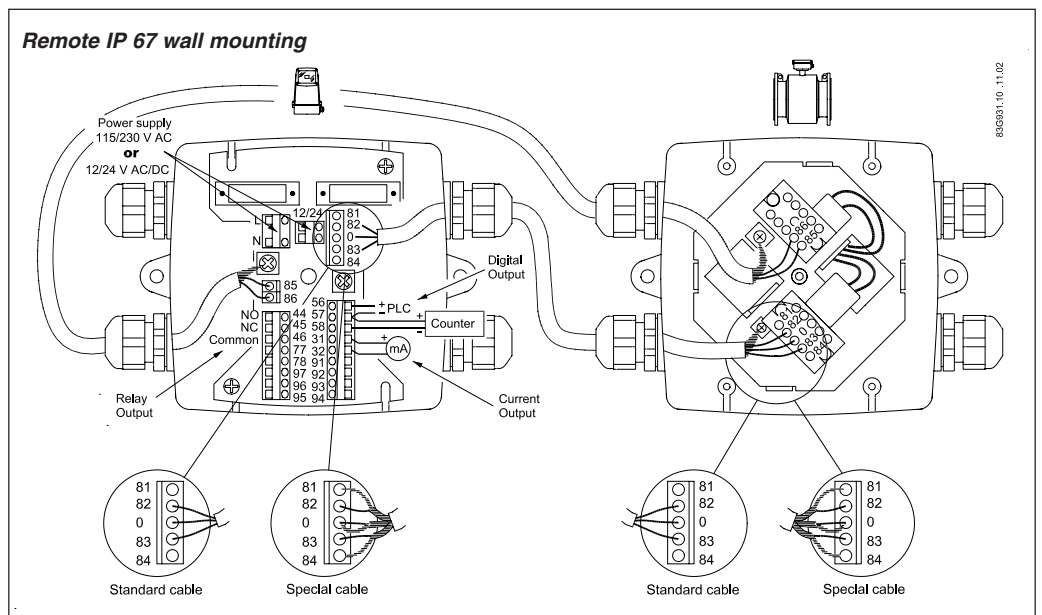
The screen must only be connected at the sensor end via a 1.5 µF capacitor. The screen must never be connected at both ends.

Remote installation

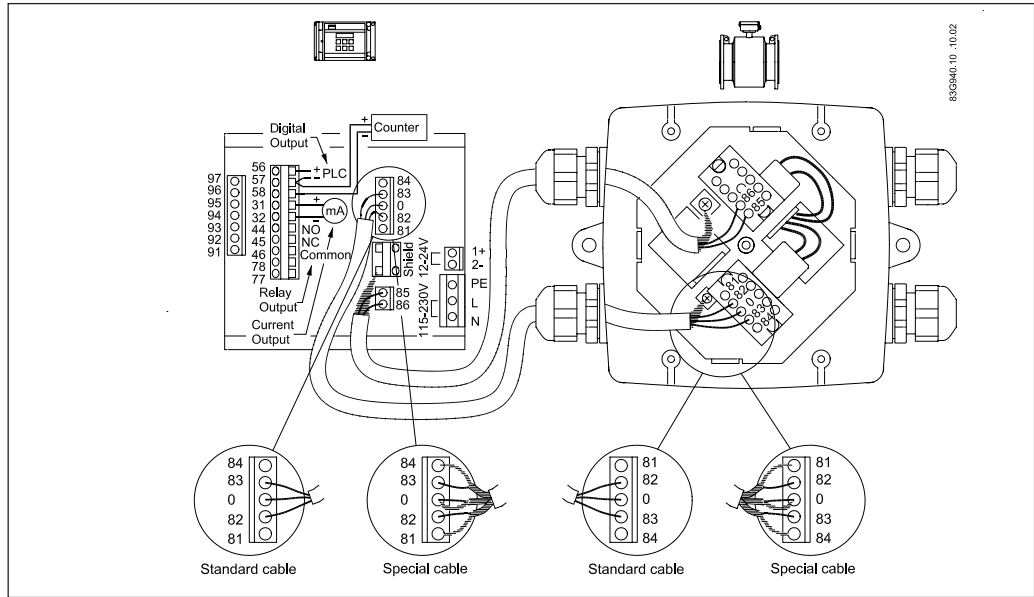
Sensor cables

- 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.

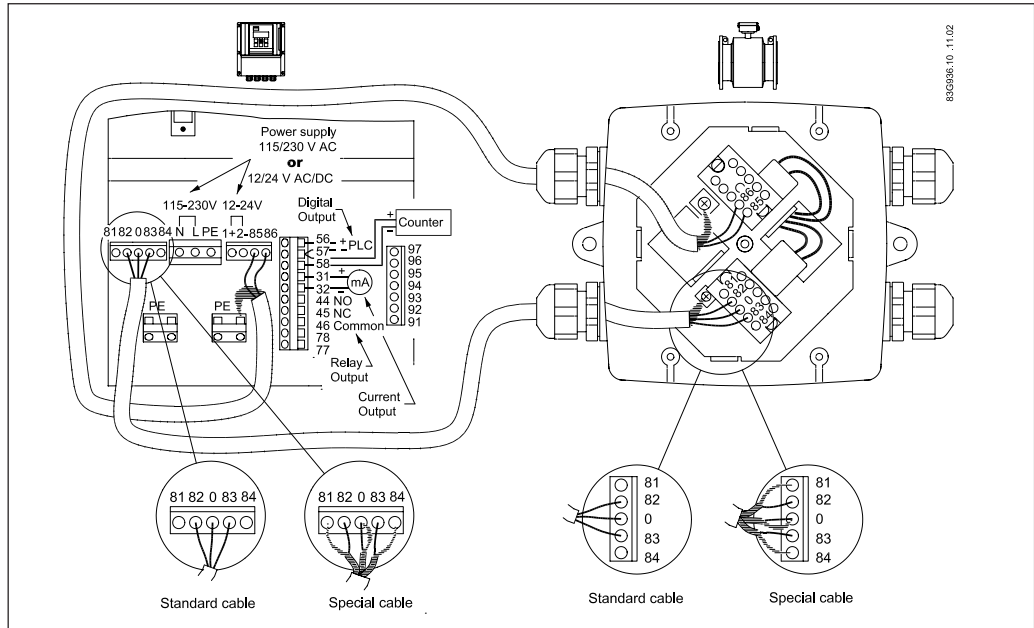


19" IP 20 version



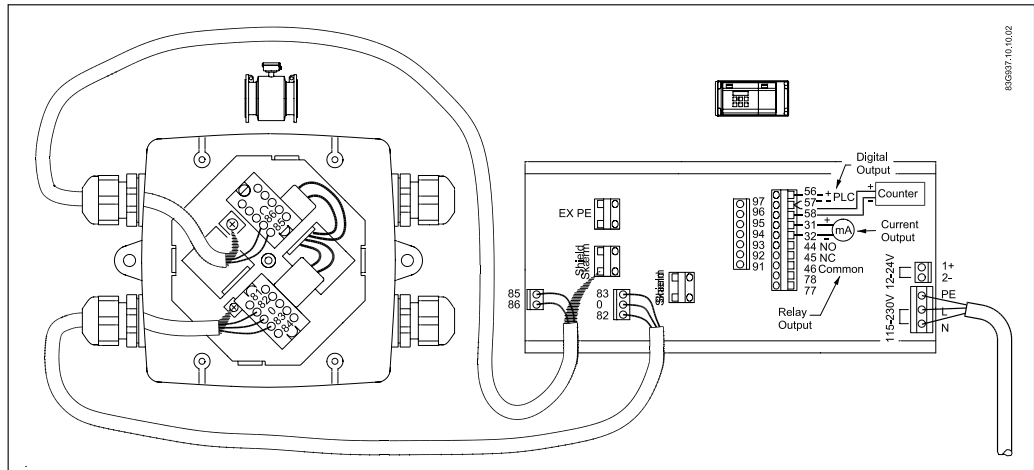
83G940.10 .10.02

19" IP 66 version



83G966.10 .11.02

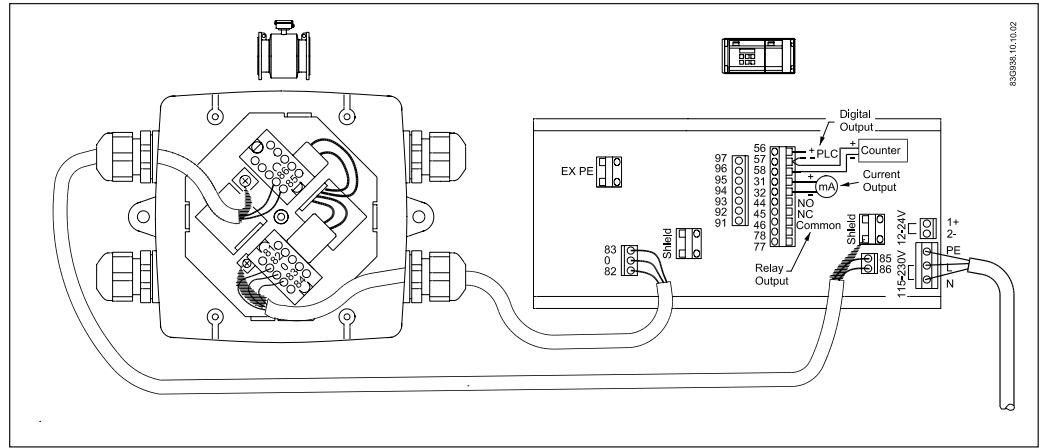
19" IP 20 version  
EEx (ia/ib) DN ≤ 300



83G937.10.10.02

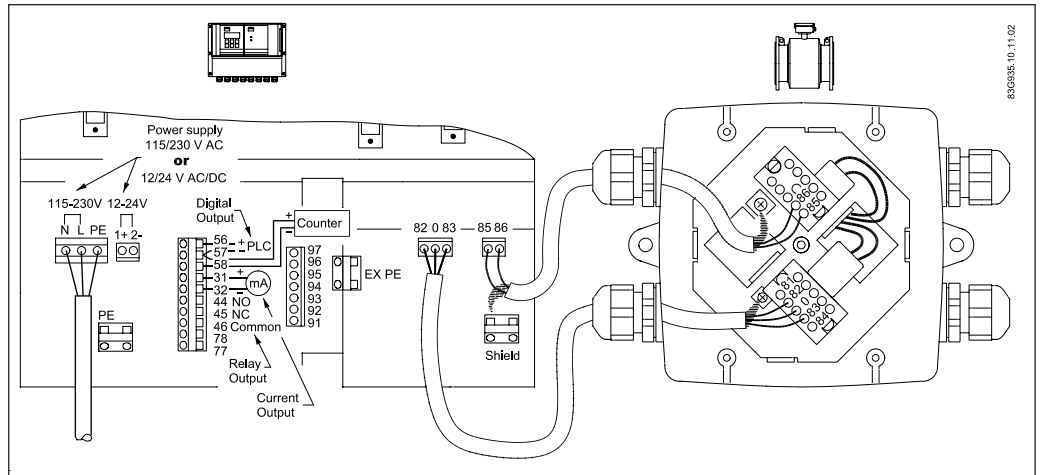
SITRANS F M MAGFLO® 7. Electrical connection

19" IP 20 version  
EEx e (ib) DN ≥ 350



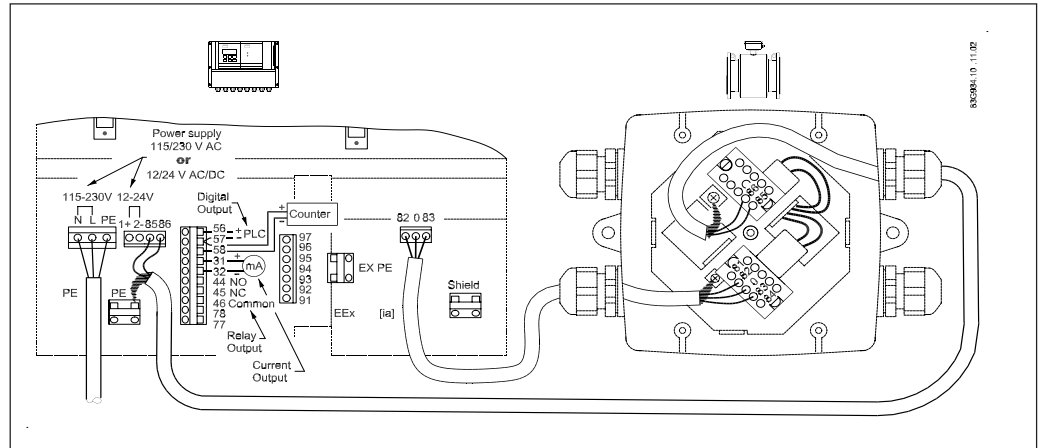
83G938.10.11.02

19" IP 66 version  
EEx (ia/ib) DN ≤ 300



83G935.10.11.02

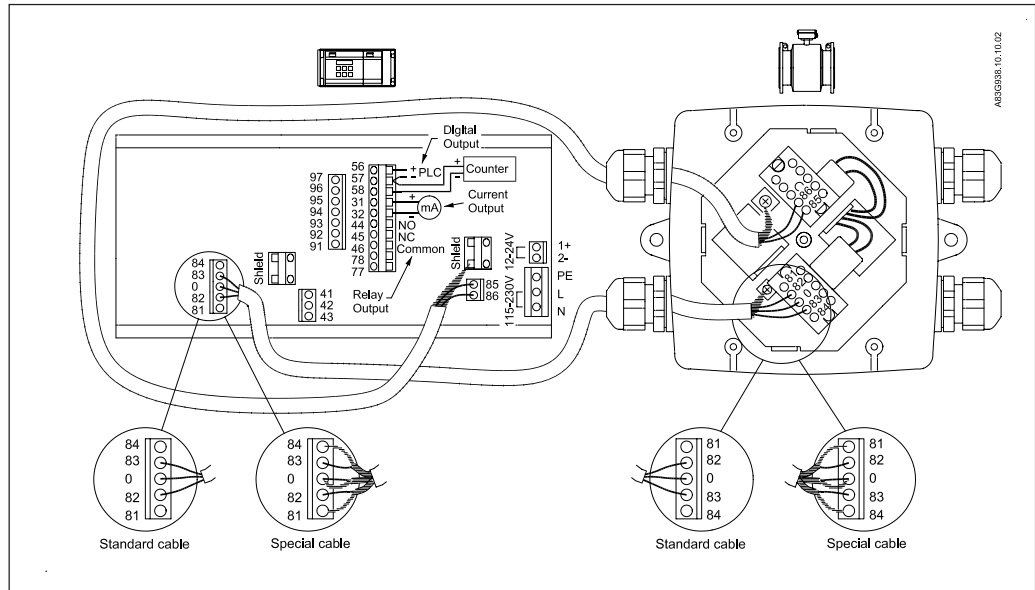
19" IP 66 version  
EEx e (ib) DN ≥ 350



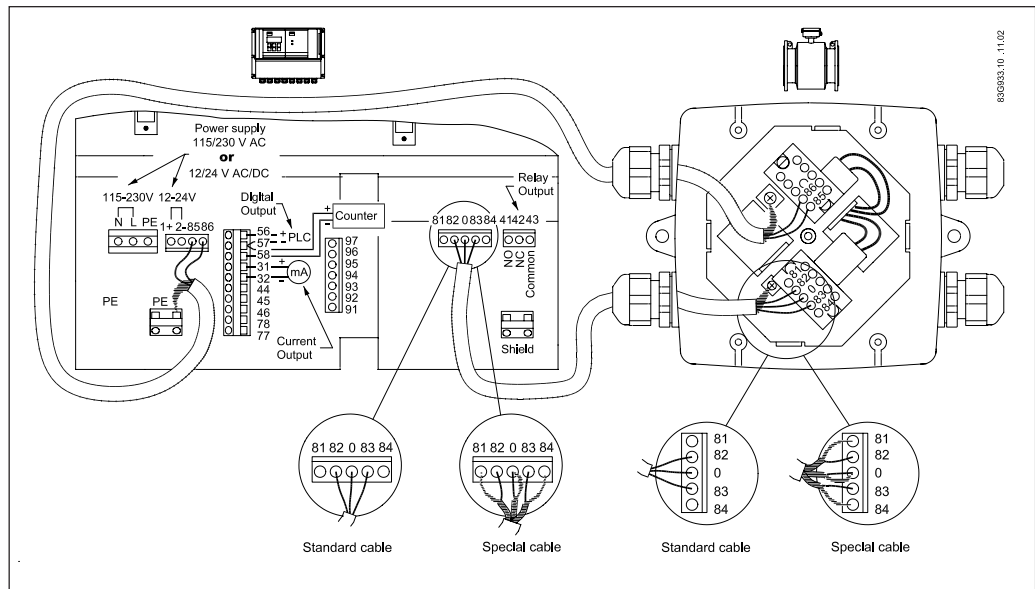
83G984.10.11.02

E C

19" IP 20 version with cleaning



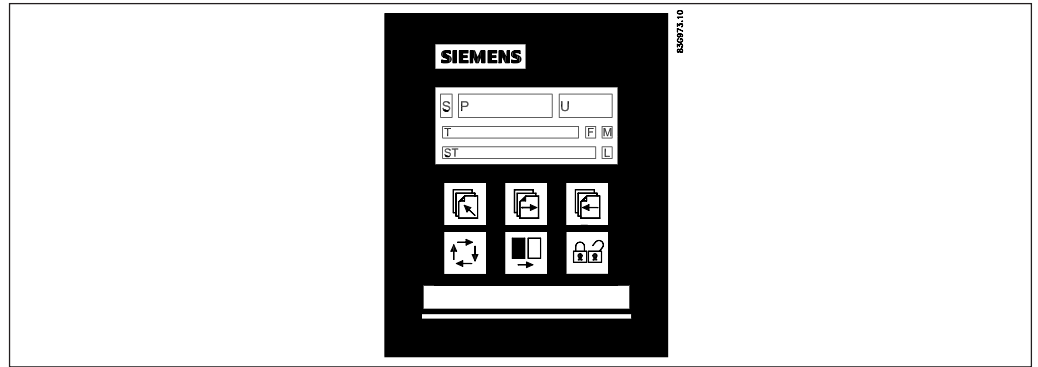
19" IP 66 version with cleaning











8. Commissioning

8.1 Keypad and display layout



Keypad

The keypad is used to set the flowmeter. The function of the keys 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 either will add information to the title line or keep individual information independent of the title line.

**F: The alarm field.**  **Two flashing triangles will appear by 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

## 8.2 Menu build-up

The menu structure of a specific transmitter type is shown in a menu overview map. Details of how a specific parameter is set is shown in a menu detail map for the specific parameter. A detail map is valid for each type of transmitter if not indicated otherwise. The menu structure is valid for the title and subtitle line only. The upper line is for primary readings only and will always be active with either flowrate, totalizer 1 or totalizer 2.

The menu is built up in two parts. An **operator menu** and a **setup menu**.

### Operator menu

The operator menu is for daily operation. The operator menu is customised in the operator menu setup. The transmitter always starts in operator menu No. 1. The page forward and page backward keys are used to step through the operator menus.

### Setup menu

The setup menu is for commissioning and service only.

Access to the setup menu is gained by pressing the top up key for 2 seconds. The setup menu operates in two modes:

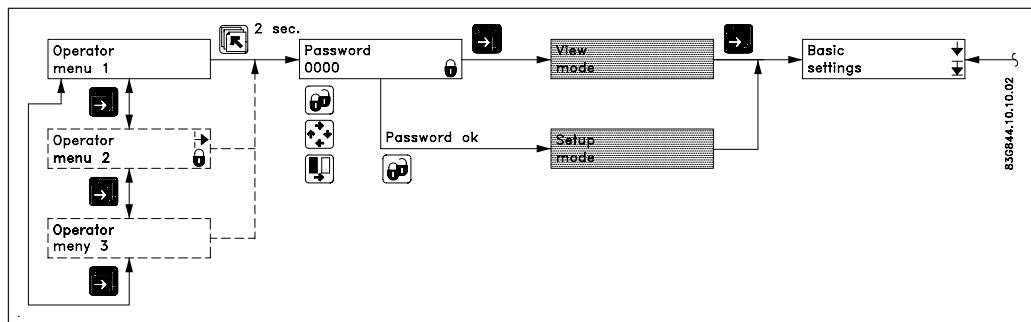
- View mode
- Setup mode

**View mode** is a read only mode. The pre-selected settings can only be scanned.

**Setup mode** is a read and write mode. The pre-selected settings can be scanned and changed. Access to the setup mode is password protected. The factory set password is 1000.

Access to a submenu in the set up menu is gained by the lock key. A short press on a top up key will bring you back to the previous menu. A long press (2 sec.) on the top up key will exit the setup menu and bring you back to operator menu No. 1.

### 8.2.1 Password



The **SETUP MENU** can be operated in two different modes:

**VIEW MODE** (Read only)  
**CHANGE MODE** (Read and write mode)

Access to view mode is always gained by pressing the forward key when in the password menu.

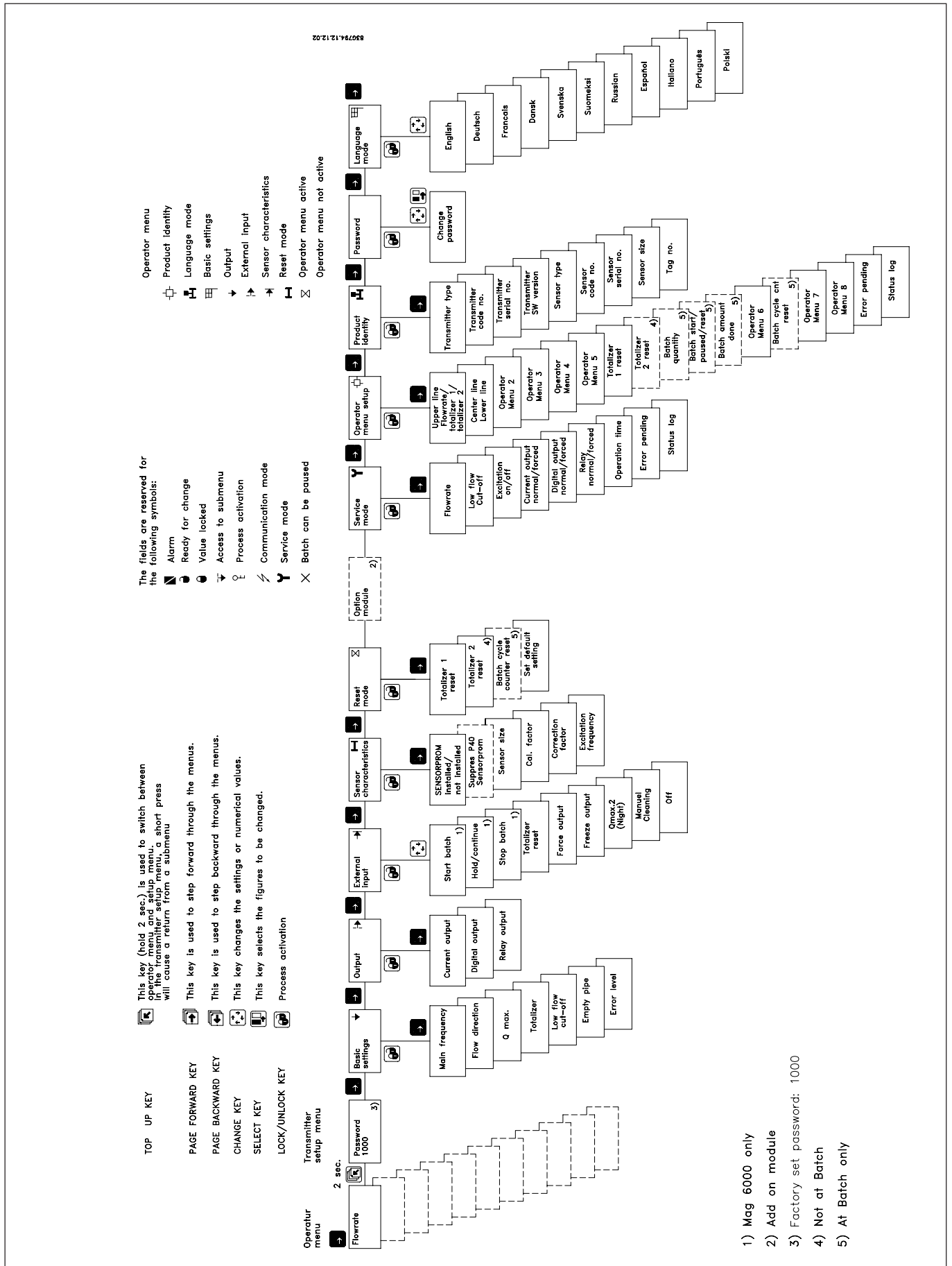
Access to change mode is password protected. The password is factory set to 1000, but can be changed to any value between 1 and 9999 in the change password menu.

The factory setting of 1000 can be re-established as follows:

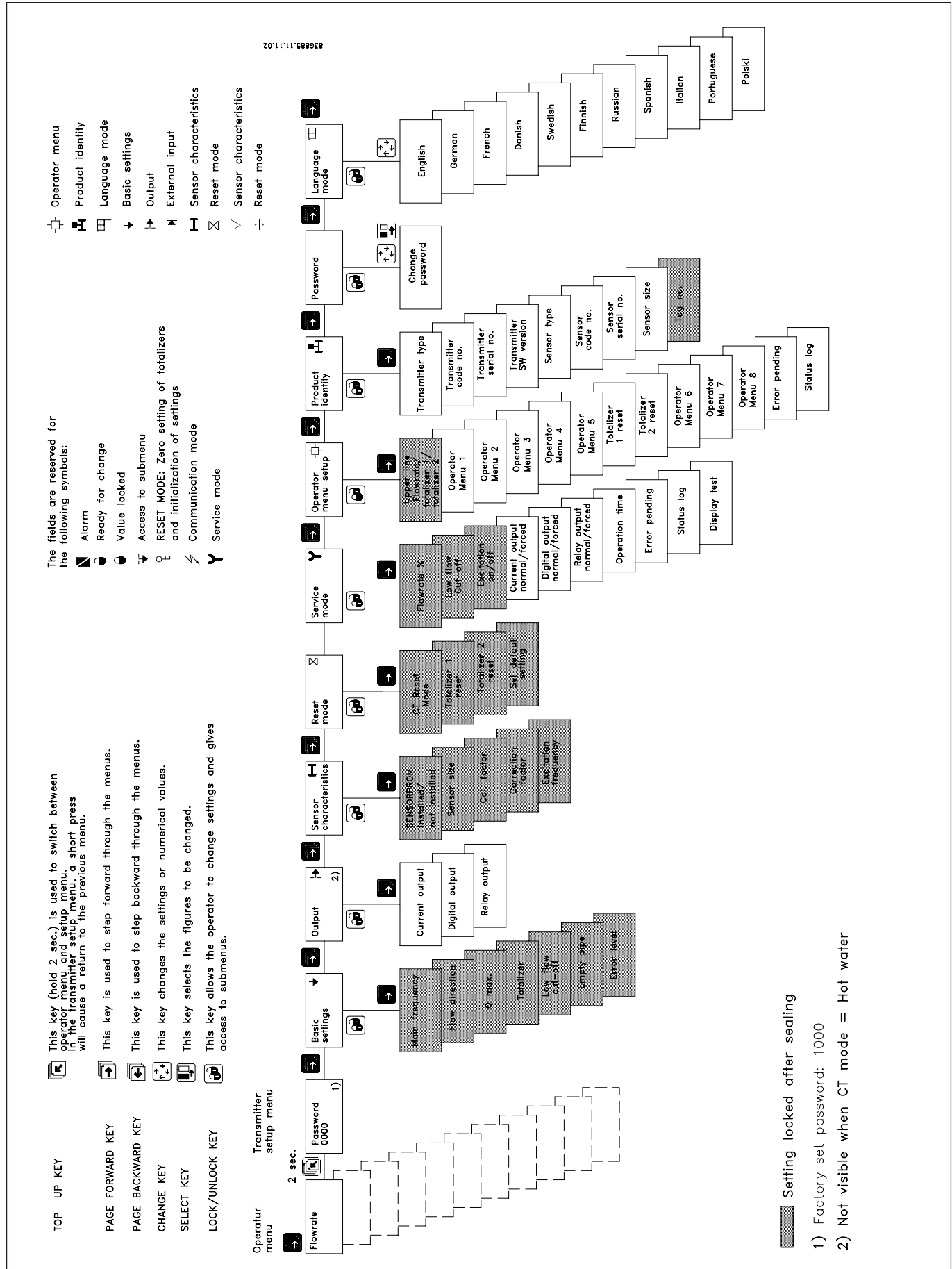
- Switch off power supply
- Press the TOP UP key and switch on the power supply
- Release the key after ROM and RAM tests are completed

The user code is now reset to 1000.

8.3.1 MAG 5000 and MAG 6000



8.3.2 MAG 5000 CT and MAG 6000 CT



### 8.4.1 Basic settings

**Main frequency**  
To select the main power supply frequency corresponding to the country in which the flowmeter is installed.  
(US = 60 Hz)

**Flow direction**  
Select the correct flow direction in the pipe

**$Q_{max.}$**   
Sets the measuring range, the analog outputs and the frequency output. Value, decimal point, unit and time can be set individually (setting is dimension dependent).

**$Q_{max.2}$**   
Sets the measuring range, the analog outputs and the frequency output. Value, decimal point, unit and time can be set individually (setting is dimension dependent). Only visible when it has been chosen as external digital input.

**Totalizers**  
To set unit and decimal point.



**Low flow cut off**  
To set a % of selected  $Q_{max.}$ . To filter noise in the installation. Influences display and all outputs.

**Error level**  
To select which error level, the flowmeter will detect an error.

**Empty pipe cut off**  
Set on - the alarm will indicate when sensor is running empty. All readings, display and outputs will indicate zero.

852794.1.10.02

Comma 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 .

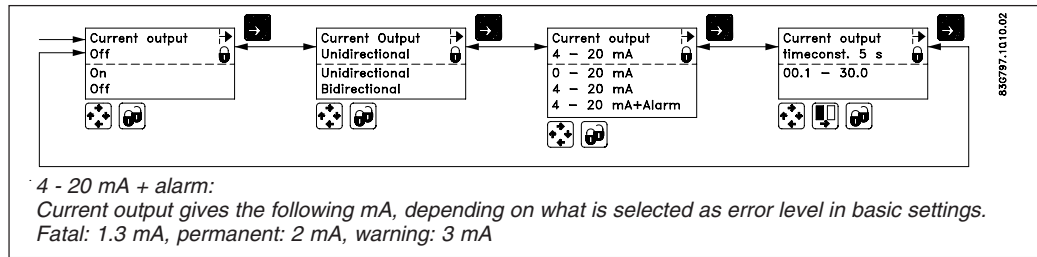
Units are changed by means of the CHANGE KEY  with the cursor placed below the unit selected. Select units (cursor moved) by means of the SELECT KEY .

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

**$Q_{max. 2}$  - is only visible when it has been chosen as external input.**

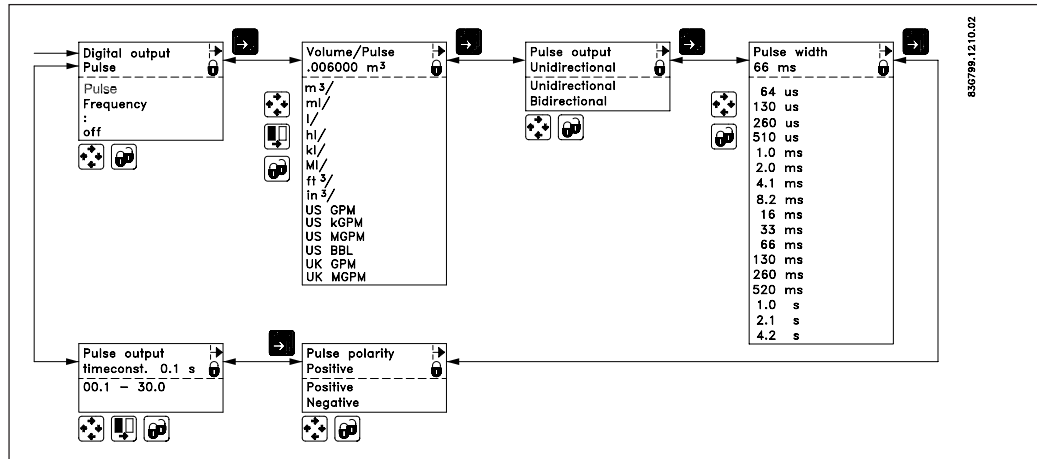
8.4.2  
Outputs

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

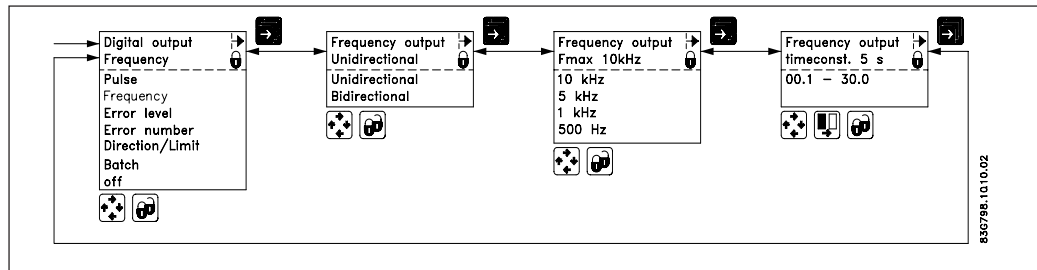


The current output must be set off when not used.

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

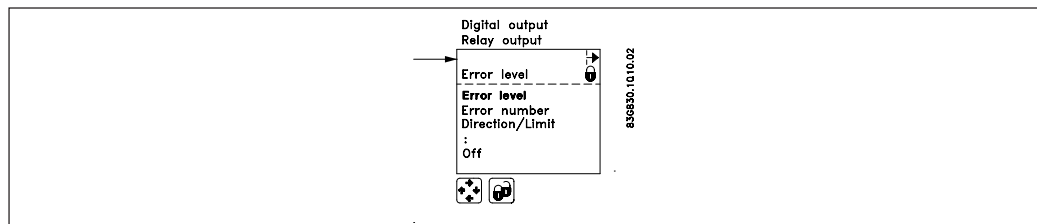


**Digital output**  
*Frequency*  
*Proportional to flowrate*  
(Terminal 56, 57, 58)

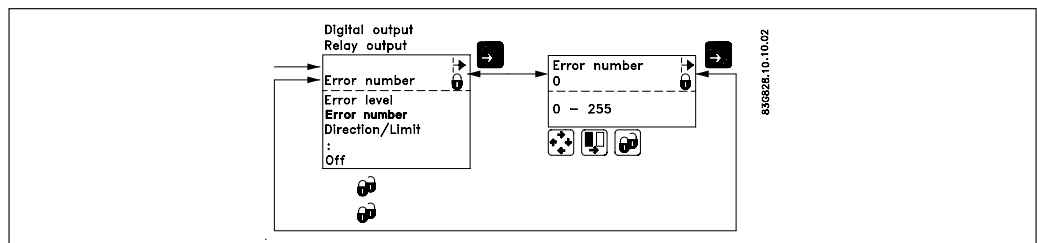


8.4.3  
Digital and relay outputs

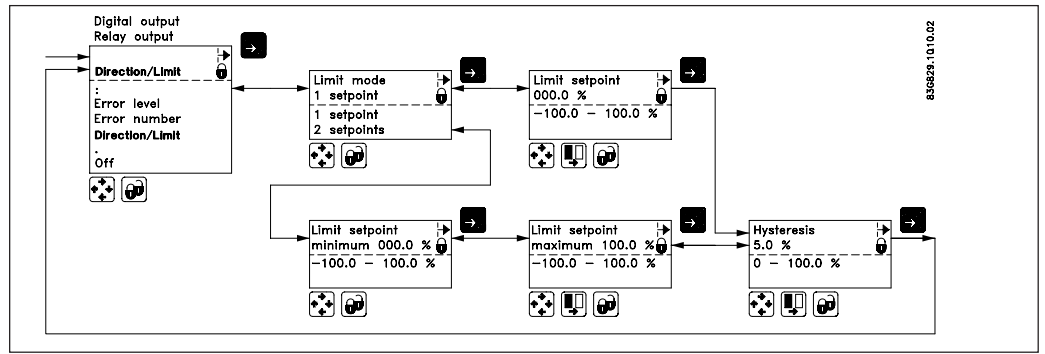
**Error level**



**Error number**



**Limit/direction**



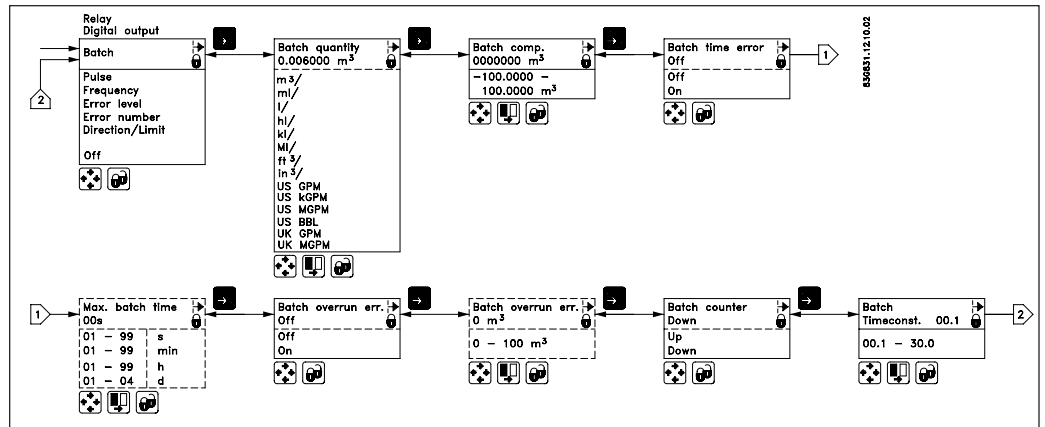
Limit switches are available for both digital as well as relay output.

**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)



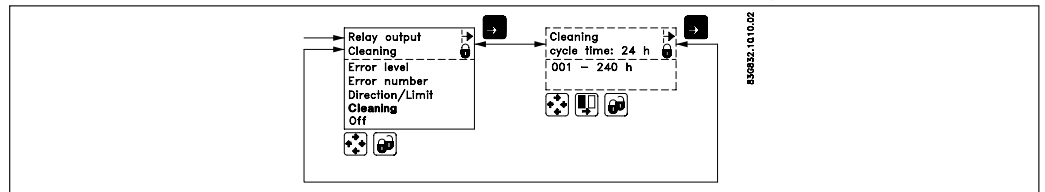
**Note**

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

**8.4.4**

**Relay outputs**

**Cleaning**

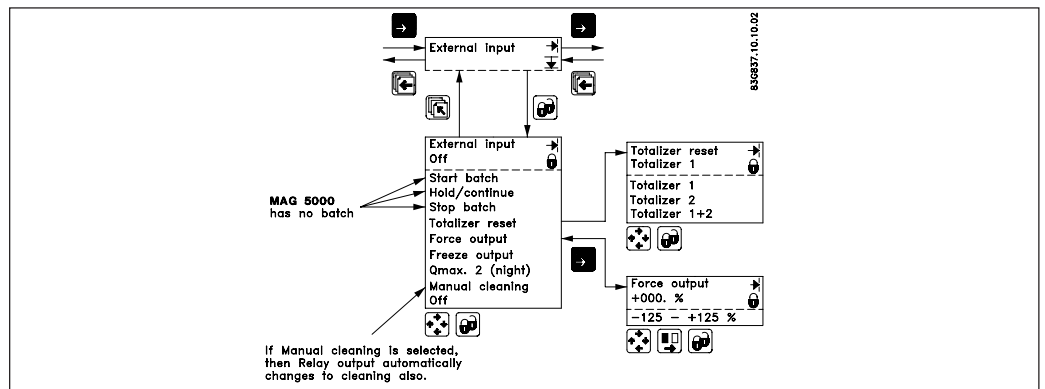


The relay output must always be used to operate the cleaning unit when a cleaning unit has been installed together with the transmitter. The relay output cannot be used for other purposes.

**8.4.5**

**External input**

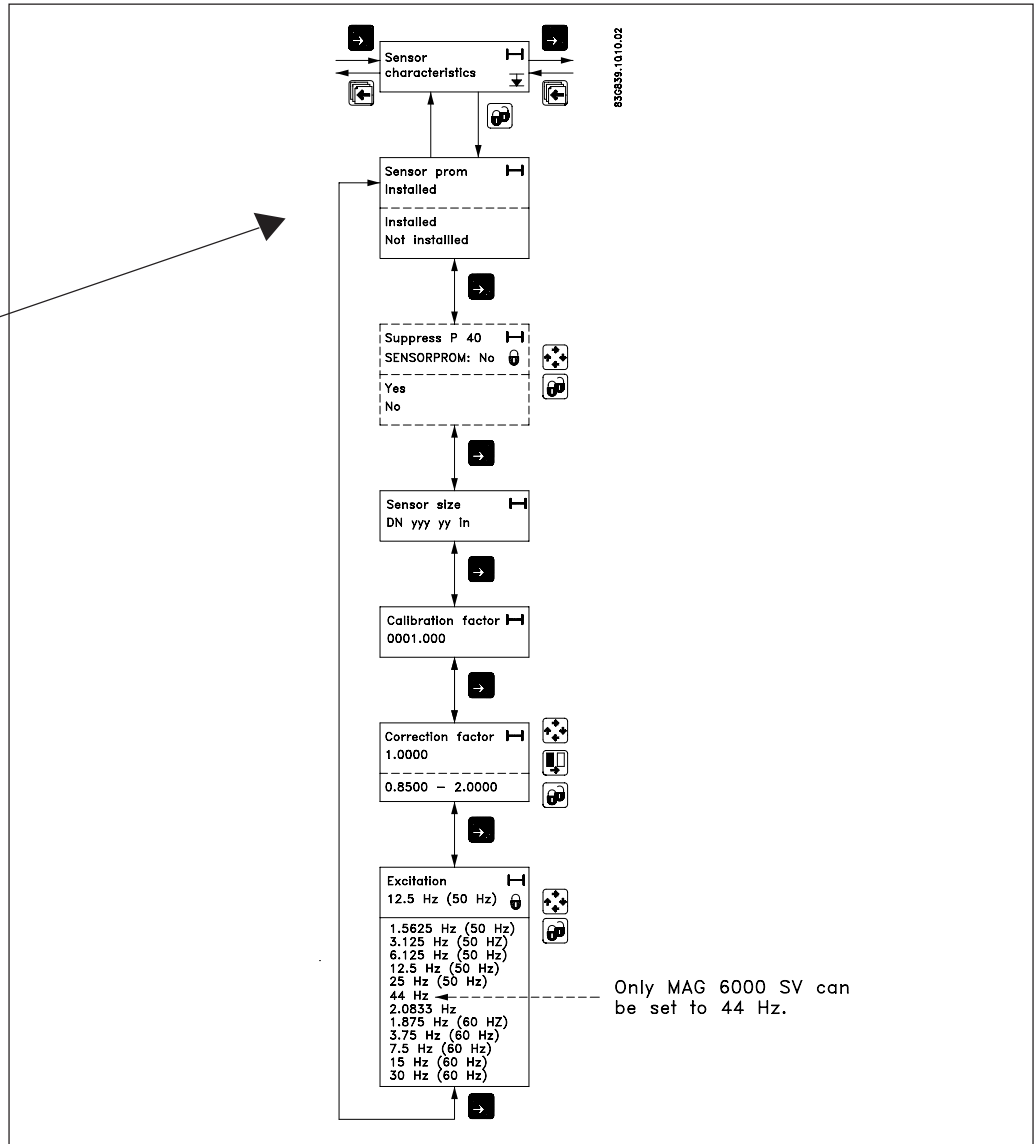
Non CT versions only



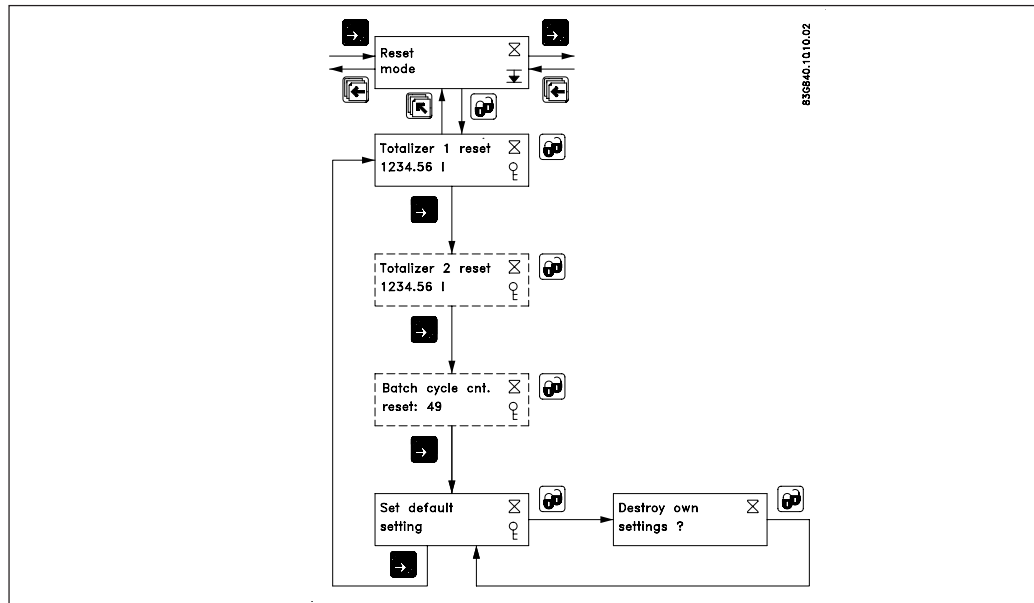
Batch control is available on MAG 6000 only.

8.4.6  
Sensor characteristics

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

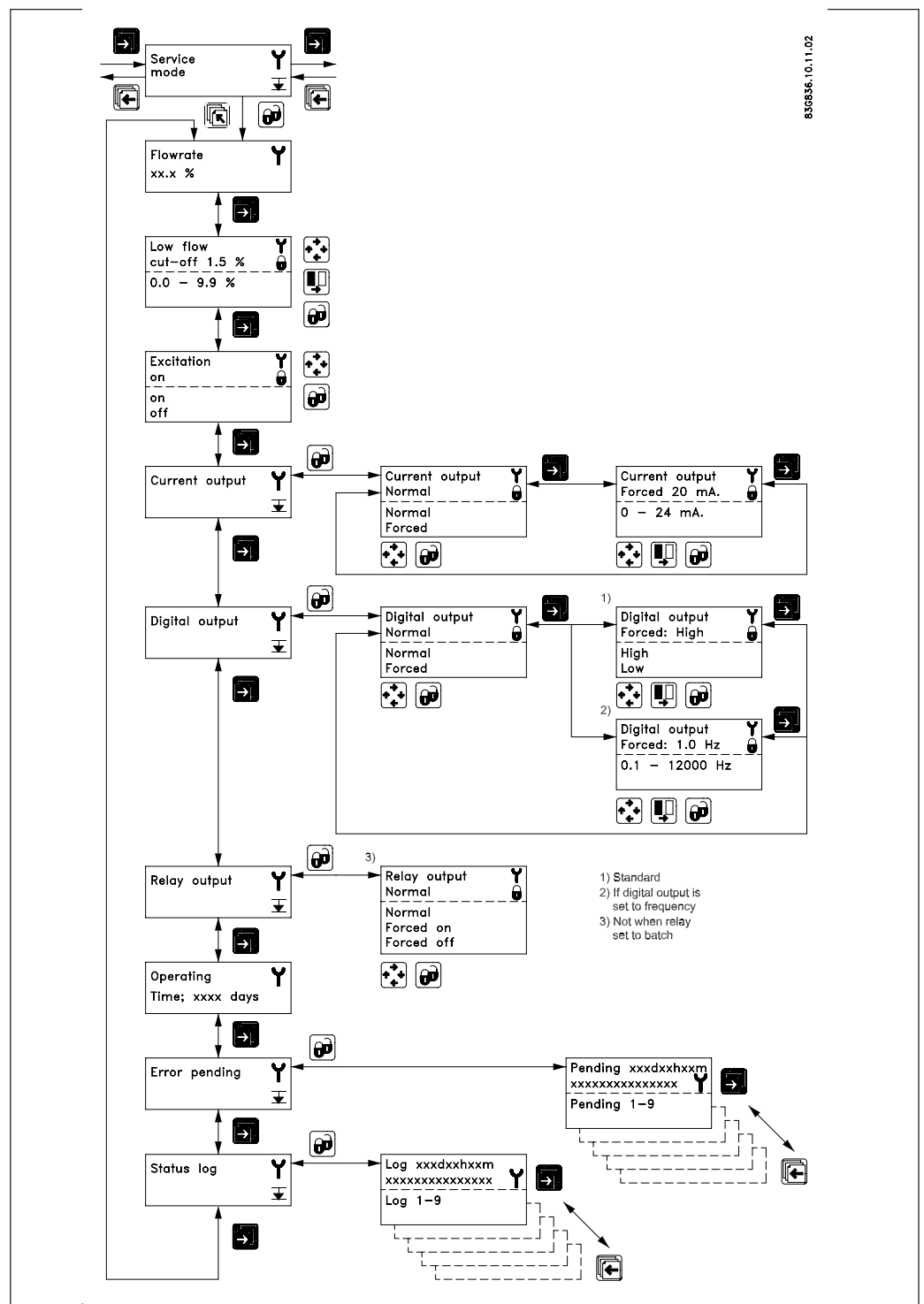


8.4.7  
Reset mode





### 8.4.8 Service mode



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

#### The error system

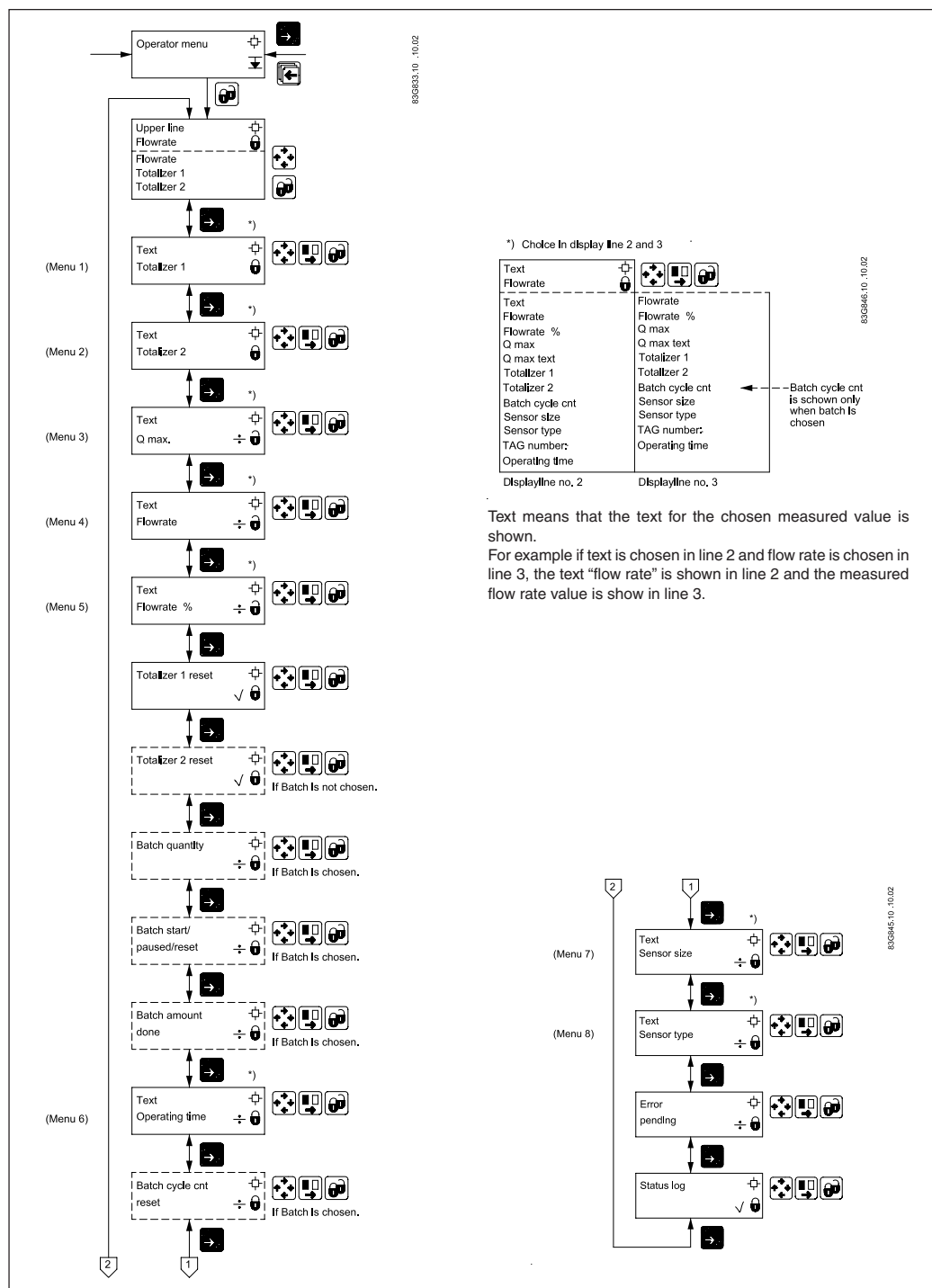
The error system is divided into an error pending list and a status log list. Time is gained as days, minutes and hours since the error has occurred.

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



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

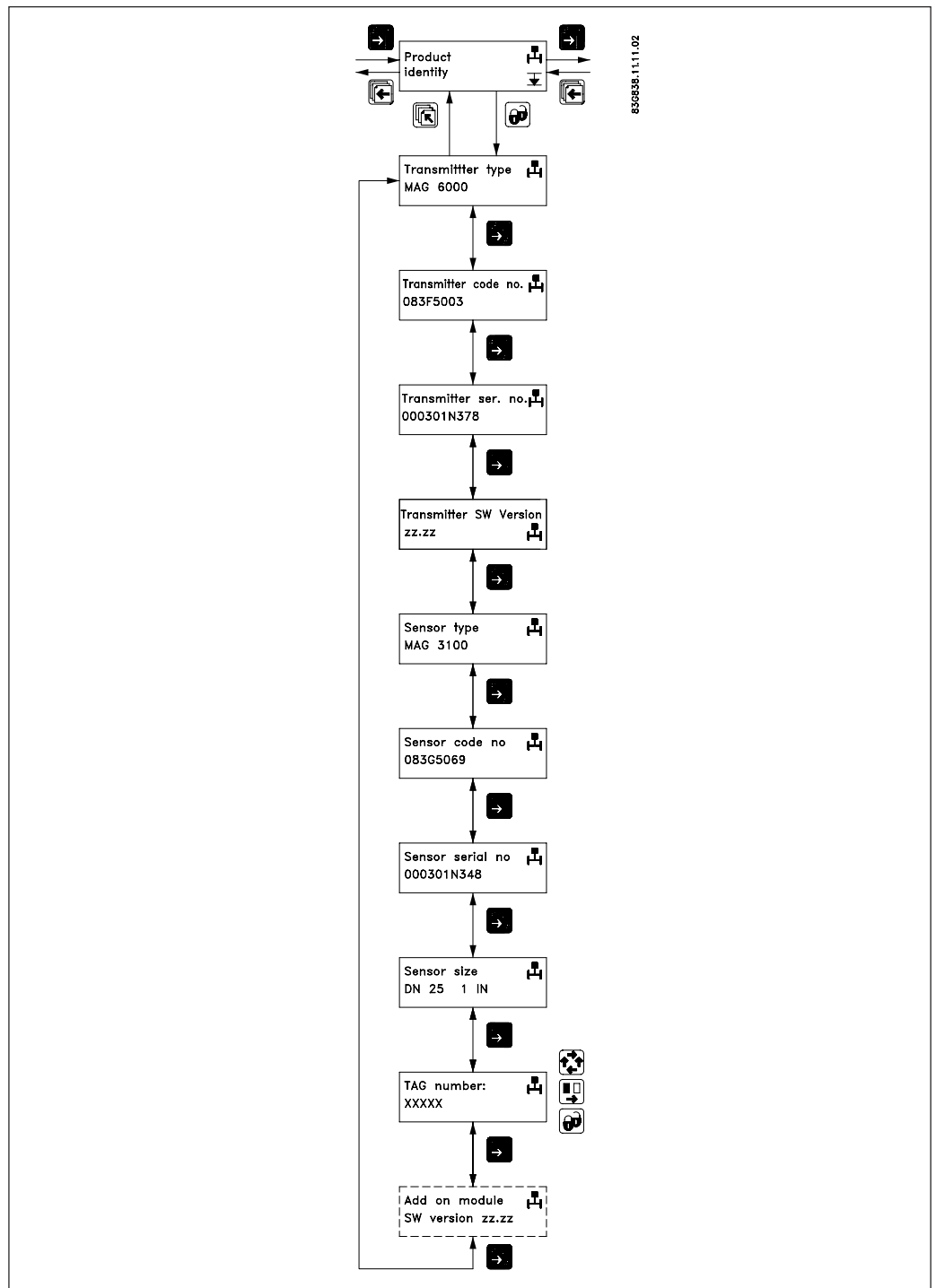
The two lower lines are for individual operator information. Information which the operator can scroll through with the forward key.

- A closed lock key in the operator menu setup, means that the menu is enabled when viewing the operator menu.
- An open lock key symbol, 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.

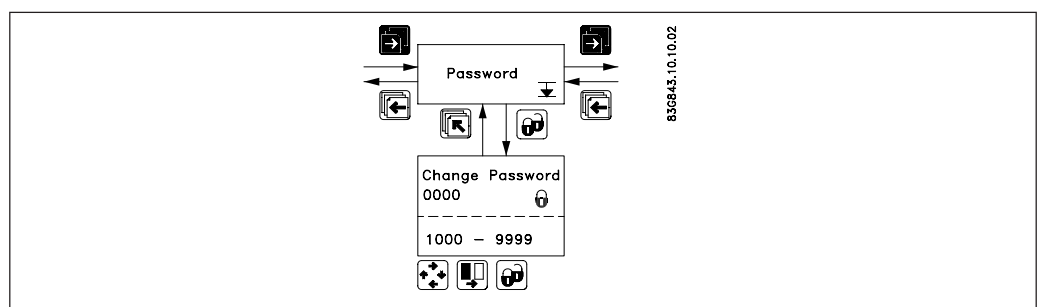
The lower line may be used for an additional flow reading to the reading already available in the upper line.

8.4.10  
Product identity

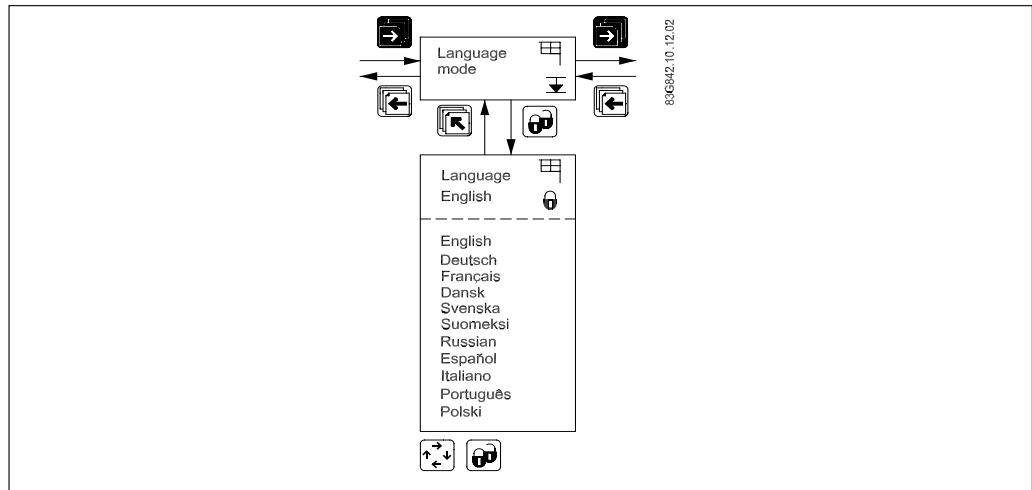


Software version of add-on module is only available if the add-on module has been installed.

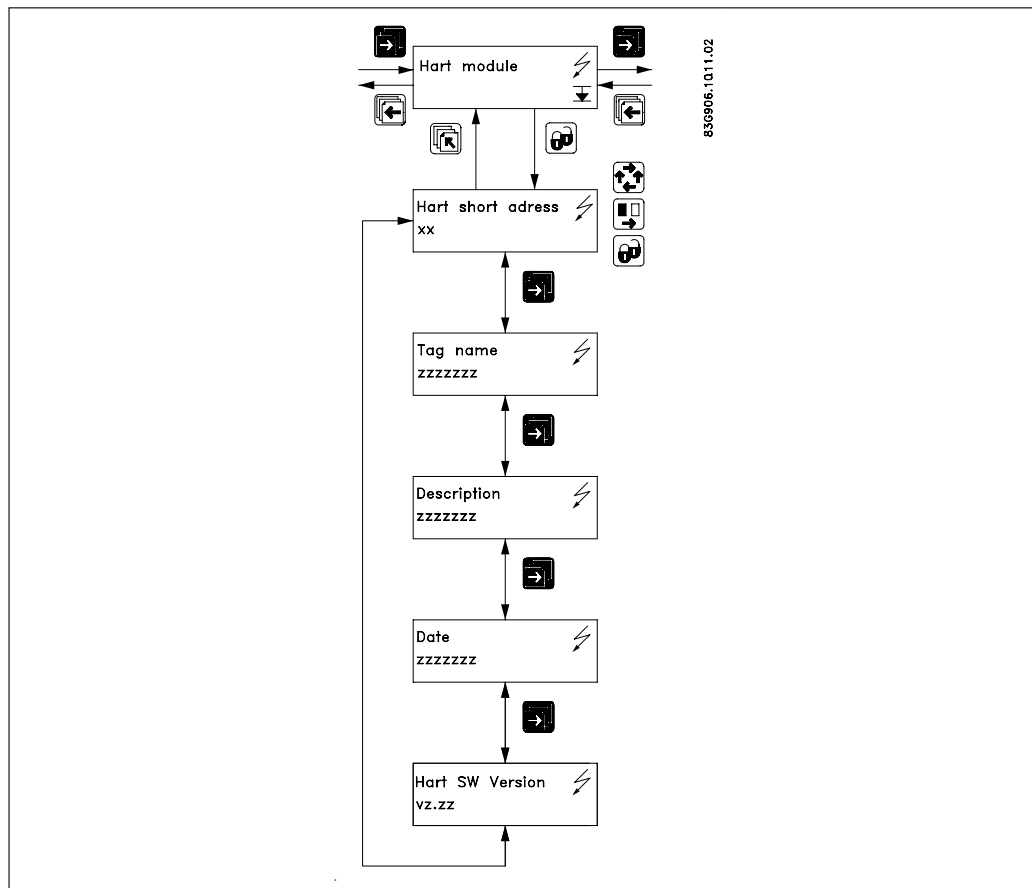
8.4.11  
Change password



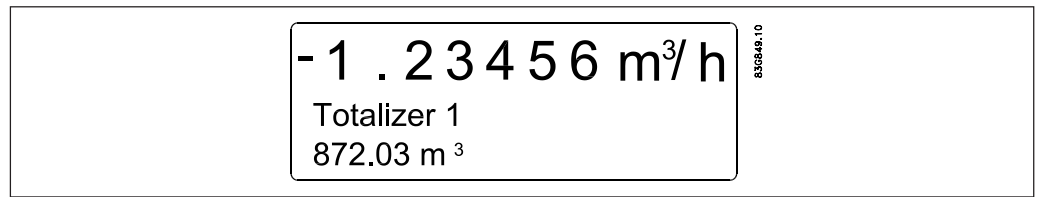
8.4.12  
Language mode



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



### 8.5.1 Flow rate



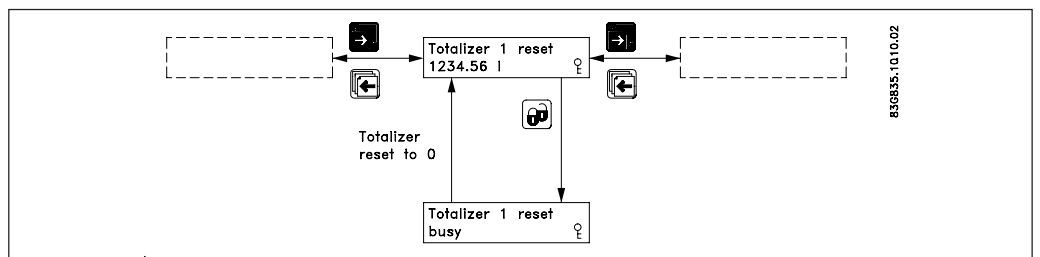
The 1<sup>st</sup> display line is always active and shows the value enabled in the operator menu setup.

- Flow rate
- Totalizer 1
- Totalizer 2

The 2<sup>nd</sup> and 3<sup>rd</sup> display lines are individually set in the operator menu. The page forward key steps through the enabled settings.

- Flow rate
- Totalizer
- Totalizer reset
- Batch control
- Batch cycle counter
- Batch cycle counter reset
- Pipe size
- Sensor type
- Pending errors
- Status log
- Tag No.

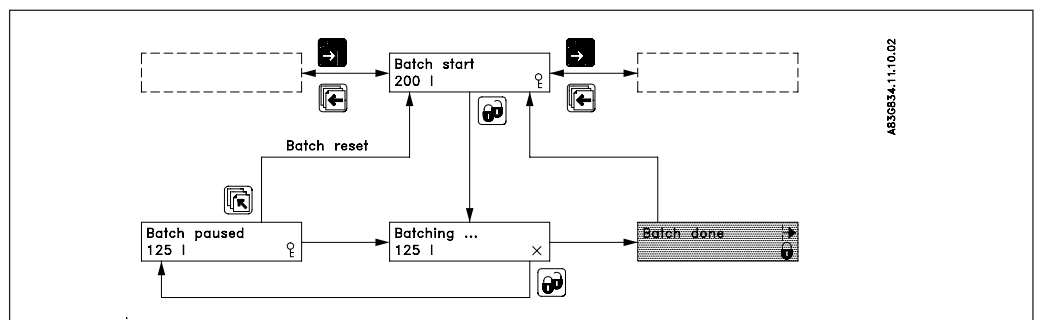
### 8.5.2 Totalizer



A totalizer is reset by pressing the lock key when the corresponding totalizer reset window is open.

### 8.5.3 Batch

(Only available on  
MAG 6000)



A batch can be started, paused or stopped from the operator menu, in addition to the externally operated batch control. The batch is controlled using the lock and the top up keys.

The lock key:

- Starts the batch
- Holds the batch (pause) when pressed during batching
- Restarts the batch to continue when pressed during a pause.

The top up key resets a batch completely during a pause.

#### **Batch cycle counter**

The accumulated number of performed batches can be viewed when enabled in the operator menu setup.

#### **Batch cycle counter reset**

The batch cycle counter is reset by pressing the lock key in the "batch cycle cnt reset" menu.

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 <sub>max.</sub>	Dim. dependent	Dim. dependent
- Volume units	Dim. dependent	m <sup>3</sup> , ml, l, kl, hl, Ml, 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, Ml, 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, Ml, 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 <sub>max.</sub> 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 <sub>max.</sub> , 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**  
Dimension dependent  
factory settings  
MAG 5000 and MAG 6000

DN		fac.set.	Q <sub>max.</sub>				unit	Volume/ pulse	Pulse unit	Totalizer unit
mm	[inches]		MAG 5100 W		MAG 1100, 3100, 3100 W					
			min.	max.	min.	max.				
2	1/12	30	-	-	3.9	156.7	l/h	1	l	l
3	1/8	70	-	-	6.4	254.5	l/h	1	l	l
6	1/4	300	-	-	25.5	1017	l/h	1	l	l
10	3/8	900	-	-	70.7	2827	l/h	1	l	l
15	1/2	2000	-	-	159.1	6361	l/h	1	l	l
25	1	5000	442.0	17671	442.0	17671	l/h	10	l	l
40	1 1/2	12	1.2	45	1.2	45	m <sup>3</sup> /h	10	l	l
50	2	20	1.6	63	1.8	70	m <sup>3</sup> /h	10	l	l
65	2 1/2	30	2.5	100	3.0	119	m <sup>3</sup> /h	100	l	l
80	3	50	4.0	160	4.6	180	m <sup>3</sup> /h	100	l	l
100	4	120	6.3	250	7.1	282	m <sup>3</sup> /h	100	l	l
125	5	180	10.0	400	11.1	441	m <sup>3</sup> /h	100	l	m <sup>3</sup>
150	6	250	15.7	629	16.0	636	m <sup>3</sup> /h	100	l	m <sup>3</sup>
200	8	400	24.9	997	28.3	1130	m <sup>3</sup> /h	1	m <sup>3</sup>	m <sup>3</sup>
250	10	700	40.0	1600	44.2	1767	m <sup>3</sup> /h	1	m <sup>3</sup>	m <sup>3</sup>
300	12	1000	62.5	2500	63.7	2544	m <sup>3</sup> /h	1	m <sup>3</sup>	m <sup>3</sup>
350	14	1200	86.6	3463	86.6	3463	m <sup>3</sup> /h	1	m <sup>3</sup>	m <sup>3</sup>
400	16	1800	113.1	4523	113.1	4523	m <sup>3</sup> /h	1	m <sup>3</sup>	m <sup>3</sup>
450	18	2000	143.2	5725	143.2	5725	m <sup>3</sup> /h	1	m <sup>3</sup>	m <sup>3</sup>
500	20	3000	176.8	7068	176.8	7068	m <sup>3</sup> /h	1	m <sup>3</sup>	m <sup>3</sup>
600	24	4000	254.5	10178	254.5	10178	m <sup>3</sup> /h	10	m <sup>3</sup>	m <sup>3</sup>
700	28	5000	346.4	13854	346.4	13854	m <sup>3</sup> /h	10	m <sup>3</sup>	m <sup>3</sup>
750	30	6000	397.7	15904	397.7	15904	m <sup>3</sup> /h	10	m <sup>3</sup>	m <sup>3</sup>
800	32	7000	452.4	18095	452.4	18095	m <sup>3</sup> /h	10	m <sup>3</sup>	m <sup>3</sup>
900	36	9000	573.0	22902	573.0	22902	m <sup>3</sup> /h	10	m <sup>3</sup>	m <sup>3</sup>
1000	40	12000	707.0	28274	707.0	28274	m <sup>3</sup> /h	10	m <sup>3</sup>	m <sup>3</sup>
1100	44	14000	855.3	34211	855.3	34211	m <sup>3</sup> /h	10	m <sup>3</sup>	m <sup>3</sup>
1200	48	15000	1018.0	40715	1018.0	40715	m <sup>3</sup> /h	10	m <sup>3</sup>	m <sup>3</sup>
1400	54	25000	-	-	1385.5	55417	m <sup>3</sup> /h	10	m <sup>3</sup>	m <sup>3</sup>
1500	60	30000	-	-	1590.5	63617	m <sup>3</sup> /h	10	m <sup>3</sup>	m <sup>3</sup>
1600	66	35000	-	-	1809.6	72382	m <sup>3</sup> /h	10	m <sup>3</sup>	m <sup>3</sup>
1800	72	40000	-	-	2290.3	91608	m <sup>3</sup> /h	10	m <sup>3</sup>	m <sup>3</sup>
2000	78	45000	-	-	2827.5	113097	m <sup>3</sup> /h	10	m <sup>3</sup>	m <sup>3</sup>

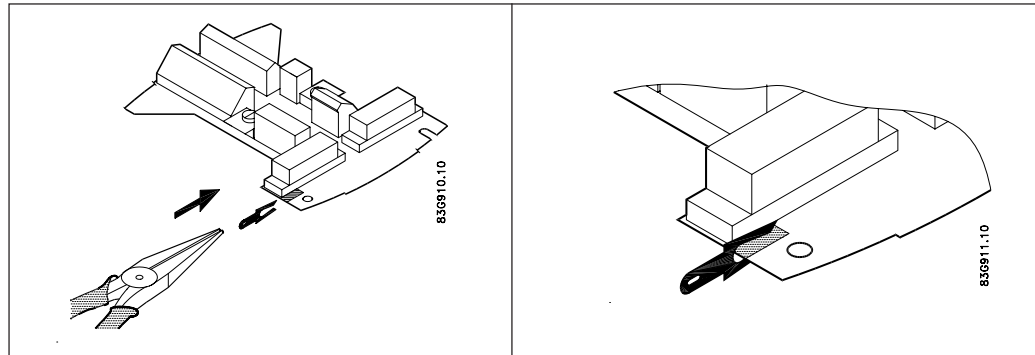
**8.6.3**  
Dimension dependent  
batch and pulse output  
settings

	Volume/pulse or batch quantity	
	min.	max.
DN 2	3.6 µl	0.09 m <sup>3</sup>
DN 3	5.9 µl	0.15 m <sup>3</sup>
DN 6	24 µl	0.62 m <sup>3</sup>
DN 10	65 µl	1.72 m <sup>3</sup>
DN 15	147 µl	3.86 m <sup>3</sup>
DN 25	409 µl	10.7 m <sup>3</sup>
DN 40	1.05 ml	27.5 m <sup>3</sup>
DN 50	1.64 ml	42.9 m <sup>3</sup>
DN 65	2.77 ml	72.5 m <sup>3</sup>
DN 80	4.19 ml	110 m <sup>3</sup>
DN 100	6.54 ml	172 m <sup>3</sup>
DN 125	10.2 ml	268 m <sup>3</sup>
DN 150	14.7 ml	386 m <sup>3</sup>
DN 200	26.2 ml	686 m <sup>3</sup>
DN 250	40.9 ml	1072 m <sup>3</sup>
DN 300	58.9 ml	1544 m <sup>3</sup>
DN 350	80.2 ml	2102 m <sup>3</sup>
DN 400	105 ml	2745 m <sup>3</sup>
DN 450	133 ml	3474 m <sup>3</sup>
DN 500	164 ml	4289 m <sup>3</sup>
DN 600	236 ml	6177 m <sup>3</sup>
DN 700	321 ml	8407 m <sup>3</sup>
DN 800	419 ml	10981 m <sup>3</sup>
DN 900	530 ml	13897 m <sup>3</sup>
DN 1000	654 ml	17157 m <sup>3</sup>
DN 1200	942 ml	24706 m <sup>3</sup>
DN 2000	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 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 select 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 selecting hot water, the output settings are not allowed and menu will not be shown on display.
- When selecting 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.

- Information without a functional error involved
- Warnings which may cause malfunction in the application. The cause of the error may disappear on its own
- Permanent errors which may cause malfunction in the application. The error requires an operator
- 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**

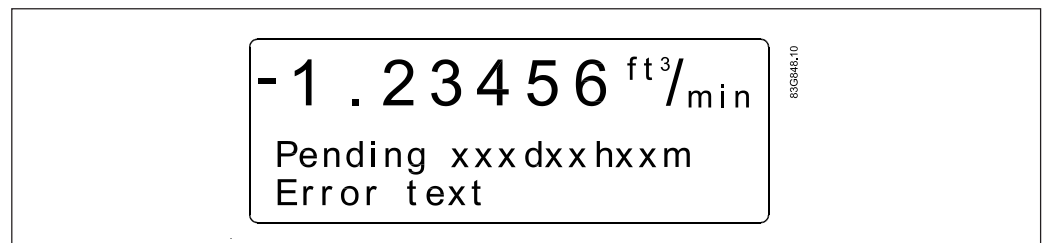
The first 9 standing errors are stored in “error pending”. When an error is removed it is removed from “error pending”.

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

- 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

The error information is displayed in the title and subtitle line. The title line will show the time since occurrence of error. The subtitle line will flash between an error text and a remedy text. The error text will indicate type of error (I, W, P or F), error No. and error text. The remedy text will inform the operator of the action to take to remove the 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 with an error 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 initialisation 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 initialisation 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 <sub>max.</sub>	Flow is above Q <sub>max.</sub> 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 defect	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 MASSFLO®, SONOFLO® 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

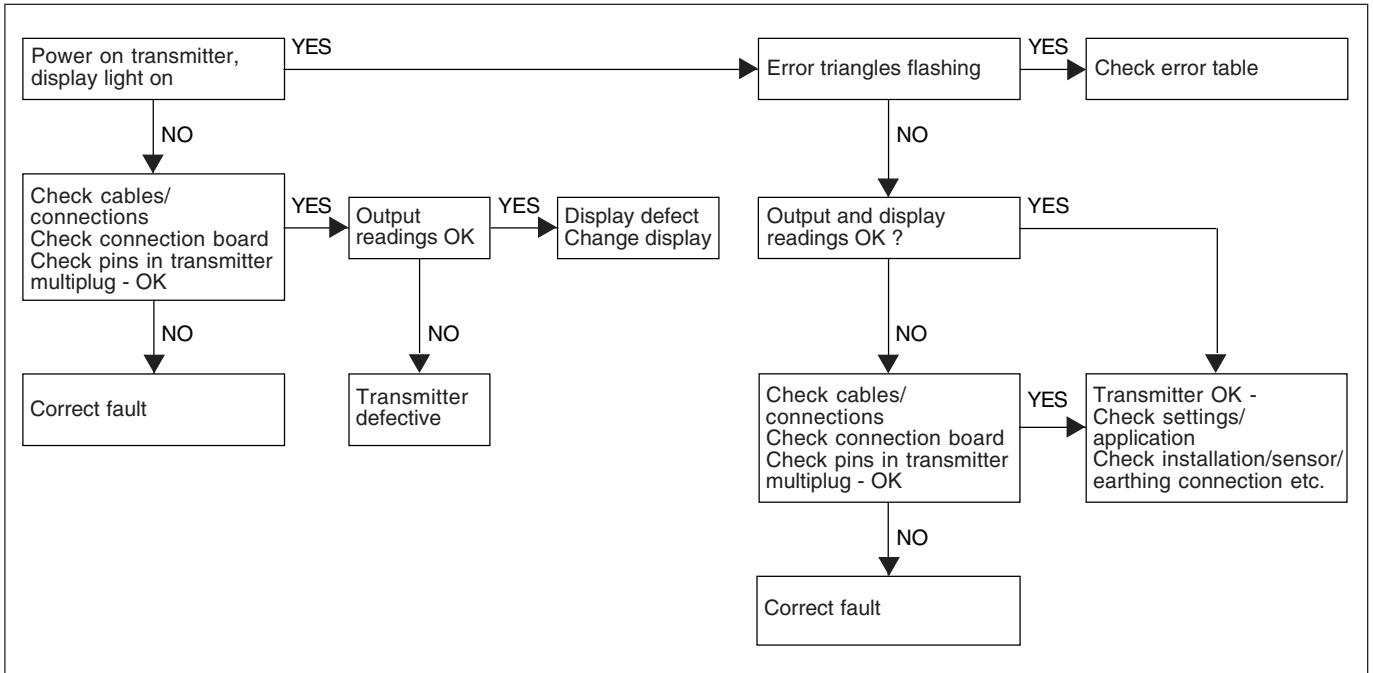
9. Service

Often problems with unstable/wrong measurements occur due to insufficient/wrong earthing or potential equalization. Please check this connection. If OK, the SITRANS F M MAGFLO® transmitter can be checked as described under 9.1 and sensor under 9.3.

9.1 Transmitter check list

When checking SITRANS F M MAGFLO® 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
	Undefined	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
<b>Indicates flow with no flow in pipe</b>	Undefined		1. No load on current output	Check cables/connections
			2. MAG 5000/6000 defective	Replace MAG 5000/6000
<b>Measuring error</b>	Undefined		P42	Initializing error
			P41	Initializing error
			P41	Initializing error
<b>Unstable flow signal</b>	Unstable		1. Pulsating flow	Select empty pipe cut-off
			2. Empty pipe cut-off is OFF	Ensure that the measuring pipe is full
			3. Electrode connection missing/ electrode cable is insufficiently screened	Ensure that electrode cable is connected and sufficiently screened
			4. Air bubbles in medium	Ensure medium does not contain air bubbles
			5. High concentration of particles or fibres	Increase time constant
<b>Measuring approx. 50%</b>	Maximum		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
			6. Missing one electrode connection	Check installation
			7. Missing one electrode connection	Check cables
<b>Loss of totalizer data</b>	OK	W20	Incorrect installation	Check installation
			No SENSORPROM® unit	Install SENSORPROM® unit
<b>##### Signs in display</b>	OK		P44	CT SENSORPROM® unit
			P44	CT SENSORPROM® unit
			F61	Deficient SENSORPROM® unit
			F62	Wrong type of SENSORPROM® unit
			F63	Deficient SENSORPROM® unit
			F71	Loss of internal data
<b>##### Signs in display</b>	OK		Replace SENSORPROM® unit or reset SENSORPROM® unit with MAG CT transmitter	Replace SENSORPROM® unit or reset SENSORPROM® unit with MAG CT transmitter
			Replace SENSORPROM® unit	Replace SENSORPROM® unit
<b>##### Signs in display</b>	OK		Replace SENSORPROM® unit	Replace SENSORPROM® unit
			Replace MAG 5000/6000	Replace MAG 5000/6000
<b>##### Signs in display</b>	OK		Flow exceeds 100% of $Q_{max}$ .	Check $Q_{max}$ . (Basic Settings)
			W21	Pulse overflow
<b>##### Signs in display</b>	OK		• Volume/pulse too small	Change volume/pulse
			• Pulse width too large	Change pulse width
<b>##### Signs in display</b>	OK		Reset totalizer manually	Reset totalizer manually
			Reset totalizer or increase totalizer unit	Reset totalizer or increase totalizer unit

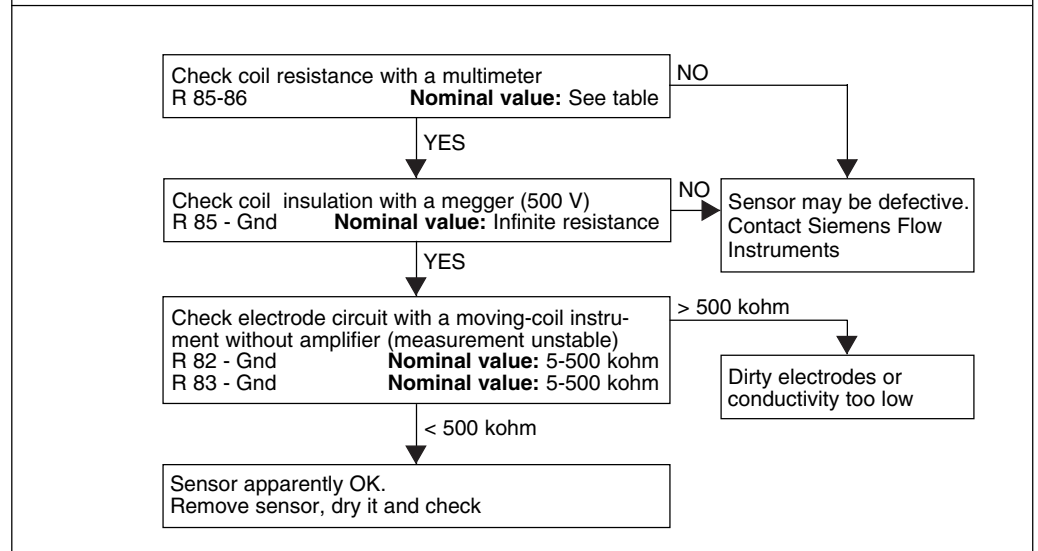
9.3  
Check list MAG sensor

**ATTENTION!**

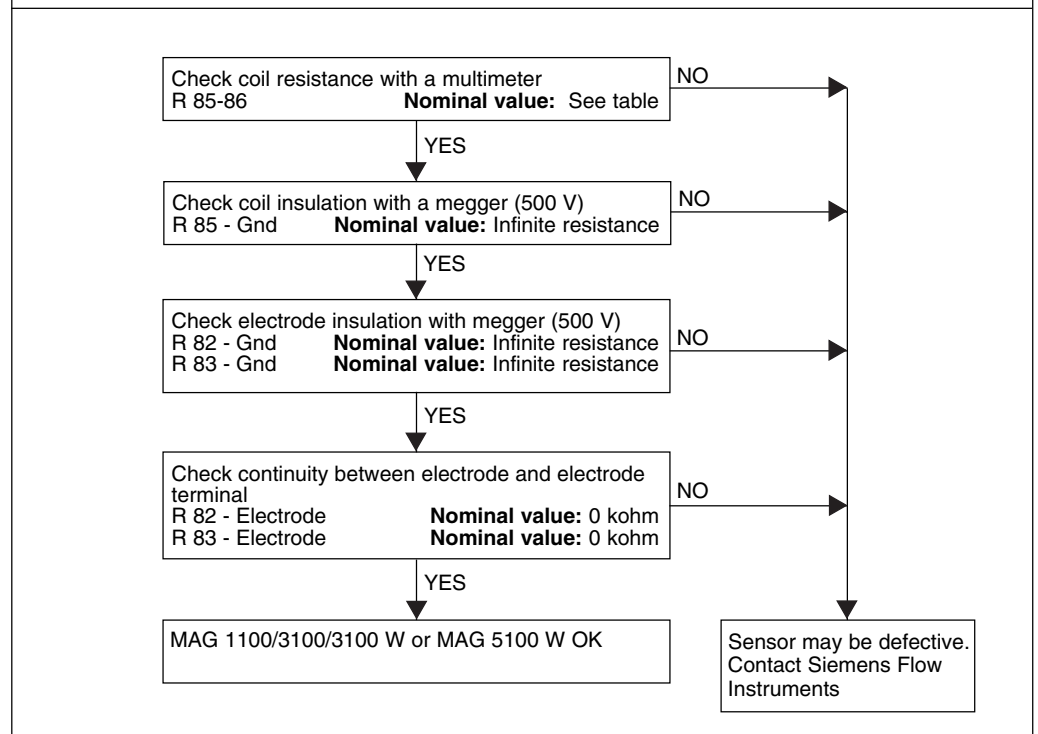
If there is leakage from MAG 1100/3100/3100 W or MAG 5100 W and the unit has been used to measure inflammable/explosive liquids, there might be a risk of explosion when checking with a megger.

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

**MAG 1100/3100/3100 W or MAG 5100 W installed and filled with the medium:**



**MAG 1100/3100/3100 W or MAG 5100 W removed from system – empty and dry:**



9.4  
Coil resistance

DN	Coil resistance						
	MAG 1100	MAG 3100		MAG 3100 W		MAG 5100 W	
	Resistance	Resistance	Tolerance	Ohms	Tolerance	Ohms	Tolerance
2	104 Ω +/- 5	104					
3	104 Ω +/- 5	104					
6	98 Ω +/- 4	104					
10	98 Ω +/- 4	104					
15 <sup>1)</sup>	98 Ω +/- 4	104					
25	98 Ω +/- 4	104	+/- 2	104	+/- 2	104	+/- 2
40	98 Ω +/- 4	92	+/- 2	92	+/- 2	92	+/- 2
50	98 Ω +/- 4	92	+/- 2	92	+/- 2	124	+/- 4
65	98 Ω +/- 4	100	+/- 2	100	+/- 2	127	+/- 4
80	98 Ω +/- 4	94	+/- 2	94	+/- 2	126	+/- 4
100	98 Ω +/- 4	92	+/- 2	92	+/- 2	125	+/- 4
125		92	+/- 2	92	+/- 2	126	+/- 4
150		94	+/- 2	94	+/- 2	116	+/- 4
200		90	+/- 2	90	+/- 2	109	+/- 4
250		92	+/- 2	92	+/- 2	104	+/- 4
300		100	+/- 2	100	+/- 2	108	+/- 4
350		112	+/- 2	112	+/- 2	112	+/- 2
400		100	+/- 4	100	+/- 4	100	+/- 4
450		108	+/- 4	108	+/- 4	108	+/- 4
500		122	+/- 4	122	+/- 4	122	+/- 4
600		115	+/- 4	114	+/- 4	114	+/- 4
700		128	+/- 4	112	+/- 4	112	+/- 4
750		133					
800		128	+/- 4	127	+/- 4	127	+/- 4
900		131	+/- 4	93	+/- 4	93	+/- 4
1000		131	+/- 4	103	+/- 4	103	+/- 4
1100		126					
1200		130	+/- 4	124	+/- 4	124	+/- 4
1400		130					
1500		124					
1600		133					
1800		133					
2000		147					

<sup>1)</sup> 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**

Please look on our homepage <http://www.siemens.com/flow> under "Product Selector".

We have checked the contents of this manual for agreement with the hardware and software described. Since deviations cannot be precluded entirely, we cannot guarantee full agreement. However, the data in this manual are reviewed regularly and any necessary corrections included in subsequent editions. Suggestions for improvement are always welcomed.

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