MAGFLO®

Electromagnetic flowmeters
Sensor types MAG 1100, MAG 3100
Signal converter types MAG 5000, MAG 6000

Range of electromagnetic flowmeters

	MAG 1100	MAG 1100 FOOD	MAG 3100	MAG 3100 W
				
Size [mm]	DN 6-100	DN 10-100	DN 15-2000	DN 25-1200
Connection	Flangeless (Sandwich design)	Weld-in adapter, clamp adapter, thread adapter	Flange	Flange
Pressure [bar]	Max. 40	Max. 40	Max. 425	Max. 40
Temperature [°C]	–20 to 200	–30 to 150	–40 to180	–10 to 95
Liner	Ceramic ($Al_2 O_3$)	Ceramic ($Al_2 O_3$) PFA	Neoprene, EPDM, Teflon (PTFE), Polyurethane, Ebonite, Linatex	Neoprene and EPDM
Electrodes	Platinum	Platinum Hastelloy	AISI 316 Ti, Hastelloy C, Platinum/Iridium, Monel, Titanium, Tantalum	AISI 316 Ti Earthing electrode
Enclosure	IP 67	IP 67	IP 67 / 68	IP 67 / 68
Ex-version	EEx [ia/ib] IIB T4-T6		EEx [ia/ib] IIB T4-T6 EEx [ia/e] IIC T3-T6	

	MAG 5000	MAG 6000	MAG 3000 Ex-d
			
Outputs	1 current output 1digital output 1 relay output	1 current output 1digital output 1 relay output	1 current output 1 frequency/pulse output 1 relay output
Flow direction	Uni/bidirectional	Uni/bidirectional	Uni/bidirectional
Communication	Optional HART®	Add-on modules HART®	
Display	3 lines 20 characters (optional without display)	3 lines 20 characters (optional without display)	2 lines 16 characters
Meter uncertainty	±0,5% o.r.	±0,25% o.r.	±0,25% o.r.
Enclosure	IP 67, IP 20	IP 67, IP 20	IP 65, IP 67
Custody transfer approval		PTB OIML R75 OIML R117	
Ex-version Safety barrier		[EEx ia/ib] IIB [EEx ia] IIC	EEx de [ia/ib] IIB T6
Power supply	12-24 V a.c./d.c. 115-230 V a.c.	12-24 V a.c./d.c. 115-230 V a.c.	24 V a.c./d.c.

Contents

1.1 Product introduction

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 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.

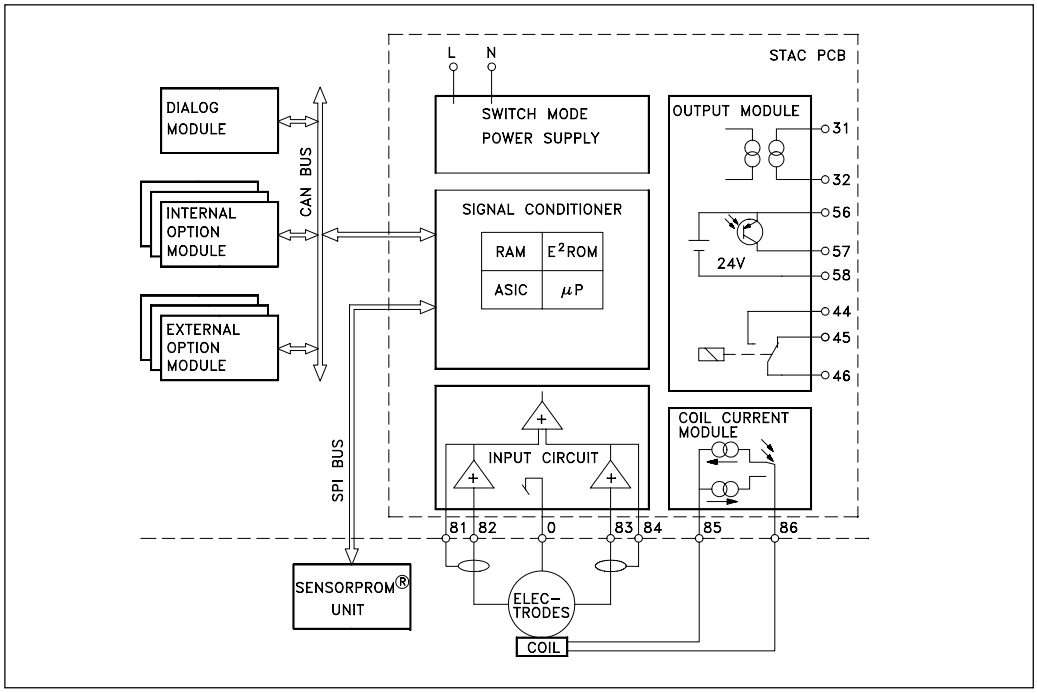
MAGFLO® electromagnetic flowmeters are characterised by simplicity:

÷ Simple to install
÷ Simple to commission
÷ Simple to operate
÷ Simple to maintain

MAGFLO® electromagnetic flowmeters are manufactured by Danfoss Instrumentation - one of the worlds leading makers of flowmeters.

All MAGFLO® electromagnetic flowmeter feature a unique SENSORPROM® memory unit which stores sensor calibration data and signal converter settings for the lifetime of the product.
At commissioning the flowmeter commerces 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 signal converter be replaced, the new converter will upload all previous settings and resume measurement without any need for reprogramming.

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 or 3100 and a signal converter type 5000 or 6000.

SENSOR
The sensor converts the flow into an electrical voltage 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 connecting flanges.

SIGNAL CONVERTER
The signal converter 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. 12 - 24 V a.c./d.c. and a 115 - 230 V a.c. switch mode type.

Coil current module generates a pulsating magnetising 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 1μS/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 signal converter as a result of long-term drift and temperature drift are monitored and continously 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 signal converter is therefore unsurpassed with a turn down ratio of min. 3000:1.

CAN communication. The signal converter 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 will show a flowrate or a totalizer value as a primary reading.

The 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.

2.1 Sensor MAG 1100 and MAG 1100 Ex

		MAG 1100 	MAG 1100 Ex & Ex-d 
Type		Flangeless sensor (Sandwich design)	Flangeless sensor (Sandwich design)
Nominal size		DN 6, 10, 15, 25, 40, 65, 80, 100 mm	DN 6, 10, 15, 25, 40, 65, 80, 100 mm
Operating pressure		PN 40. Vacuum: 1 ↔ 10^{-6} bar	PN 40. Vacuum: 1 ↔ 10^{-6} bar
Temperature of medium			
	Ceramic	–20°C to +150°C	–20°C to +120°C
	High temp.	–20°C to +200°C	
Temperature shock (Ceramic liner)		(Duration > 1 min.):	(Duration > 1 min.):
		DN 6, 10, 15, 25 Max. ΔT ≤ 15°C/min.	DN 6, 10, 15, 25 Max. ΔT ≤ 15°C/min.
		DN 40, 50, 65 Max. ΔT ≤ 10°C/min.	DN 40, 50, 65 Max. ΔT ≤ 10°C/min.
		DN 80, 100 Max. ΔT ≤ 5°C/min.	DN 80, 100 Max. ΔT ≤ 5°C/min.
		(Duration ≤ 1 min., followed by 10 min. rest):	(Duration ≤ 1 min., followed by 10 min. rest):
		DN 6, 10, 15, 25 Max. ΔT ≤ 80°C	DN 6, 10, 15, 25 Max. ΔT ≤ 80°C
		DN 40, 50, 65 Max. ΔT ≤ 70°C	DN 40, 50, 65 Max. ΔT ≤ 70°C
		DN 80, 100 Max. ΔT ≤ 60°C	DN 80, 100 Max. ΔT ≤ 60°C
Ambient temperature		Remote signal converter: –40°C to +100°C	Remote signal converter: –40°C to +100°C
		Compact signal converter: –20°C to +50°C	Compact signal converter: –20°C to +50°C
Liner		Aluminium oxide Al_2O_3 (ceramics)	Aluminium oxide Al_2O_3 (ceramics)
Electrodes		Platinum with gold/titanium brazing alloy	Platinum with gold/titanium brazing alloy
Enclosure		Stainless steel AISI 316 (1.4436)	Stainless steel AISI 316 (1.4436)
Terminal box	*Standard*	Fibreglass reinforced polyamide	Stainless steel AISI 316 (1.4436)
	High temp.	Stainless steel AISI 316 (1.4436)	
Fixing studs		Stainless steel AISI 304 (1.4301)	Stainless steel AISI 304 (1.4301)
		Number and size to DIN 2501	Number and size to DIN 2501
Mating flanges		DIN 2501 (PN 10-40), ANSI B16.5 class 150 and 300 or equivalent	To DIN 2501 (PN 10-40), ANSI B16.5 class 150 and 300 or equivalent
	Option	DN 6/10: 1/2" pipe connection adapters thread: / 1/2" tappered ISO 7-1	
Gaskets	*Standard*	EPDM (max. 150°C, PN 40)	EPDM (max. 150°C, PN 40)
	Option	Graphite (max. 200°C, PN 40)	Graphite (max. 200°C, PN 40)
	Option	PTFE (max. 130°C, PN 25)	PTFE (max. 130°C, PN 25)
Cable entries		4 pcs. Pg 13.5	4 pcs. Pg 13.5
Enclosure rating			
	Standard	IP 67 to IEC 529 (3 m w.g. for 72 h)	IP 67 to IEC 529 (1 m w.g. for 30 min.)
	Option	IP 68 (10 m w.g. with submersible kit)	
Mechanical load (vibration)		18-1000 Hz random, 3.17 G rms, in all directions, to IEC 68-2-36	18-1000 Hz random in all directions, to IEC 68-2-36
			Sensor: 3.17 G Compact Ex-d.: 1.14 G
Test pressure		80 bar (2 ↔ PN)	80 bar (2 ↔ PN)
Ex approvals			EEx [ia/ib] IIB T4-T6/DEMKO, No. 97D.121909X
			EEx de [ia/ib] IIB T4-T6/DEMKO 94C.115327X
Exitation frequency		DN 6-65: 12.5 Hz	DN 6-65: 12.5 Hz
		DN 80-100: 6.25 Hz	DN 80-100: 6.25 Hz

2.2 Sensor MAG 1100 FOOD

		MAG 1100 FOOD 	MAG 1100 FOOD PFA 
Type		Hygienic sensor	
Nominal size		DN 10, 15, 25, 40, 50, 65, 80, 100 mm	
Process connection		Hygienic adapters available for: ← Direct welding into dairy pipe ← Clamp fitting ← Threaded fitting	
Operating pressure		40 bar	20 bar
	Vacuum	1 ↔ 10^{-6} bar	0.02 bar
Temperature of medium		–20°C to +150°C	–30°C to +130°C
		Suitable for steam sterilization	Suitable for steam sterilization at 150°C
Temperature shock		(Duration > 1 min.):	Max. ±100°C/s
		DN 6, 10, 15, 25 Max. ΔT ≤ 15°C/min.	
		DN 40, 50, 65 Max. ΔT ≤ 10°C/min.	
		DN 80, 100 Max. ΔT ≤ 5°C/min.	
		(Duration ≤ 1 min., followed by 10 min. rest):	
		DN 6, 10, 15, 25 Max. ΔT ≤ 80°C	
		DN 40, 50, 65 Max. ΔT ≤ 70°C	
		DN 80, 100 Max. ΔT ≤ 60°C	
Ambient temperature		Remote signal converter: –40°C to +100°C	Remote signal converter: –30°C to +100°C
		Compact signal converter: –20°C to +50°C	Compact signal converter: –20°C to +50°C
Liner		Aluminium oxide Al_2O_3 (ceramic)	Reinforced PFA (Teflon)
Electrodes		Platinum/gold/titanium	Hastelloy C-276
Enclosure		Stainless steel AISI 316 (1.4436)	Stainless steel AISI 316 (1.4436)
Terminal box	*Standard*	Fibreglass reinforced polyamide	Fibreglass reinforced polyamide
	Option	Stainless steel AISI 316 (1.4436)	Stainless steel AISI 316 (1.4436)
Cable entries		4 pcs. Pg 13.5	4-off Pg 13.5
Enclosure rating	*Standard*	IP 67 to IEC 529 (3 m w.g. for 72 h)	IP 67 to IEC 529 (3 m w.g. for 72 h)
	Option	IP 68 to 10 m w.g. with submersible kit	IP 68 to 10 m w.g. with submersible kit
Mechanical load (vibration)		18-1000 Hz random, 3.17 G rms, in all directions, to IEC 68-2-36	18-1000 Hz random, 3.17 G rms, in all directions, to IEC 68-2-36
Test pressure		80 bar (2 ↔ PN)	40 bar (2 ↔ PN)
Approvals		3A, EHEDG	3A
Exitation frequency		DN 10-65: 12.5 Hz	DN 10-65: 12.5 Hz
		DN 80-100: 6.25 Hz	DN 80-100: 6.25 Hz

Accessories MAG 1100 FOOD

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

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

	MAG 3100 	MAG 3100 Ex / Ex-d 			MAG 3100 W 
Type	Sensor with flanges	Sensor with flanges			Sensor with flanges
Nominal size	DN 15-2000 mm	DN 15-2000 mm / 15-300 mm			DN 25-1200 mm
Temperature of medium		Temperature classification			
Liner:		T3 + T4	T5	T6	
Neoprene (standard)	0 - 95°C	0-95°C	0-90°C	0-75°C	0 - 95°C
EPDM[1])	–10 - 95°C	–10-95°C	–10-90°C	–10-75°C	–10 - 95°C
Linatex® rubber	–40 - 70°C	–20-70°C	–20-70°C	–20-70°C	
Ebonite[1])	0 - 95°C	0-95°C	0-90°C	0-75°C	
Polyurethane	0 - 50°C	0-50°C	0-50°C	0-50°C	
PTFE	–20 - 120°C	–20-120°C	–20-90°C	–20-75°C	
PTFE High temperature	–20 - 180°C				
Ambient temperature					
Remote signal converter	–40°C - 100°C	–20°C - 40 (50)°C[2])			–40°C - 100°C
Compact signal converter	–20°C - 50°C	–20°C - 40 (50)°C[2])			–20°C - 50°C
Operating pressure[3]) [**abs.bar**]					
Liner:					
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
Natural rubber & Linatex®	0.01 to 40 bar	0.01 to 40 bar			
Ebonite	0.01 to 100 bar	0.01 to 100 bar			
Polyurethane	0.4 to 100 bar	0.4 to 100 bar			
PTFE teflon:					
DN 15 to 600	Max. 100°C: 0.3 to 40 bar	0.3 to 40 bar			
DN 15 to 600	Max. 120°C: 0.5 to 40 bar				
DN 15 to 300	Max. 180°C: 0.6 to 40 bar				
Exitation frequency	DN ≤ 65: 12 ½ Hz DN 65 < DN ≤ 300: 6 ¼ Hz DN 300 < DN ≤ 1200: 3 ⅛ Hz DN > 1200: 1 9/16 Hz	DN ≤ 65: 12 ½ Hz DN 80/100: 6 ¼ Hz DN ≥125: 3 ⅛ Hz			All sizes: 3 ⅛ Hz
Enclosure rating *Standard*	IP 67 to IEC 529 (3 m w.g. for 72 h)				
Option	IP 68 to IEC 529 (10 m w.g.)				
Cable entries	4 pcs. Pg 13.5 - 2 others available				
Mechanical load	18-1000 Hz random, 3.17 G rms, in all directions, to IEC 68-2-36				
Design pressure	1.5↔PN				

1) With WRC (Water Research Council, UK) approval
2) 50ϒC for DN 125-300 only
3) Maximum operating pressure decreases with increasing operating temperature and with stainless steel flanges
Standard flanges above 120ϒC: BS 4504 sec. 3.1 table 15 material group A1
AISI 304 flanges: BS 4504 sec. 3.1 table 16 material group B2
AISI 316 flanges: BS 4504 sec. 3.1 table 16 material group B4

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

		MAG 3100	MAG 3100 Ex / Ex-d	MAG 3100 W
				
Flanges	*Standard*			
BS 4504, sec. 3.1 1989 Plate flange code no. 101 Raised face type B (~DIN 2501)		DN 15-50: PN 40 DN 65-150: PN 16 DN 200-1000: PN 10 DN 1100-1200: PN 6 DN 1400-2000: PN 6 (Forged weld neck type code no. 111)		DN 25-50: PN 40 DN 65-150: PN 16 DN 200-1200: PN 10
	Option	DN 65-1000: PN 6 DN 1200-2000: PN 10 DN 200-2000: PN 16 DN 200-600: PN 25 DN 65-600: PN 40 DN 50-400 PN 64 (DIN 2636) DN 25-350 PN 100 (DIN 2637)		DN 200-600: PN 16
ANSI B 16.5 (~BS 1560)		3/4"-24": Class 150 (20 bar) 3/4"-24": Class 300 (50 bar)		3/4"-24": Class 150 (20 bar)
BS 10		3/4"-60": Table D/E		
AS 2129		3/4"-48": Table D/E		
AS 4087		DN 50-1200 (14 bar)		
JIS B 2220		DN 50-1000: K10 (10 bar) DN 50-1200: K16 (16 bar)		
AWWA C-207		28"-78": Class D (10 bar)		28"-48": Class D (10 bar)
Electrodes	*Standard*	AISI 316 Ti (1.4571)		AISI 316 Ti (1.4571)
	Option	Hastelloy C-276, Platinum / Iridium, Titanium, Monel (Alloy 400), AISI 316 Ti Ceramic Coated, Tantalum		
Earthing electrodes				
	Standard	Not included		AISI 316 Ti (1.4571)
	Option	AISI 316 Ti (1.4571), Hastelloy C276 All liner materials except PTFE		
Measuring pipe		AISI 304 (1.4301)		
Flange and housing material	*Standard*	Low grade carbon steel BS 4360 grade 43A (St. 37.2) Corrosion-resistant two-component coating (min. 150 µm)		Low grade carbon steel BS 4360 grade 43A (St. 37.2) Corrosion-resistant two-component coating (min. 150 µm)
	Option	AISI 304 (1.4301) flanges and St. 37.2 housing. Coating as above		
	Option	AISI 316 (1.4436/1.4401) flanges and housing		
Ex-approval	*Remote*	DN 15-100 EEx [ia/ib] m IIB T4-T6		
		DN 125-300 EEx [ia/ib] e IIB T4-T6		
		DN 350-2000 EEx e [ia] IIC T3-T6		
	Compact	DN 15-300 EEx de [ia/ib] IIB T4-T6		
		MAG 3000 Ex-d		

2.4.1 Signal converter MAG 5000 (DN 6 to DN 1200)

	**Accuracy 0.5%**
Current output	
Current	0-20 mA or 4-20 mA
Load	< 800 ohm
Time constant	0.1-30 s adjustable
Digital output	
Frequency	0-10 kHz, 50% duty cycle
Time constant	0.1-30 s adjustable
Active	24 V d.c., 30 mA, 1 KΩ ≤ R_{load} ≤ 10 KΩ, short-circuit-protected
Passive	3-30 V d.c., max. 110 mA, 200 Ω ≤ R_{load} ≤ 10 KΩ
Relay	Changeover relay
Load	42 V a.c./2 A, 24 V d.c./1A
Digital input	11-30 V d.c., R_i = 4.4 KΩ
Activation time	50 ms
Current	$I_{11\ V\ d.c.}$ = 2.5 mA, $I_{30\ V\ d.c.}$ = 7 mA
Functions	Flowrate, 2 totalizers, low flow cuf-off, empty pipe cut-off, flowdirection, error system, operating time,
	uni/bidirectional flow, limit switches, pulse output, control for cleaning unit
Galvanic isolation	All inputs and outputs are galvanically isolated
Cut-off Low-flow	0-9.9% of maximum flow
Empty pipe	Detection of empty pipe
Totalizer	Two eight-digit counters for forward, net or reverse flow
Display	Background illumination with alphanumerical text, 3 x 20 characters to indicate flowrate, totalized values, settings and faults. Reverse flow indicated by negative sign.
Time constant	Time constant as current output time constant
Zero point adjustment	Automatic
Electrode input impedance	> 1 x 10^{14} Ω
Exitation frequency	3 $^1/_8$ Hz pulsating d.c. current (125 mA)
Ambient temperature	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%)
Communication	
Standard	Without serial communication
Optional	HART®
Compact	
Enclosure material	Fibre glass-reinforced polyamide
Enclosure rating	IP 67 to IEC 529 and DIN 40050 (1 m w.g. for 30 min.)
Mecanical load	18-1000 Hz random, 3.17 G rms, in all directions, to IEC 68-2-36
19" insert	
Enclosure material	Standard 19" insert of aluminium/steel (DIN 41494)
	Width: 21 TE
	Height: 3 HE
Enclosure rating	IP 20 to IEC 529 and DIN 40050
Mechanical load	Version: 1 G, 1-800 Hz sinusoidal in all directions, to IEC 68-2-6
EMC performance	Emission: EN 50081-1 (Light industry)
	Immunity: EN 50082-2 (Industry)
Supply voltage	115-230 V a.c. +10% - –15%, 50-60 Hz
	11-30 V d.c. or 11-24 V a.c.
Power consumption	230 V a.c.: 9 VA
	24 V d.c.: 6 W, I_N = 250 mA, I_{ST} = 8 A (30 ms)
	12 V d.c.: 5 W, I_N = 400 mA, I_{ST} = 4 A (250 ms)

2.4.2 Signal converter MAG 6000

	**Accuracy 0.25%**		
Current output			
Current	0-20 mA or 4-20 mA		
Load	< 800 ohm		
Time constant	0.1-30 s adjustable		
Digital output			
Frequency	0-10 kHz, 50% duty cycle		
Time constant	0.1-30 s adjustable		
Active	24 V d.c., 30 mA, 1 KΩ ≤ R_{load} ≤ 10 KΩ, short-circuit-protected		
Passive	3-30 V d.c., max. 110 mA, 200 Ω ≤ R_{load} ≤ 10 KΩ		
Relay	Changeover relay		
Load	42 V a.c./2 A, 24 V d.c./1A		
Digital input	11-30 V d.c., R_i = 4.4 KΩ		
Activation time	50 ms		
Current	$I_{11\ V\ d.c.}$ = 2.5 mA, $I_{30\ V\ d.c.}$ = 7 mA		
Functions	Flowrate, 2 totalizers, low flow cuf-off, empty pipe cut-off, flowdirection, error system, operating time, uni/bidirectional flow, limit switches, pulse output, control for cleaning unit and batch		
Galvanic isolation	All inputs and outputs are galvanically isolated		
Cut-off Low-flow	0-9.9% of maximum flow		
Empty pipe	Detection of empty pipe		
Totalizer	Two eight-digit counters for forward, net or reverse flow		
Display	Background illumination with alphanumerical text, 3 x 20 characters to indicate flowrate, totalized values, settings and faults. Reverse flow indicated by negative sign.		
Time constant	Time constant as current output time constant		
Zero point adjustment	Automatic		
Electrode input impedance	> 1 x 10^{14} Ω		
Exitation frequency	Pulsating d.c. current (125 mA) with one of the following frequencies: 1 $^{9}/_{16}$ Hz, 3 $^{1}/_{8}$ Hz, 6 $^{1}/_{4}$ Hz, 12 $^{1}/_{2}$ Hz or 25 Hz		
Ambient temperature	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%)		
Custody transfer approval MAG 6000 CT only	PTB (cold water)	DANAK OIML R75 (hot water)	DANAK OIML R117 (cold water/milk, beer etc.)
Communication			
Standard	Prepared for client mounted add-on modules		
Optional	HART as add-on module		
Compact			
Enclosure material	Fibre glass-reinforced polyamide		
Enclosure rating	IP 67 to IEC 529 and DIN 40050 (1 m w.g. for 30 min.)		
Mecanical load	18-1000 Hz random, 3.17 G rms, in all directions, to IEC 68-2-36		
19" insert			
Enclosure material	Standard 19" insert of aluminium/steel (DIN 41494)		
	Width: 21 TE		
	Height: 3 HE		
Enclosure rating	IP 20 to IEC 529 and DIN 40050		
Mechanical load	Version: 1 G, 1-800 Hz sinusoidal in all directions, to IEC 68-2-6		
EMC performance	Emission: EN 50081-1 (Light industry)		
	Immunity: EN 50082-2 (Industry)		
Supply voltage	115-230 V a.c. +10% - –15%, 50-60 Hz, 9 VA		
	11-30 V d.c. or 11-24 V a.c., 9 W		
Power consumption	230 V a.c.: 9 VA		
	24 V d.c.: 6 W, I_N = 250 mA, I_{ST} = 8A (30 ms)		
	12 V d.c.: 5 W, I_N = 400 mA, I_{ST} = 4A (250 ms)		

2.4.3 Safety barrier (ia/ib)

	**DN ≤ 300**			
Application	For use with MAG 5000/6000 19" insert and MAG 1100 Ex/3100 Ex in the size range DN 6-300			
Ex approval	[EEx ia/ib] IIB			
Cable parameter	Group	Capacity in µF	Inductance in mH	
Electrode cable	IIB	≤ 31	≤ 80	
Coil cable	IIB	≤ 0.5	≤ 8	
Ambient temperature	During operation: –20 to +50°C			
	During storage: –20 to +70°C			
19" insert				
Enclosure material	Standard 19" insert in aluminium/steel (DIN 41494)			
	Width: 21 TE			
	Height: 3 HE			
Enclosure rating	IP 20 to IEC 529 and DIN 40050			
Mechanical load	1 G, 1-800 Hz sinusoidal in all directions, to IEC 68-2-6			
EMC performance				
Emission	EN 50081-1 (Light industry)			
Immunity	EN 50082-2 (Industry)			

2.4.4 Safety barrier (ia)

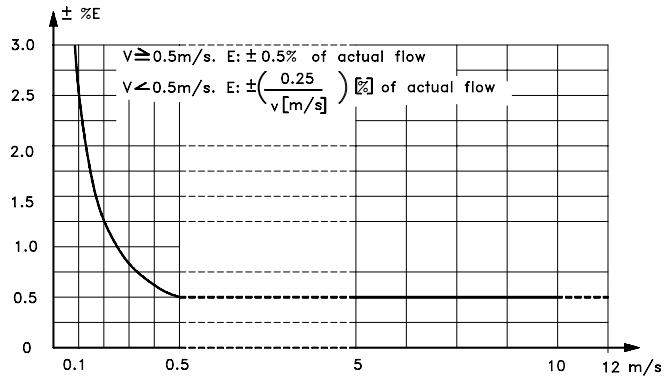
	**DN ≤ 350**		
Application	For use with MAG 5000/6000 19" insert and MAG 3100 Ex in the size range DN 350-2000		
Ex approval	[EEx ia] IIC		
Cable parameter	Group	Capacity in µF	Inductance in µH
	IIC	≤ 4.1	≤ 1.5
	IIB	≤ 45	≤ 87
	IIA	≤ 45	≤ 87
Ambient temperature	During operation: –20 to +50°C		
	During storage: –20 to +70°C		
19" insert			
Enclosure material	Standard 19" insert in aluminium/steel (DIN 41494)		
	Width: 21 TE		
	Height: 3 HE		
Enclosure rating	IP 20 to IEC 529 and DIN 40050		
Mechanical load	1 G, 1-800 Hz sinusoidal in all directions, to IEC 68-2-6		
EMC performance			
Emission	EN 50081-1 (Light industry)		
Immunity	EN 50082-2 (Industry)		

2.4.5 Cleaning unit

		
Application		For use together with MAG 5000 and 6000 19" insert to clean the electrodes on MAG 1100 or MAG 3100. **NB** May not be used with intrinsically safe systems
Cleaning voltage (unloaded)		
	a.c. cleaning	60 V a.c.
	d.c. cleaning	30 V d.c.
Cleaning period		60 sec. + 60 sec. pause period
Relay		Switch relay activated when cleaning is in progress
	Load	42 V/2 A
Operation		
	Automatic	Yes
	Manual	No
Indicator lamps		LEDs: "ON" and "CLEANING"
Supply voltage and power consumption	a.c.	115-230 V a.c. +10% to –15%, 50-60 Hz, 7 VA cleaning, 5 VA stand by
Ambient temperature		During operation: –20 to +50°C
		During storage: –20 to +70°C
19" insert	Enclosure material	Standard 19" insert in aluminium/steel (DIN 41494)
		Width: 21 TE
		Height: 3 HE
	Enclosure rating	IP 20 to IEC 529 and DIN 40050
	Mechanical load	1 G, 1-800 Hz sinusoidal in all directions, to IEC 68-2-6

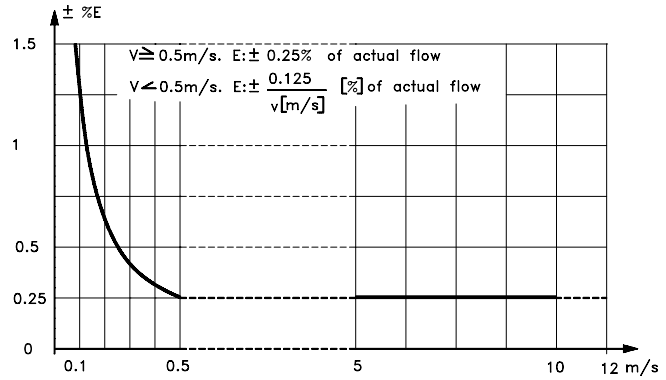
2.5 Meter uncertainty

MAG 5000



V: Actual flow velocity [m/s]
E: Meter uncertainty as a percentage of actual flow

MAG 6000



V: Actual flow velocity [m/s]
E: Meter uncertainty as a percentage of actual flow

Reference conditions (ISO 9104 and DIN/EN 29104)

Temperature of medium	20°C ±2 K
Ambient temperature	20°C ±2 K
Supply voltage	Un ±1%
Warming-up time	30 min.
Incorporation in pipe section	Inlet section 10↔DN (DN ≤ 1200), 5↔DN (DN > 1200) Outlet section 5↔DN (DN ≤ 1200), 3↔DN (DN > 1200)
Flow conditions	Fully developed flow profile

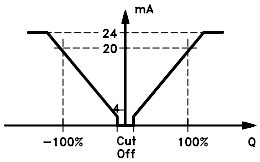
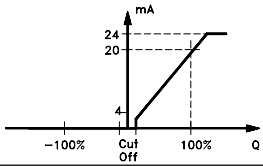
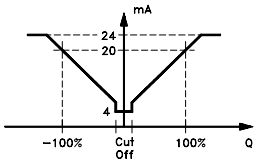
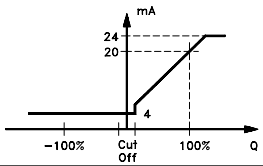
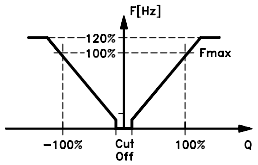
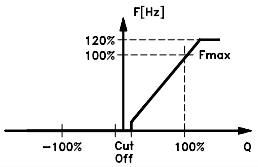
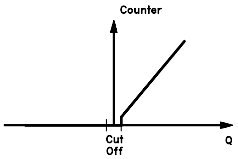
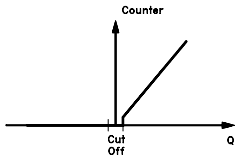
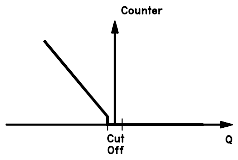
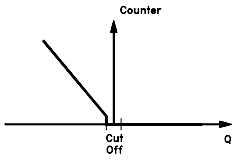
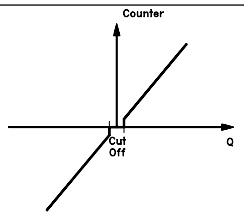
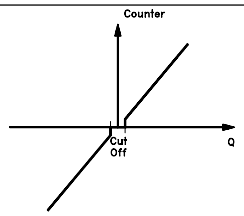
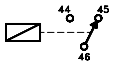
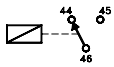
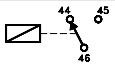
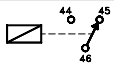
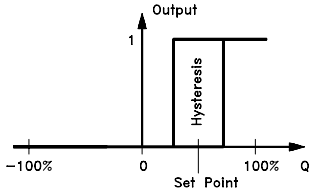
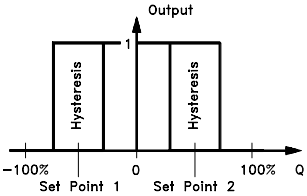
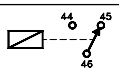
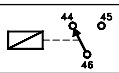
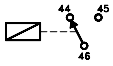
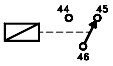
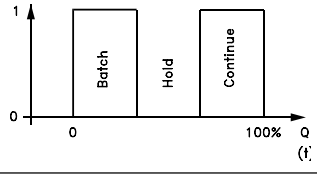
Additions in the event of deviations from reference conditions

Current output	As pulse output ±(0.1% of actual flow +0.05% FSO)
Effect of ambient temperature	Display/frequency/pulse output: < ±0.003% / K act.
	Current output: < ±0.005% / K act.
Effect of supply voltage	< 0.005% of measuring value on 1% change
Repeatability	±0.1% of actual flow for V ≤ 0.5 m/s

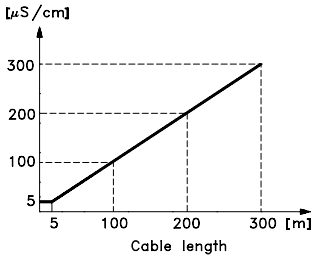
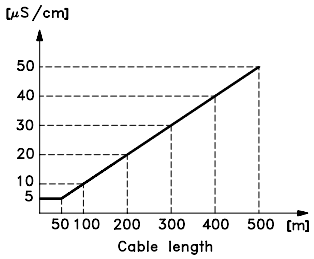
For the sizes DN 1400 to DN 2000 the measuring accuracy is ±0.5% as standard and MAG 6000 only must be used. (±0.25% as option).

For all MAG 3100 W sizes the measuring accuracy is ±0.5%.

2.6 Output characteristics MAG 5000 and MAG 6000

Output characteristics	Bidirectional mode	Unidirectional mode
0-20 mA		
4-20 mA		
Frequency		
Totalizer forward		
Reverse		
Net flow		
Relay	Power down 	Active 
Error relay	No error 	Error 
Limit switch	1 set point	2 set points
		
	Low flow 	Intermediate flow 
	High flow 	High flow/ Low flow 
Batch on digital output		

2.7.1 Sensor cables and conductivity of medium

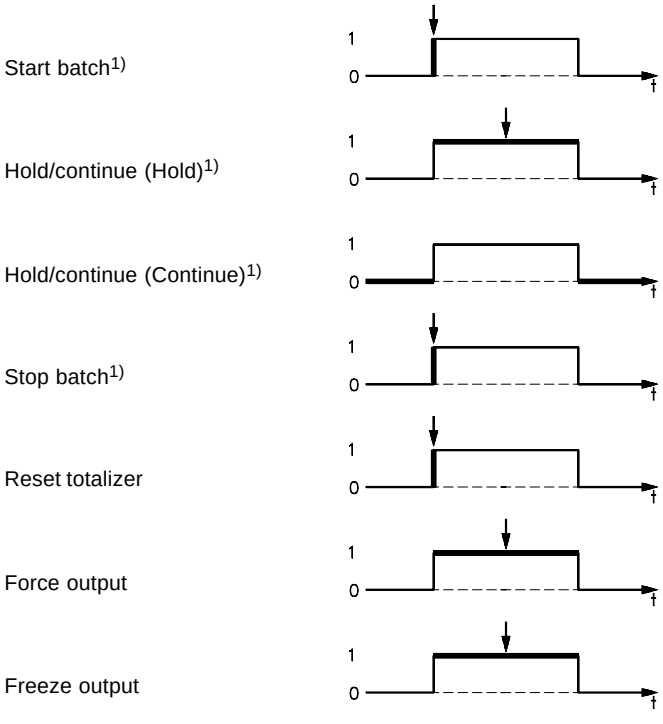
Conductivity of medium	**Compact installation:** Liquids with an electrically conductivity ≤ 5 µS/cm. By a conductivity between 5 and 10 µS/cm the repeatability may increase to ±0.5% of actual flow.
	Remote installation: Standard cable  Special cable 

NB
By detection of empty sensor the min. conditivity must always be ≥20 µS/cm and the max. length of electrode cable when remote mounted is 50 metres.
By remote mounting in Ex applications special cable cannot be used, empty sensor cannot be detected and the electrically conductivity must be ≥ 30 µS/cm.

2.7.2 Min. sensor cable data

			Coil cable	*Electrode cable*
Basic data	No of conductors		2	3
	Min. sqr area		0.5 mm²	0.2 mm²
	Max. capacitance		N.A.	350 pF/m
Max. cable loop resistance	Media temperature:	< 100°C	40 Ω	N.A.
		< 200°C	6 Ω	N.A.

2.7.3 Input characteristics MAG 5000 and MAG 6000



1) MAG 6000 only

2.8 HART® communication add-on module

Application	MAG 6000, MAG 6000 CT Optional available as factory mounted in MAG 5000 Blind
Communication standard	Bell 202 frequency shift keying (f.s.k.) standard
Communication modes	· Single loop mode
	· Multi-drop mode, 14 slave devices
Communicator	Rosemount Hand held communicator type 275

Cable specification

		Communication mode
		Single loop
Q [mm²] CU		≤ 0.2 mm²/AWG 24
Screen		YES (Overall screen)
Loop resistance	*Min.*	230 Ω
	Max.	800 Ω
Cable capacity		≤ 400 pF/m
Cable length		1500 m
Twisted pair		YES

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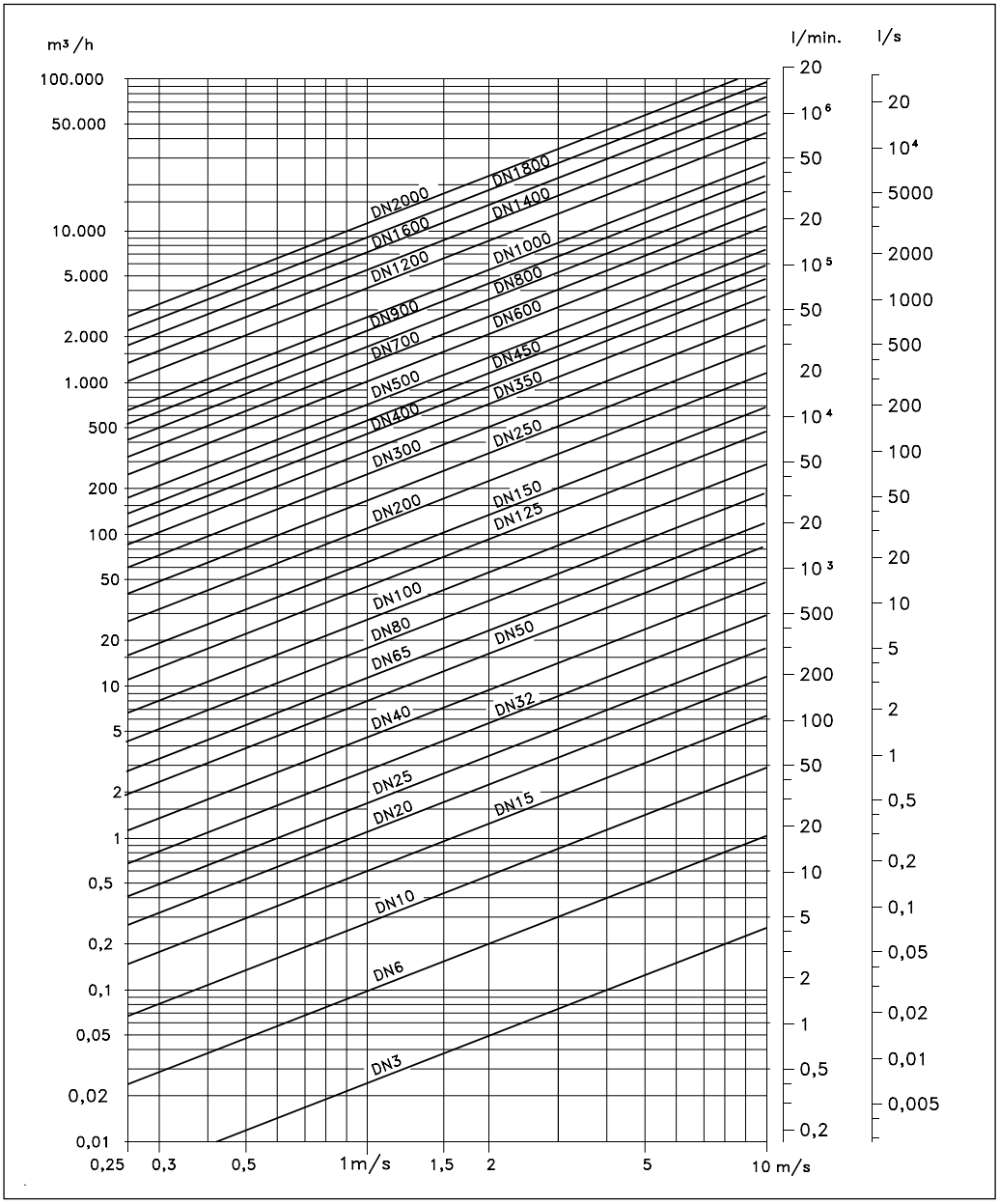
2.9 Cable data (Supplied by Danfoss)

		Standard cable	***Special electrode cable***
Basic data	No of conductors	3	3
	Sqr area	1.5 mm²	0.25 mm²
	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
Amb. temperature	· Flexible installation	–5 to 70°C	–5 to 70°C
	· Non flexible installation	–30 to 70°C	–30 to 70°C
Cable parameter	Capacity	161.50 pF/m	N.A.
	Inductance	0.583 µH/m	N.A.
	L/R	43.83 µH/Ω	N.A.

3.1 Sizing table (DN 3-2000)



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:

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

3.2.1 Minimum conductivity

Applications	Min. conductivity
Compact mounted	5 µS/cm
Remote mounted	5 µS/cm
With empty pipe detection	20 µS/cm
Ex-installations (Remote mounted only)	30 µS/cm
District heating systems (Without DC cleaning unit)	250 µS/cm

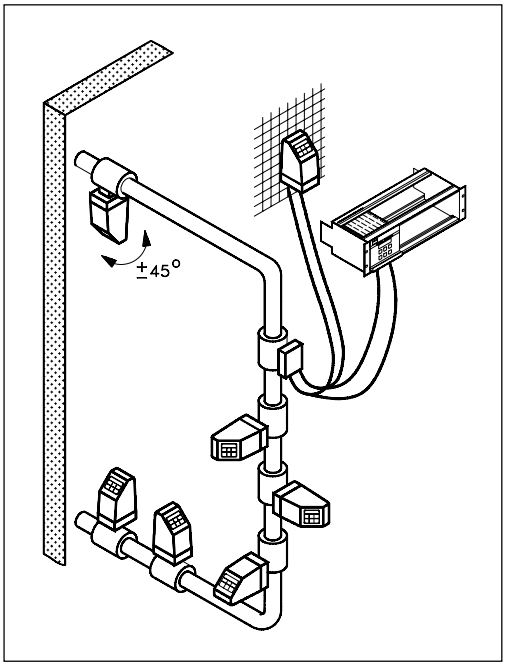
3.2.2 Liner selection guide

Liner	Applications
Ceramics Al_2O_3	General purpose, agressive chemicals
PFA	General purpose, dairy, food and beverage
Neoprene	General purpose, sewage, drinking water and district heating
EPDM	Drinking water, sea water
PTFE	Agressive chemicals, paper and pulp, high temperature applications
Polyurethane	Abrasive media, high pressure, sewage with hydro carbons (Solvents, oils, etc.)
Linatex	Abrasive media and mining slurries
Ebonite	Drinking water, high pressure applications and district heating

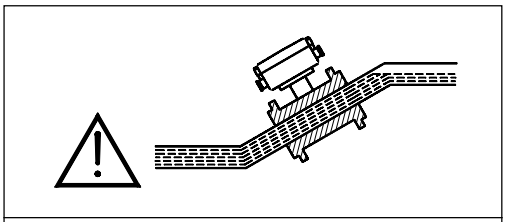
3.2.3 Electrode selection guide

Electrodes	Applications
AISI 316 Ti	General purpose, water, sewage, district heating
AISI 316 Ti Ceramic coated	High content of fibres, paper pulp
Hastelloy C-276	Good chemical proporties, sea water
Monel	Salt, brine and alkaline solutions
Titanium	Chlorine, chlorite, nitric and chromic acids. Textile bleaching industry
Tantalum	Almost any acid solution
Platinum and platinum /irridium	The ultimate electrode material. Unaffected by most liquids

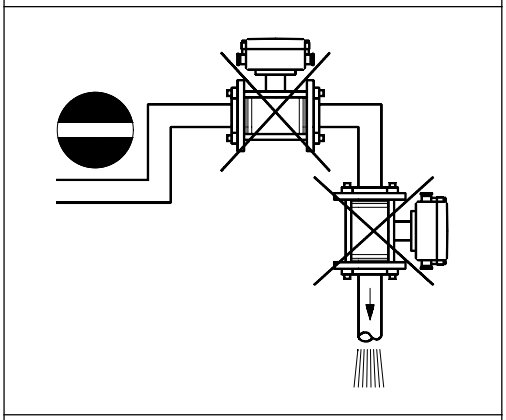
3.3 Installation conditions



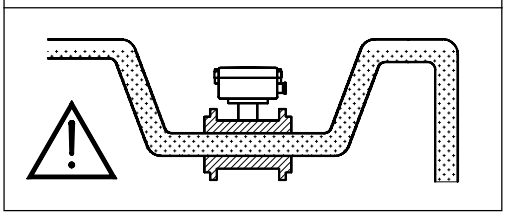
Reading and operating the flowmeter is possible under almost any installation conditions because the display can be oriented in relation to the sensor. To ensure optimum flow measurement attention should be paid to the following:



The sensor must always be completely full with liquid.

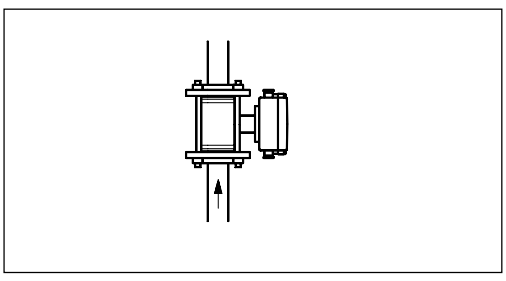


Therefore avoid:
- Installation at the highest point in the pipe system
- Installation in vertical pipes with free outlet



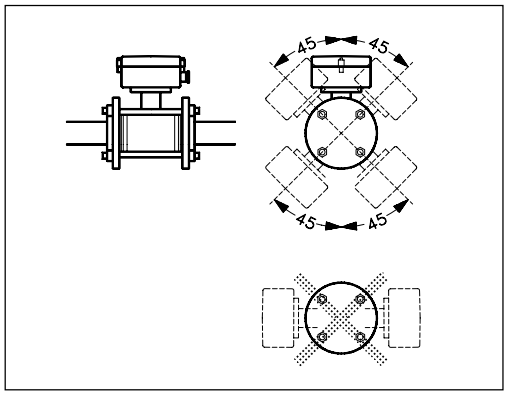
For partially filled pipes or pipes with downward flow and free outlet the flowmeter should be located in a U-tube.

Installation in vertical pipes



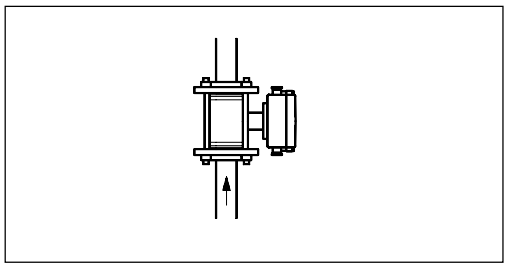
Recommended flow direction: upwards. This minimizes the effect on the measurement of any gas/air bubbles in the liquid.

Installation in horizontal pipes



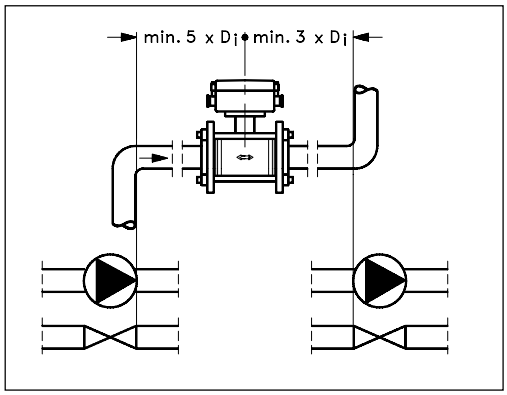
The sensor must be mounted as shown in the upper figure. Do not mount the sensor as shown in the lower figure. This will position the electrodes at the top where there is possibility for air bubbles and at the bottom where there is possibility for mud, sludge, sand etc.
If using empty pipe detectionthe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

Measuring abrasive liquids and liquids containing particles



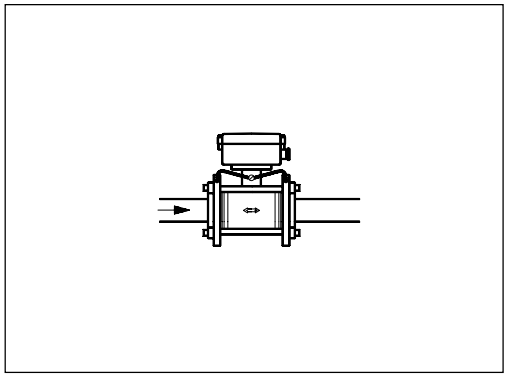
Recommended installation is in a vertical/ inclined pipe to minimize the wear and deposits in the sensor.

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.

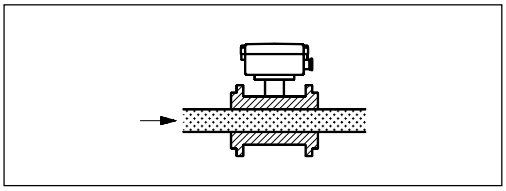
Potential equalization



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

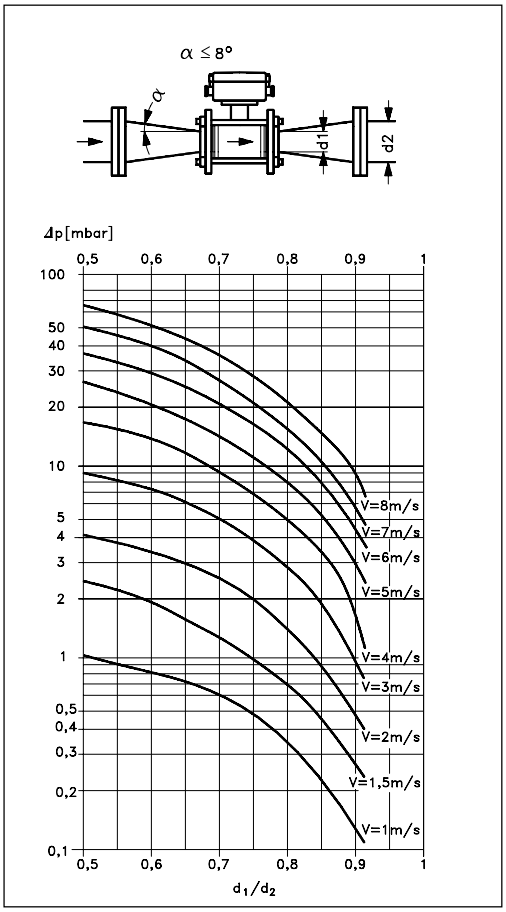
A. Wire jumper between sensor and adjacent flanges. (MAG 1100 and MAG 3100).
B. Direct metallic contact between sensor and fittings. (MAG 1100 FOOD).
C. Built in earthing electrodes. (MAG 3100 and MAG 3100 W).
D. Optional earthing/protection flanges/rings. (MAG 1100 and MAG 3100).
E. Optional graphite 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", section 2.

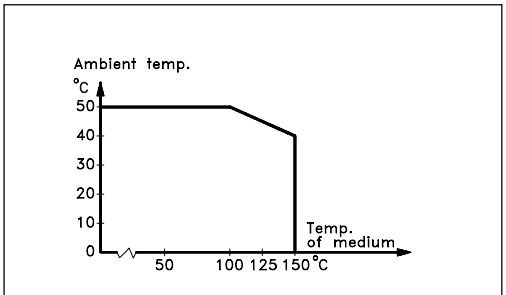
Installation in large pipes



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

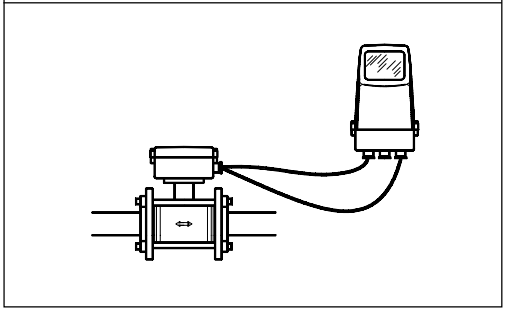
Example:
A flow velocity of 3 m/s (V) in a sensor with a diameter reduction from DN 100 to DN 80 (d_1/d_2 = 0.8) gives a pressure drop of 2.9 mbar.

Compact/remote installation



The sensor and signal converter 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", section 2 must be used.

3.4 Cleaning unit

The cleaning unit can be used with MAG 5000 or 6000 in 19" insert version.
The cleaning unit can be used in applications where the liner material and subsequently the electrodes may be coated by 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

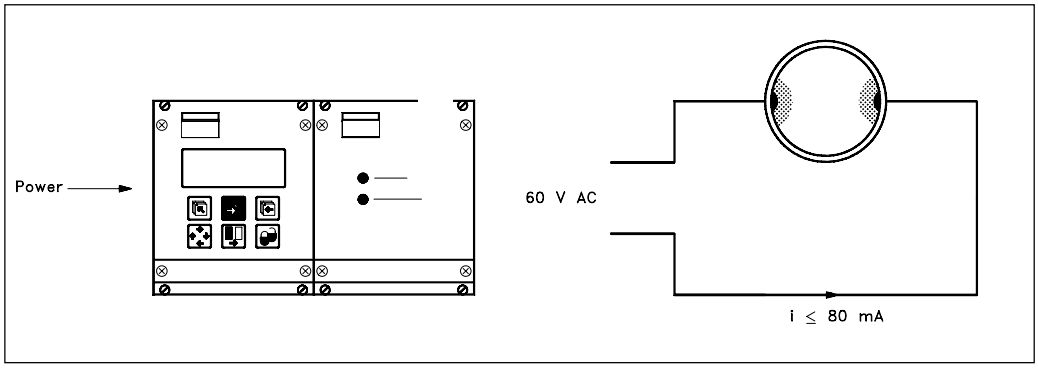
The cleaning unit cleans the electrodes electrochemically by applying a voltage to the electrodes for approx. 60 sec. While cleaning, the signal converter stores and holds the last measured flow reading on the display and also the signal outputs. After an additional pausing period of 60 sec. the flowmeter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

The relay in the signal converter 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.

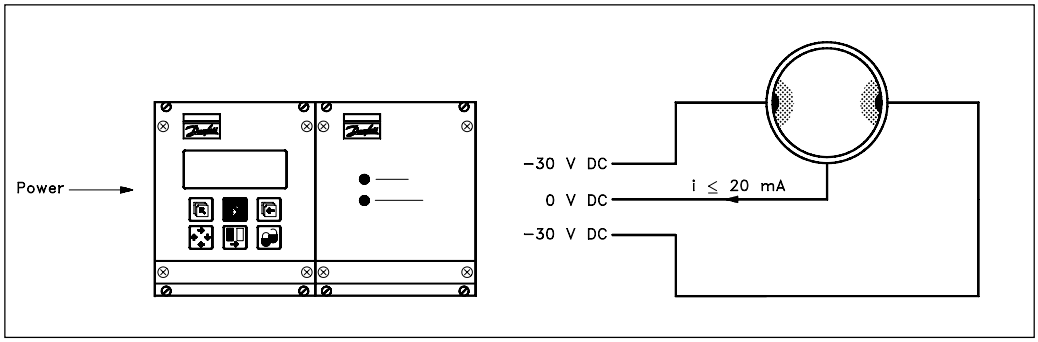
The cleaning sequence can also be controlled manually through the electrical input of the signal converter. Before this is done, ensure the measuring pipe is full.

AC-cleaning



AC-cleaning is used to remove fatty deposits on the electrodes. These fatty deposits are seen in waste water applications, in abbatoirs 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

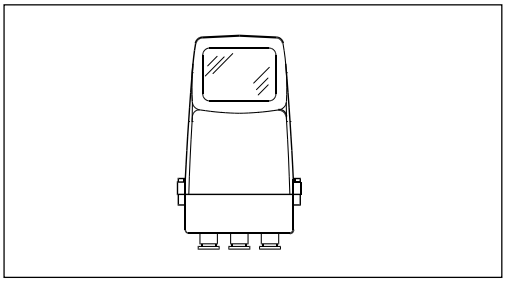


DC-cleaning is used to eliminate electrically conductive deposits in the measuring pipe influencing the measuring accuracy.
Particularly in district heating applications an electrically conductive deposit (magnetite) may occur and short circuit the electrode signal. In this case the accuracy of the meter decreases and the signal/noise conditions of the meter become inferior. The problem only arise if the conductivity of the water is less than approx. 250 µS/cm.

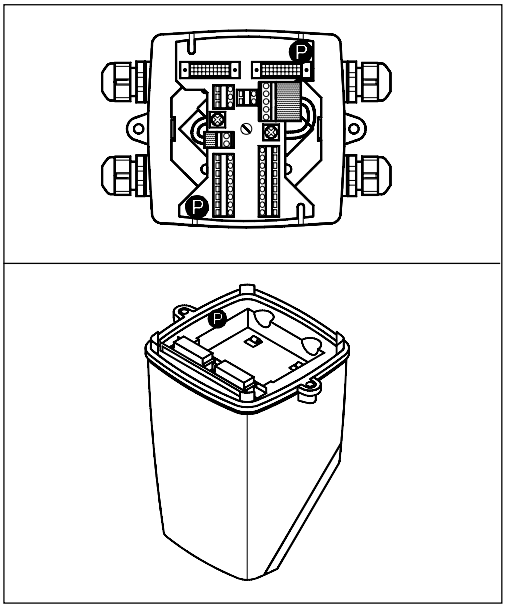
During DC-cleaning, electrolysis takes place where the flow of electrons removes the particle deposits from the electrode area.

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

3.5 Custody transfer approval



The MAG 6000 signal converter can be supplied in a version tested and approved for custody transfer. The internal counter can accordingly be used for charging.
This requires verification, sealing and setting of the signal converter together with the sensor for a specific flow range. After sealing the data on the signal converter may not be changed.



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

3.6 Ex installations

Signal converters

The signal converter can be one of the following type:

MAG 5000/6000 19" with safety barrier (ia/ib) for separate mounting in safe area

Approval [EEx ia/ib] llB. The safety barrier is to be used with sensors MAG 1100 Ex and MAG 3100 Ex, DN 6 - 300. When this safety barrier is used. The coil circuit is intrinsic safety "ib" and the electrode circuit is intrinsic safety "ia".

MAG 5000/6000 19" with safety barrier (ia) for separate mounting in safe area

Approval [EEx ia] llC. The safety barrier is to be used with sensors MAG 3100 Ex, DN 350 - 2000. When the safety barrier is used. The coil circuit is increased safety "e" and the electrode circuit is intrinsic safety "ia".

Sensors

The sensors can be one of the following type.

MAG 1100 Ex for mounting in Ex areas

Approval EEx [ia/ib] llB T4..T6. DEMKO no. 97D.121909X. DN 6 - 100.

MAG 3100 Ex for mounting in Ex areas

The sensor carries the approval:

DN 15 - 100	EEx [ia/ib] m llB T4..T6, DEMKO no. 94C116403X.
DN 125 - 300	EEx [ia/ib] e llB T4..T6, DEMKO no. 94C115326X.
DN 350 - 2000	EEx e [ia] llC T3 - T6, SIRA no. Ex 92C3107X.

The electrode circuit in the sensors is manufactured to an intrinsically safe category "ia" and the coil circuit to an intrinsically safe category "ib", achieved by an integrated and patented protection circuit. For DN 350 - 2000 the coil circuit is increased safety "e".

Marking

The marking has the following meaning according to European Norm EN 50014.

E: Certified to CENELEC standard.

Ex: Designates explosion proof material and indicates that the apparatus has been approved in accordance with a certificate issued.

i: "Intrinsic safety" is a protection ensuring that the energy in the electric circuit is too small to ignite the explosive atmosphere. There are two categories of intrinsic safety: "ia" and "ib".

- ia: In intrinsic safety category "ia", the circuit must remain safe, even in the event of two simultaneous errors occurring that are independent of one another.
- ib: In intrinsic safety category "ib" the circuit must remain safe if one error occurs.

d: The enclosure of the of the signal converter is so strong that it can resist an explosion in side the enclosure. The enclosure is dimensioned in a way so that an explosion will not effect the surroundings.

e: "Increased safety" is a constructional safeguard which ensures the apparatus does not contain normally arcing or sparking devices, or hot surfaces that will cause ignition.

ll: Designates that the apparatus may be used in all areas (Except mining).

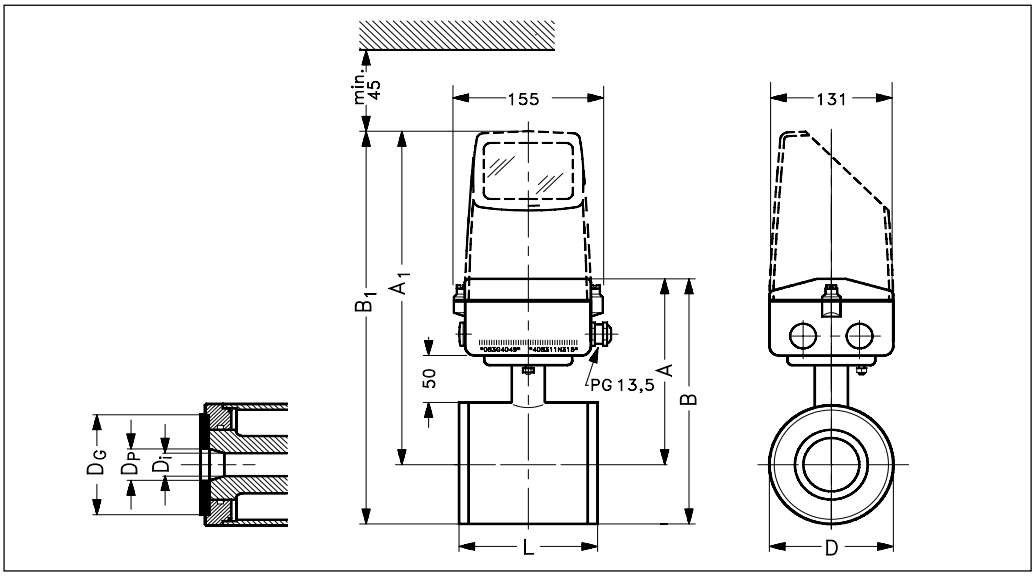
B: Indicates the gas group in which the unit may be used.

T4..T6 The temperature class describes the maximum temperature which any exposed surface of the equipment may reach. The sensor can have temperature class T3, T4, T5 or T6 depending on the temperature of the media. Please see technical data for the sensor.

T3:	Max. surface temperature	200 °C.	=> (Max. media temperature 180 °C).
T4:	Max. surface temperature	135 °C.	=> (Max. media temperature 120 °C).
T5:	Max. surface temperature	100 °C.	=> (Max. media temperature 90 °C).
T6:	Max. surface temperature	85 °C.	=> (Max. media temperature 75 °C).

4.1 Sensor MAG 1100

MAG 1100, compact/separate

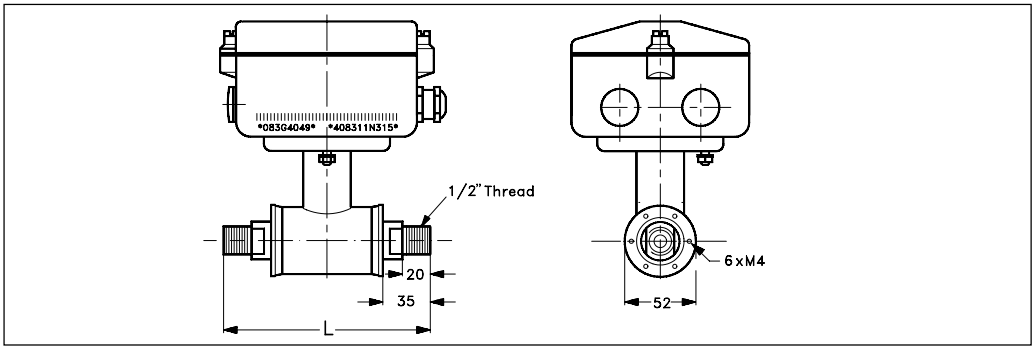


DN	A[1] [mm]	B[1] [mm]	A_1 [mm]	B_1 [mm]	D [mm]	D_i (Al_2O_3) [mm]]	D_p [mm]	D_G [mm]	Weight[2] [kg]
6	156	181	309	334	48.3	6	17.3	34	2.2
10	156	181	309	334	48.3	10	17.3	34	2.2
15	156	181	309	334	48.3	15	17.3	40	2.2
25	164	196	317	349	63.4	25	28.5	56	2.7
40	176	218	329	371	84.0	40	43.4	75	3.4
50	184	235	337	388	101.6	50	54.5	90	4.2
65	194	254	347	407	120.0	65	68.0	112	5.5
80	200	266	353	419	133.0	80	82.5	124	7.0
100	213	292	366	445	159.0	100	107.1	150	10.0

[1]) 13 mm shorter when the AISI terminal box is used. (Ex and high temperature 200°C).
[2]) With signal converter 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
6	64	66	70	64	77
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

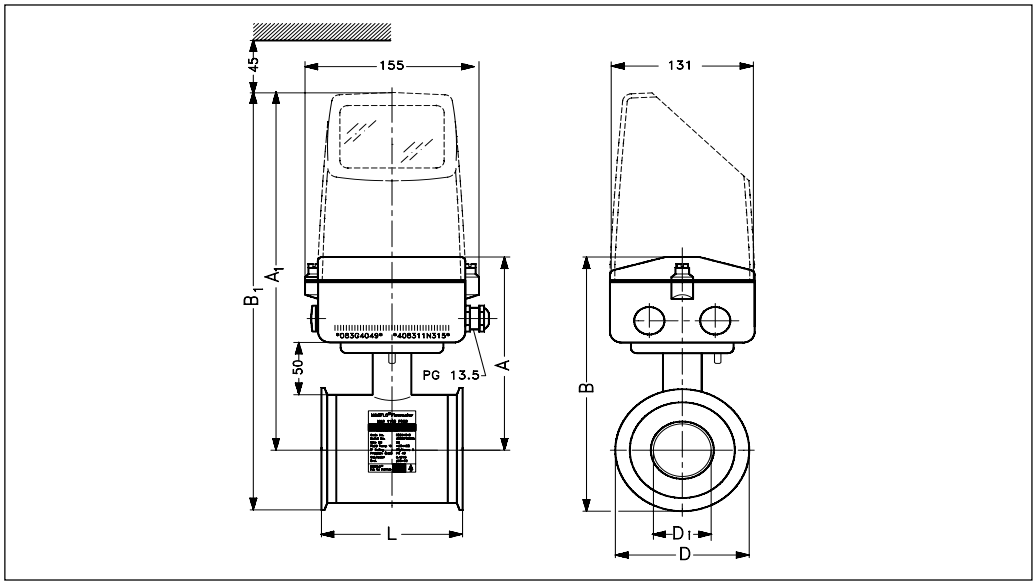


The MAG 1100 DN 6 and DN 10 are prepared for assembly with the 1/2" pipe connection (ISO).
The length "L" varies dependent on the gasket choice:

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

4.2 Sensor MAG 1100 FOOD

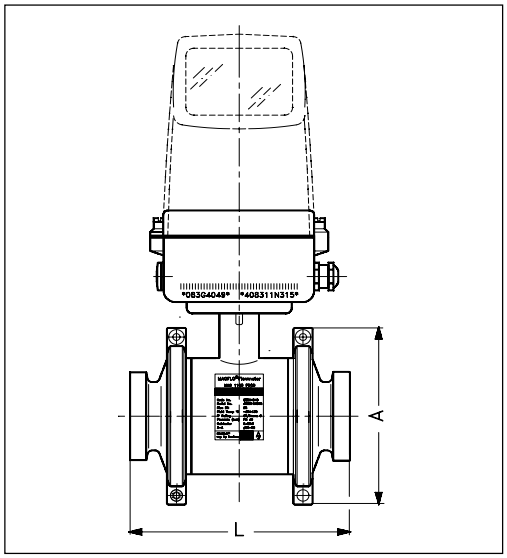
MAG 1100 FOOD, compact and separate



DN	L [mm]	A [mm]	A_1 [mm]	B [mm]	B_1 [mm]	D [mm]	D_i (Al_2O_3) [mm]	D_i (PFA) [mm]	Weight [1] [kg]
10	64	156	309	181	334	64	10	10	2.2
15	64	156	309	181	334	64	15	16	2.2
25	79	164	317	196	349	77.5	25	26	2.7
40	94	176	329	218	371	91	40	38	3.4
50	104	184	337	235	388	119	50	50	4.2
65	131	194	347	254	407	130	65	66	5.5
80	156	200	353	266	419	155	80	81	7.0
100	186	213	366	292	445	183	100	100	10.0

[1]) With signal converter MAG 5000 or MAG 6000 installed weight is increased by approx. 0.8 kg.

Built-in length

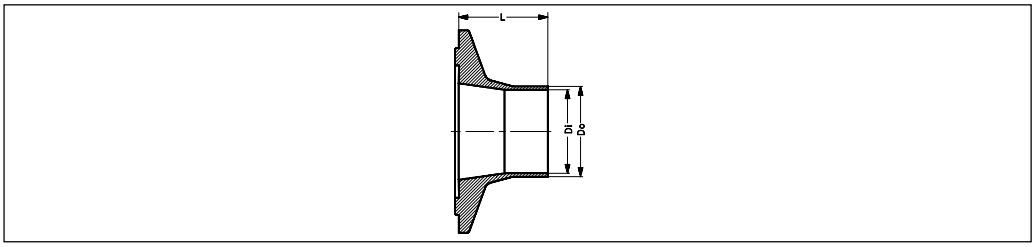


DN	A [mm]	L [1] [mm]
10	99	146
15	99	146
25	113	161
40	126	176
50	154	186
65	165	223
80	200	258
100	225	288

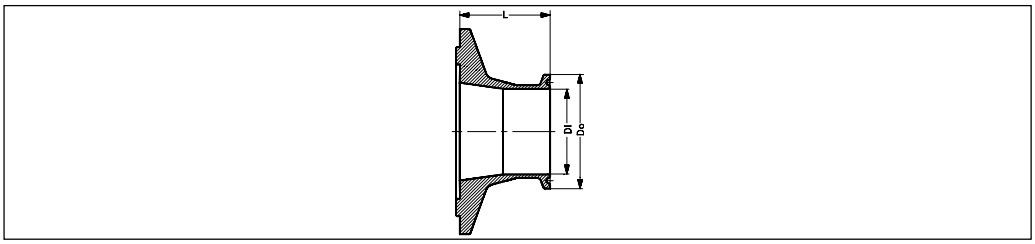
[1]) The total built-in length "L" is independent of the adapter type selected.

D & W

Accessories
MAG 1100 FOOD



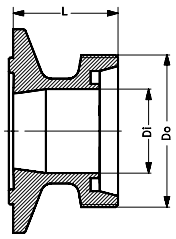
Adapter DN [mm]	Sensor DN [mm]	L [mm]	Weld-in type									
			DIN 11850		DS/ISO 2037		SMS 3008		BS4825-1		Tri-Clover®	
			Di [mm]	Do [mm]	Di [mm]	Do [mm]	Di [mm]	Do [mm]	Di [mm]	Do [mm]	Di [mm]	Do [mm]
10	10	40	10.0	13.0	10.0	13.0	10.0	13.0	10.0	13.0	-	-
15	15	40	16.0	19.0	16.0	19.0	16.0	19.0	16.0	19.0	-	-
15.9	15	40	-	-	-	-	-	-	-	-	13.5	15.9
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	-	-
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	35.6	38.6
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	48.6	51.6
50	50	40	50.0	53.0	-	-	-	-	-	-	-	-
63.5	65	45	-	-	60.3	64.1	60.3	64.1	60.3	64.1	60.3	64.1
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	76.7
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	97.6	102.6
114.3	100	50	-	-	110.3	115.6	110.3	115.6	110.3	115.6	-	-



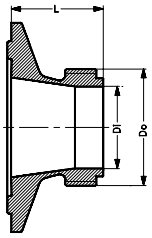
Adapter DN [mm]	Sensor DN [mm]	L [mm]	Clamp type									
			DIN 32676		ISO 2852		SMS 3016		BS4825-3		Tri-Clamp®	
			Di [mm]	Do [mm]	Di [mm]	Do [mm]	Di [mm]	Do [mm]	Di [mm]	Do [mm]	Di [mm]	Do [mm]
10	10	40	10.0	34.0	10.0	34.0	10.0	34.0	-	-	-	-
15	15	40	16.0	34.0	16.0	34.0	16.0	34.0	-	-	-	-
20	15	40	20.0	34.0	20.0	34.0	-	-	-	-	-	-
25	25	40	-	-	22.6	50.5	22.6	50.5	22.6	50.5	22.6	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	35.6	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	48.6	64.0
63.5	65	45	-	-	60.3	77.5	60.3	77.5	60.3	77.5	60.3	77.5
65	65	45	66.0	91.0	-	-	-	-	-	-	-	-
76.1	80	50	-	-	72.9	91.0	72.9	91.0	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	97.6	119.0

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

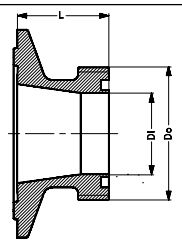
Accessories
MAG 1100 FOOD



Adapter DN [mm]	Sensor DN [mm]	L [mm]	Threaded type DIN 11851 Di [mm]	Threaded type DIN 11851 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 Di [mm]	ISO 2853 Do [mm]	SS 3351 Di [mm]	SS 3351 Do [mm]	BS 4825-4 (IDF) Di [mm]	BS 4825-4 (IDF) 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	-	-

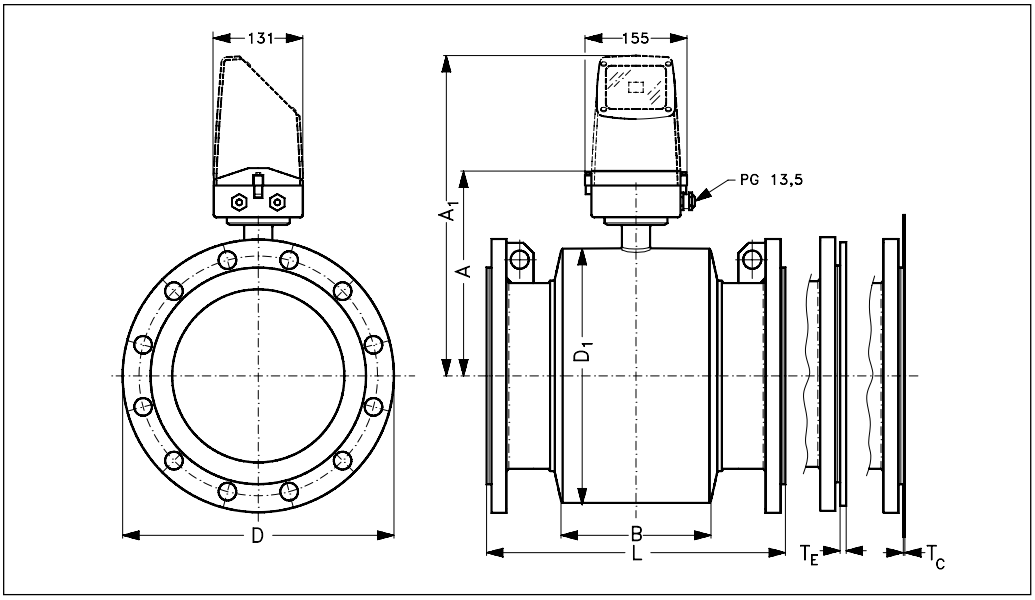


Adapter DN [mm]	Sensor DN [mm]	L [mm]	Threaded type SMS 1145 Di [mm]	Threaded type SMS 1145 Do [mm]
25	25	40	22.6	40.0
32	25	40	29.6	48.0
38	40	40	35.6	60.0
51	50	40	48.6	70.0
63.5	65	45	60.3	85.0
76	65	45	72.0	98.0

D & W

4.3 Sensor MAG 3100 and MAG 3100 W

MAG 3100 & MAG 3100 W, compact/separate

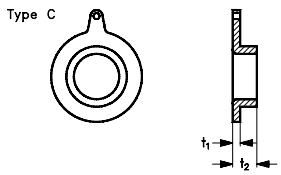


DN	A[1]	A1	B	D1	L[2]											TC[3]	TE[3]	Weight[4]
					DIN 2501/BS 4504					BS 1560/ANSI 16.5		BS 10 AS 2129 D & E AS 4087 Class 14	JIS B 2220		AWWA C-207 Class D			
					PN 6, 10, 16	PN 25	PN 40	PN 64	PN 100	Class 150	Class 300		10K	16K				
[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kg]
15	187	338	59	104	200	200	200	-	-	200	200	200	-	-		-	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	-	-	200	1.2	6	8
50	205	356	72	139	200	200	200	276	300	200	200	200	200	200		1.2	6	9
65	212	363	72	154	200	200	200	320	350	200	272	200	200	200		1.2	6	11
80	222	373	72	174	200	272	272	323	340	272	272	200	200	272		1.2	6	12
100	242	393	85	214	250	280	280	380	400	280	310	250	250	280		1.2	6	16
125	255	406	85	239	275	300	300	420	450	300	335	275	275	300		1.2	6	19
150	276	427	85	282	300	325	325	415	450	325	370	300	300	325		1.2	6	27
200	304	455	137	338	350	350	350	480	530	350	410	350	350	350		1.2	8	40
250	332	483	137	393	450	450	450	550	620	450	500	450	450	450		1.2	8	60
300	357	508	137	444	500	500	500	600	680	500	550	500	500	500		1.6	8	80
350	362	513	270	451	500	500	550	700	800	550	590	500	500	550	-	1.6	8	110
400	387	538	270	502	500	500	550	750	-	550	590	500	500	550	-	1.6	10	125
450	418	569	310	563	560	560	600	-	-	600	640	560	560	600	-	1.6	10	175
500	443	594	350	614	625	625	680	-	-	680	730	625	625	680	-	1.6	10	200
600	494	645	430	715	750	750	750	-	-	820	860	750	750	820	-	1.6	10	300
700	544	695	500	816	875	-	-	-	-	-	-	875	875	875	875	2.0	-	350
750	571	722	556	869	-	-	-	-	-	-	-	937	937	937	937	2.0	-	
800	606	757	560	927	1000	-	-	-	-	-	-	1000	1000	1000	1000	2.0	-	475
900	653	804	630	1032	1125	-	-	-	-	-	-	1125	1125	1125	1125	2.0	-	560
1000	704	906	670	1136	1250	-	-	-	-	-	-	1250	1250	1250	1250	2.0	-	700
1100	755	906	770	1238	1375	-	-	-	-	-	-	-	-	-	-	2.0	-	
1200	810	961	792	1348	1500	-	-	-	-	-	-	1500	-	1500	1500	2.0	-	1250
1400	925	1076	1000	1675	1750	-	-	-	-	-	-	-	-	-	-	3.0	-	1753
1500	972	1123	1020	1672	-	-	-	-	-	-	-	1875	-	-	1875	3.0	-	
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

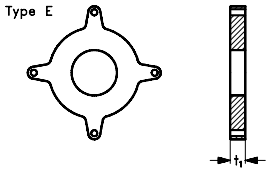
[1]) 13 mm shorter with AISI terminal box (Ex and high temperature)
[2]) When earthing flanges are used the thickness of the earthing flange must be added to the built-in length
[3]) T_C = Type C grounding ring, T_E = Type E grounding ring
[4]) Weights are approx and for PN 16 without signal converter.

D = Outside diameter of flange, see flange tables

Eathing/protection flange



DN	t_1 [mm]	t_2 [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	40	9-16



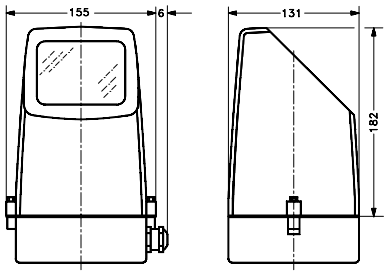
DN	t_1 [mm]	Weight [kg]
15	6	0.07
25-150	6	0.3-1.4
200-350	8	1.7-4.1
400-600	10	6.5-13.0

Type C flanges for liners of neoprene, EPDM, polyurethane, linatex and ebonite.
Type E flanges for liners of PTFE.
MAG 3100 high temperature (PTFE) is always equipped with 2 pcs. type E earthing flanges.

4.4 Signal converter

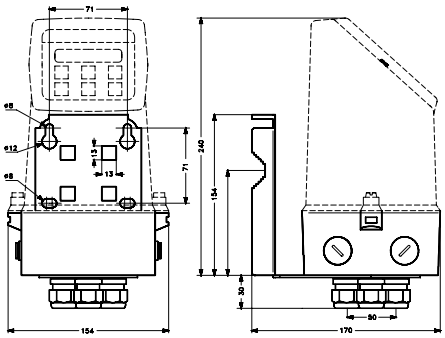
Compact polyamid

Signal converter installed in compact mode



Weight: MAG 3000 and MAG 2500: 0.75 kg

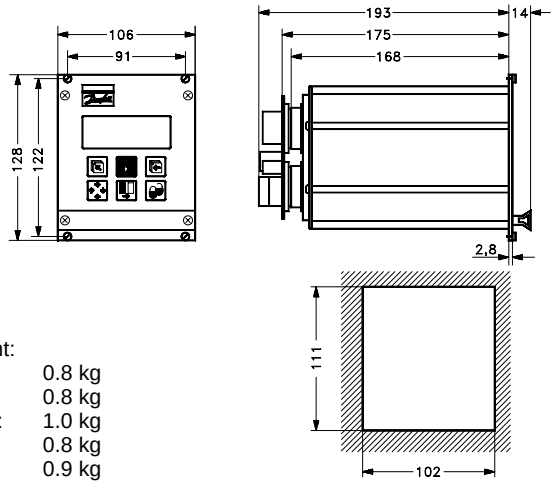
Signal converter installed remote



Weight: Wall bracket: 0.9 kg

D & W

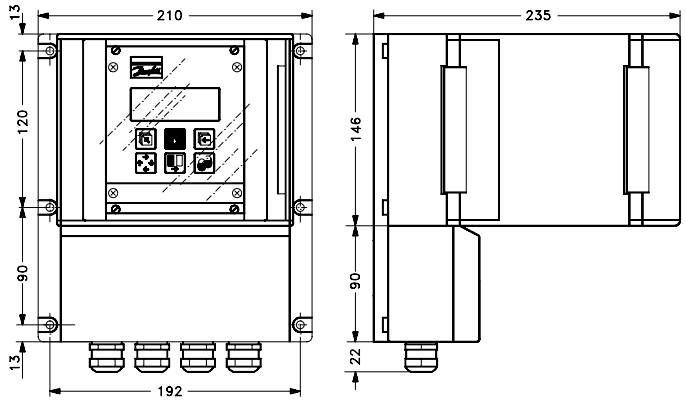
19"insert, standard unit



Weight incl. bag print:

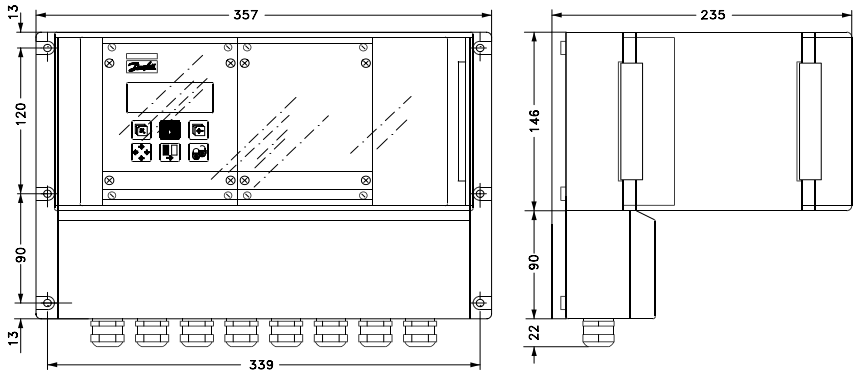
MAG 5000:	0.8 kg
MAG 6000:	0.8 kg
Safety barrier (ia/ib):	1.0 kg
Safety barrier (ia):	0.8 kg
Cleaning unit:	0.9 kg

Wall mounting box 21 TE



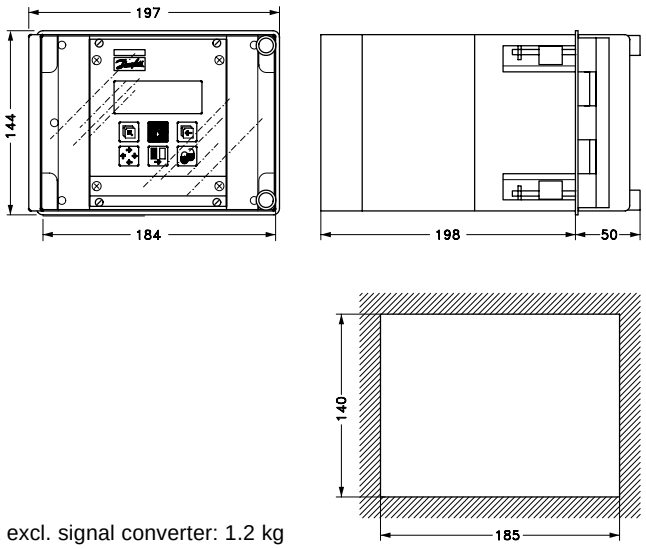
Weight excl. signal converter: 2.3 kg

Wall mounting box 42 TE



Weight excl. signal converter: 2.9 kg

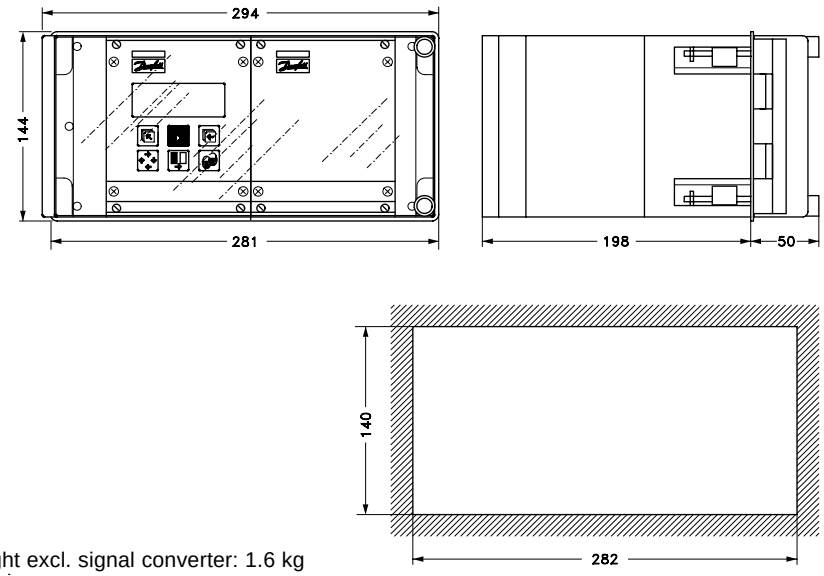
Panel front unit 21 TE



Weight excl. signal converter: 1.2 kg

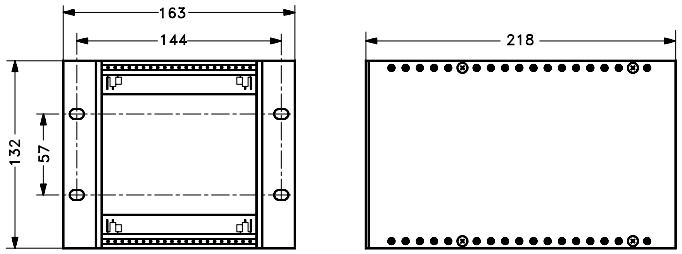
D & W

Panel front unit 42 TE



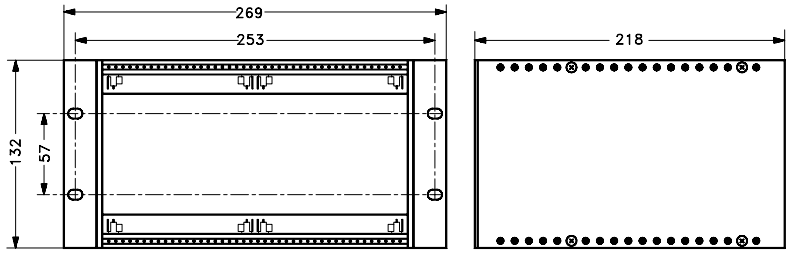
Weight excl. signal converter: 1.6 kg

Back of panel unit 21 TE



Weight: 0.7 kg

Back of panel unit 42 TE



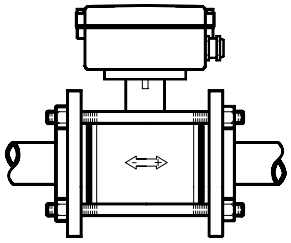
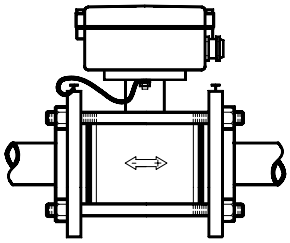
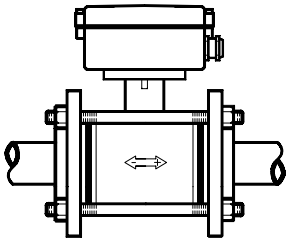
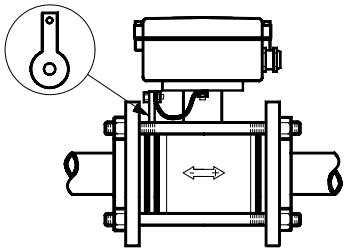
Weight: 0.9 kg

D & W

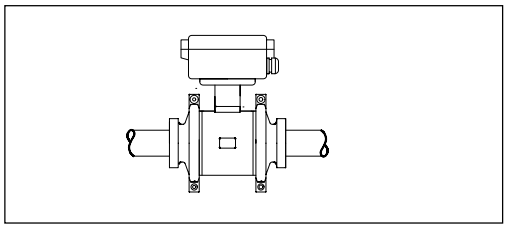
5.1 Potential equalization

To obtain optimum results from the measuring system the sensor's chassis point/housing must have the same electrical potential as the liquid being measured.

MAG 1100

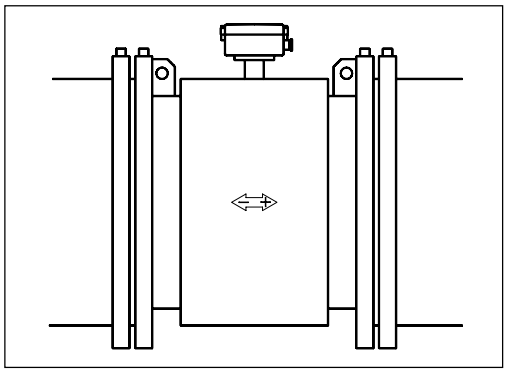
	Graphite gaskets	EPDM or PTFE gaskets
Electrically conductive piping	 **A**: Potential equalization with electrically conductive graphite gaskets	 **B**: Potential equalization using earth strap supplied.
Electrically non-conductive piping	 **C**: Potential equalization with electrically conductive graphite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

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.

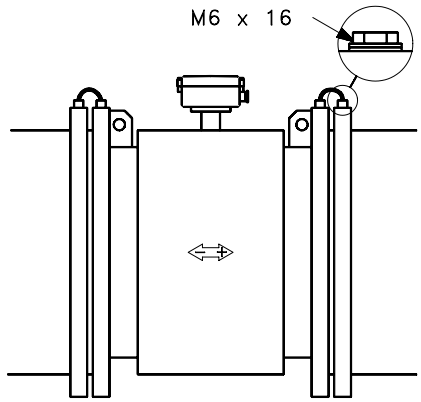
MAG 3100 (With earthing electrodes)



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

MAG 3100 (Without earthing electrodes)

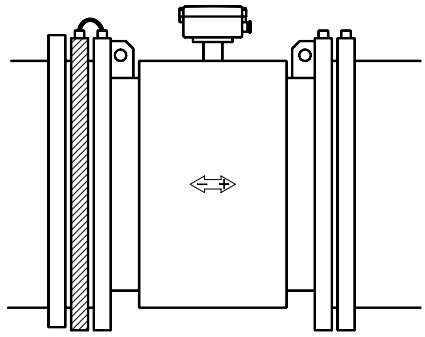
Electrically conductive piping



Potential equalization, electrically conductive pipe

Use an earth straps on one side.

Non-conductive piping

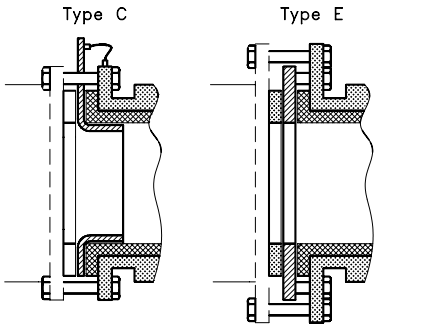


Type of earthing flange depending on liner material

Here an earthing flange is used, placed between flowmeter and the adjacent pipe flange. Selection of earthing flange depends on the medium, liner material and application, see figure.

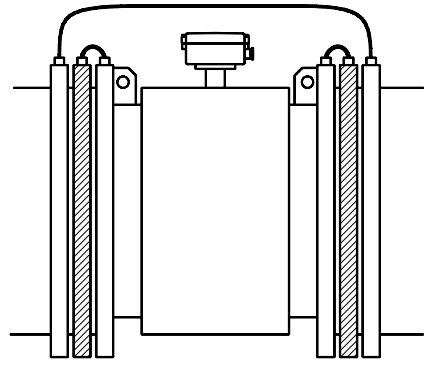
Liner material	Suitable earthing flange
All except PTFE	Type C
PTFE	Type E

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.

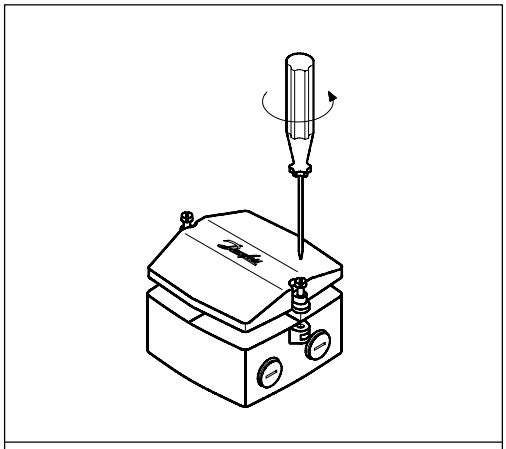
5.3 Cathodic protected piping

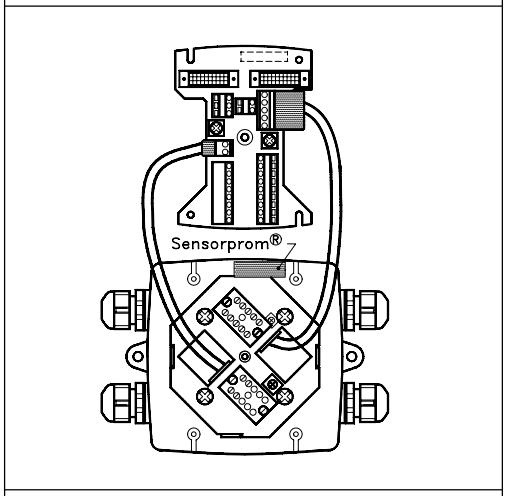


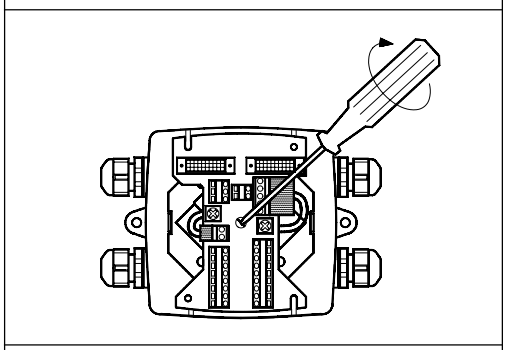
Special attention must be given to systems with cathodic protection.
By compact mounting:
The signal converter must be supplied through an isolation transformer. The terminal "PE" must never be connected.
By remote mounting:
The screen must only be connected at the sensor end via a 1.5 µF condensator. The screen must never be connected at both ends.
By isolated sensor:
If above mentioned connections are unacceptable the sensor must be isolated from the pipe work.

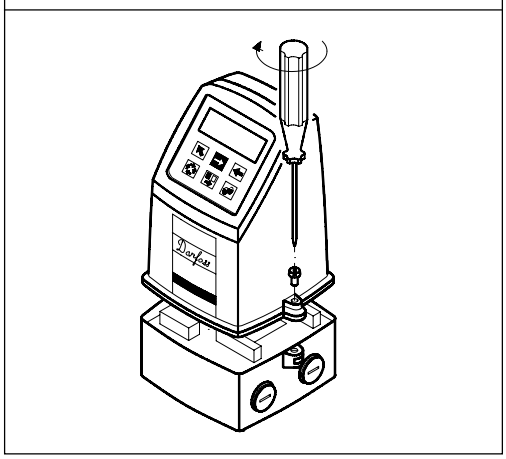
6.1.1 Compact installation MAG 5000 and MAG 6000

Compact polyamid









Remove and discard the terminal box lid of the sensor.

Fit the PG 13.5 cable glands for the supply and output cables.

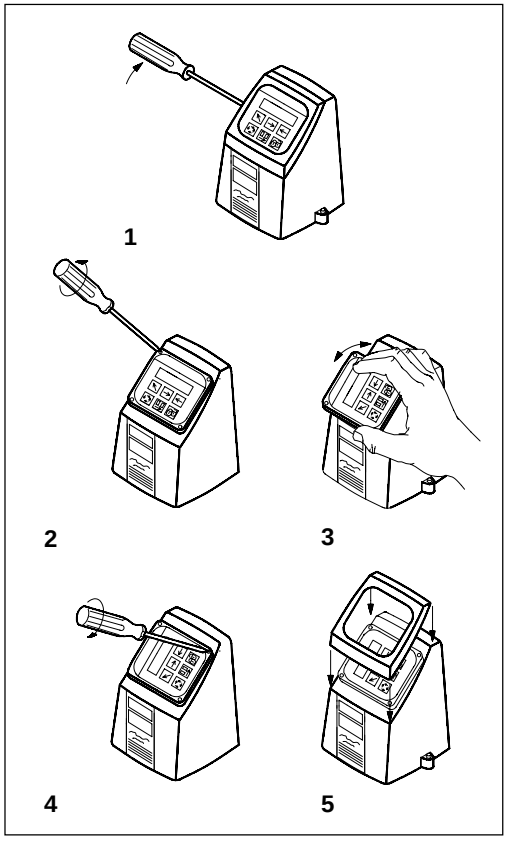
Remove the two black plug assemblies for coil and electrode cables in the terminal box and connect them to their corresponding terminal numbers on the connection plate.

Mount the connection plate in the terminal box. The SENSORPROM® unit connections will then be established automatically when the connection plate is mounted in the terminal box. Tighten the earthing screw in the centre of the connection box properly.
If you have an old terminal box without centre thread, then fix the connection plate with the two diagonal opposite screws.

Fit the supply and output cables respectively and tighten the cable glands to obtain optimum sealing.
Please see the wiring diagram in section 7 for the electrical connections.

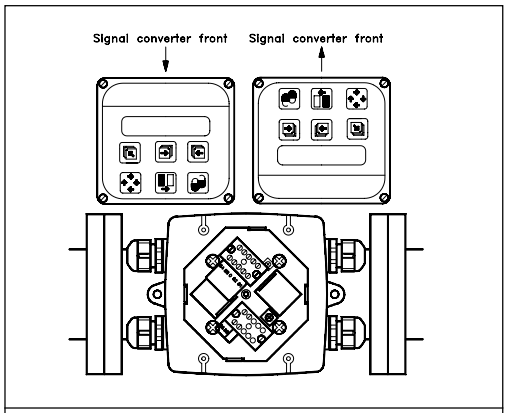
Mount the signal converter on the terminal box.

Turning the control pad

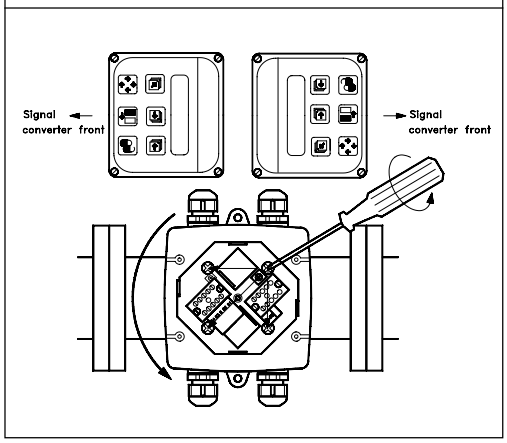


1. Remove the outer frame using a finger-nail or a screwdriver.
2. Loosen the 4 screws retaining the control pad.
3. Withdraw the control pad and turn it to the required orientation.
4. Tighten the 4 screws until a mechanical stop is felt in order to obtain IP 67 enclosure rating.
5. Snap-lock the outer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

Turning the signal converter

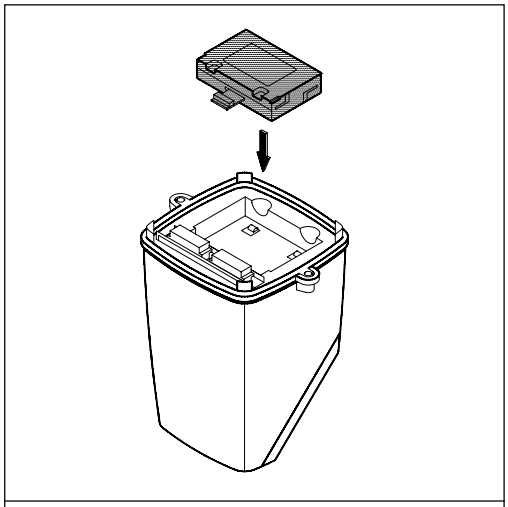


The signal converter can be mounted in either direction as the arrow indicates without turning the terminal box.

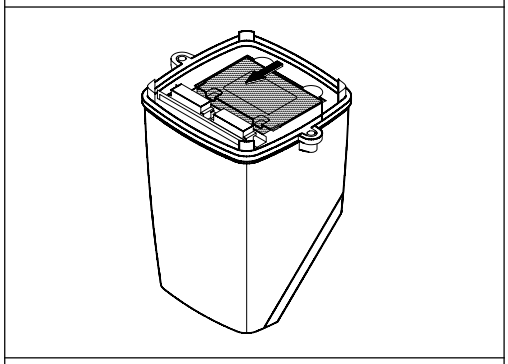


The terminal box can be rotated ±90° in order to optimize the viewing angle of the signal converter display/keypad:
Unscrew the four screws in the bottom of the terminal box. Turn the terminal box to the required position and retighten the screws firmly.

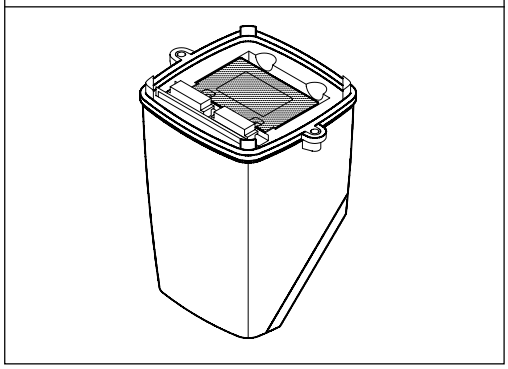
6.2.1 Add-on modules MAG 6000 only



Unpack the add-on modules and locate it in the bottom of the signal converter as shown.



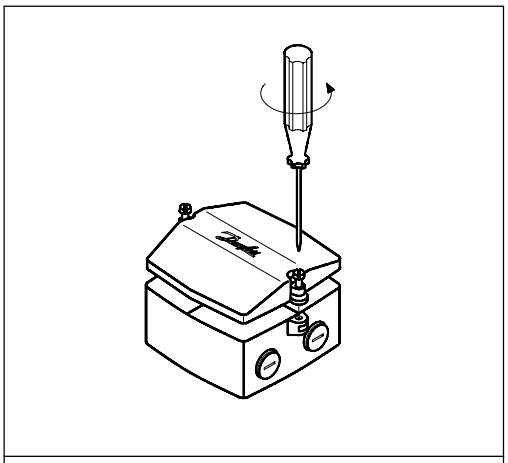
Press the add-on module forwards as far as possible.



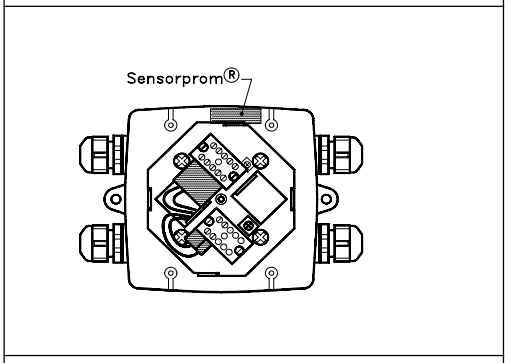
The add-on module has now been installed and the signal converter is ready to be installed on the terminal box.
Communication to the operator menu and electrically inputs and outputs are automatically established by power on.

6.2.1 Remote installation

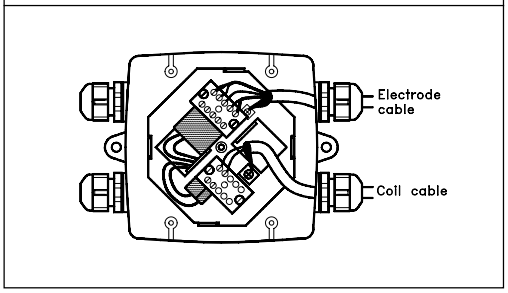
At the sensor



Remove and keep the sensor terminal box lid.

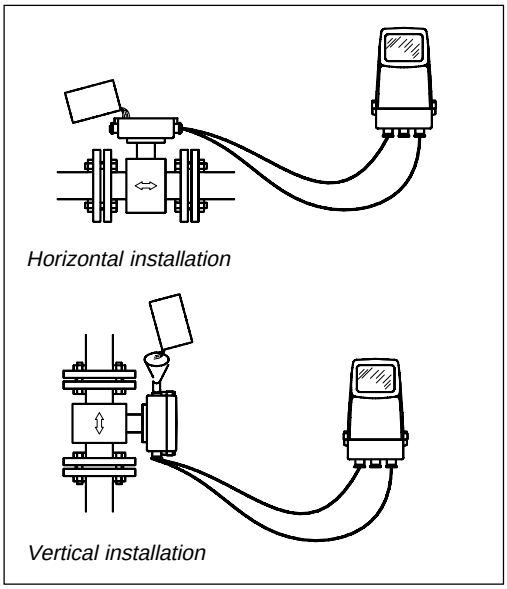


Remove the SENSORPROM® unit and keep it for later use. The SENSORPROM® unit will be mounted on the connection plate to the signal converter.



Fit and connect the electrode and coil cables as shown in section 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.

IP 68 Applications only



Horizontal installation

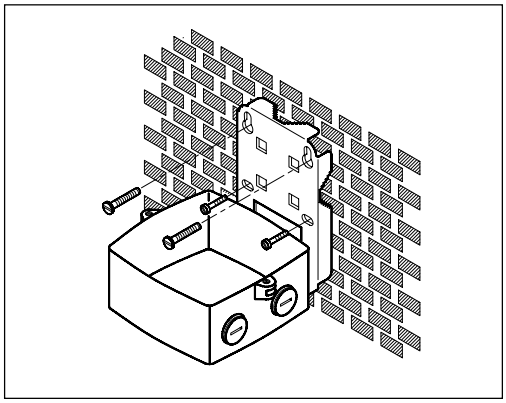
Vertical installation

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 selfhealing gel which cures in approx. 24 hours.
The gel can be penetrated with test instruments or be removed in case of cable replacement.

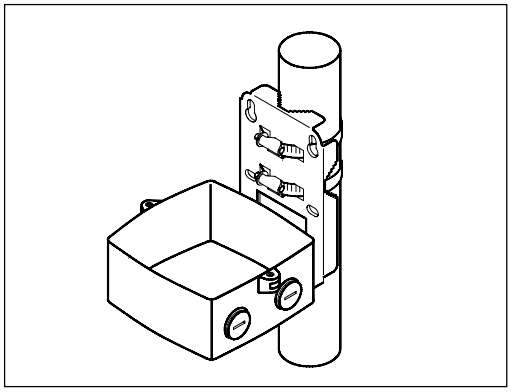
6.2.2 Remote installation

Wall mounting



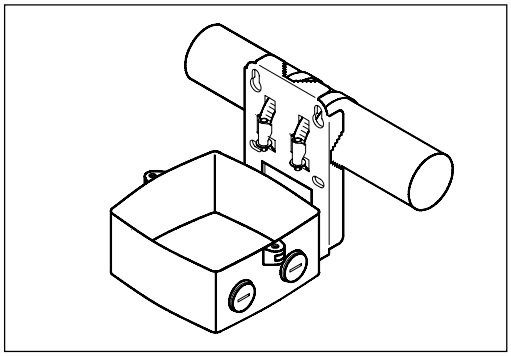
Mount wall bracket on a wall or in the back of a panel.

Vertical pipe mounting



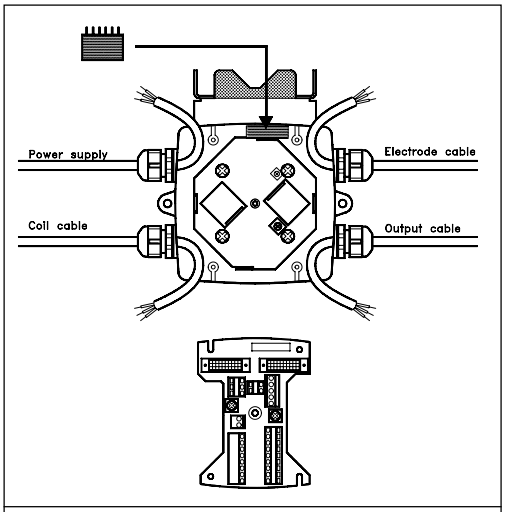
Mount wall bracket on a vertical or horizontal pipe using an ordinary hose clip or a duct strap.

Horizontal pipe mounting

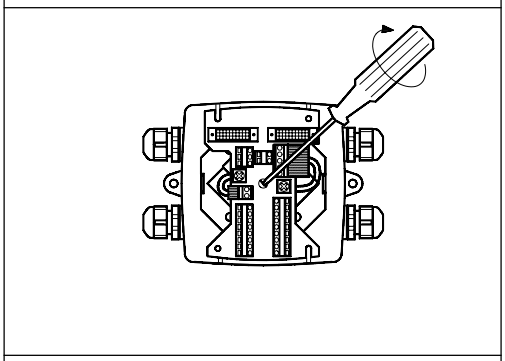


6.2.2 Remote installation

Wall mounting
(continued)

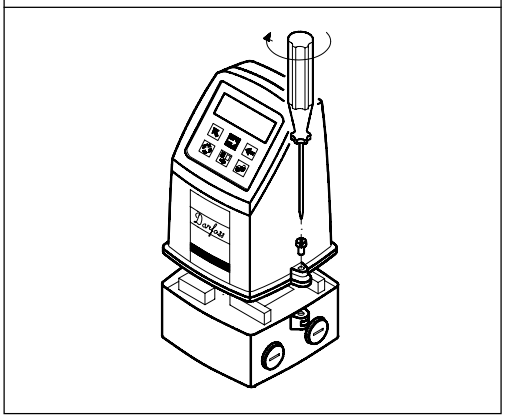


Take the SENSORPROM® memory unit from the sensor. Mount the SENSORPROM® unit in the wall mounting unit as shown. The text on the SENSORPROM® unit **must** turn towards the wall bracket.



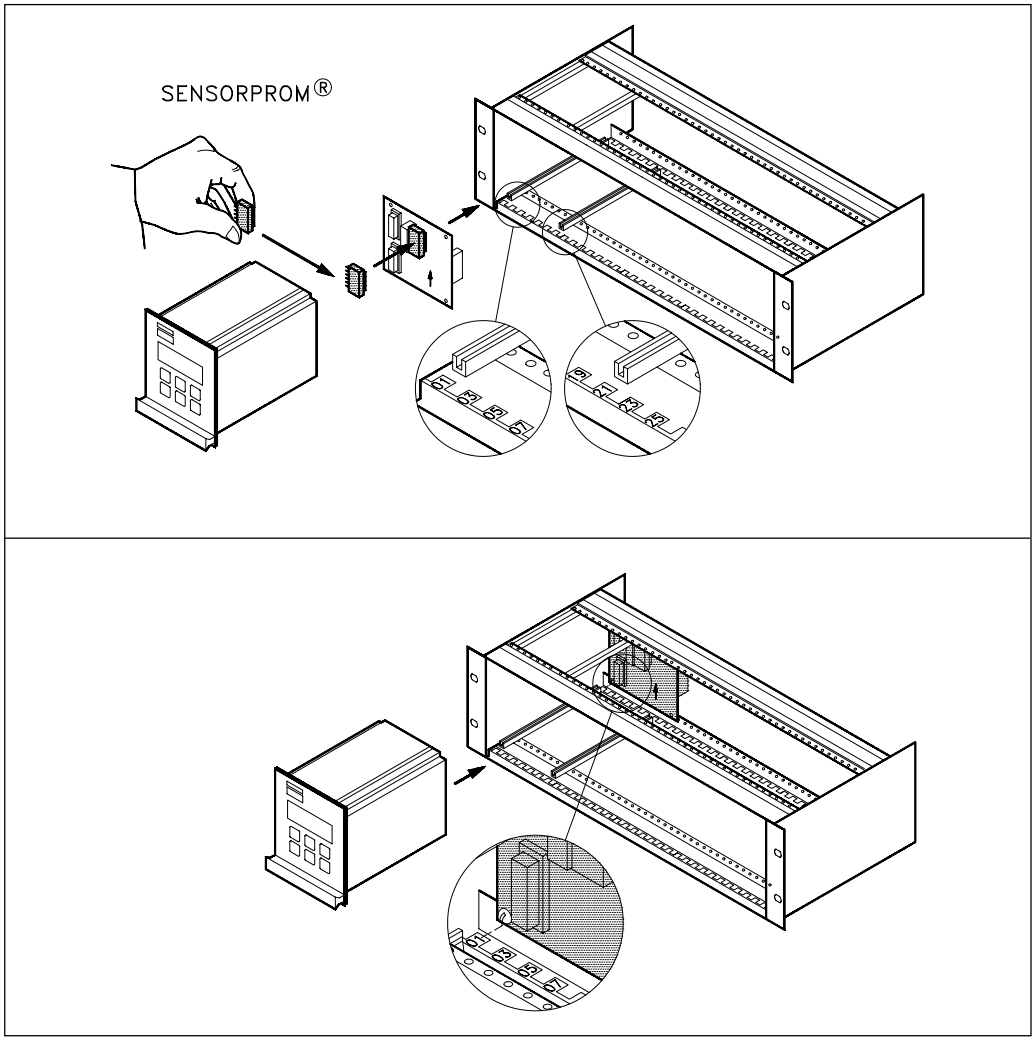
Mount the connection plate in the terminal box. Tighten the earthing screw in the centre of the connection box properly.
If you have an old wall mounting unit without centre thread, then fix the connection plate with the two diagonal opposite screws.

Fit the coil, electrode, supply and output cables respectively and tighten the cable glands to obtain optimum sealing. Please see the wiring diagram in section 7 for the electrical connections.



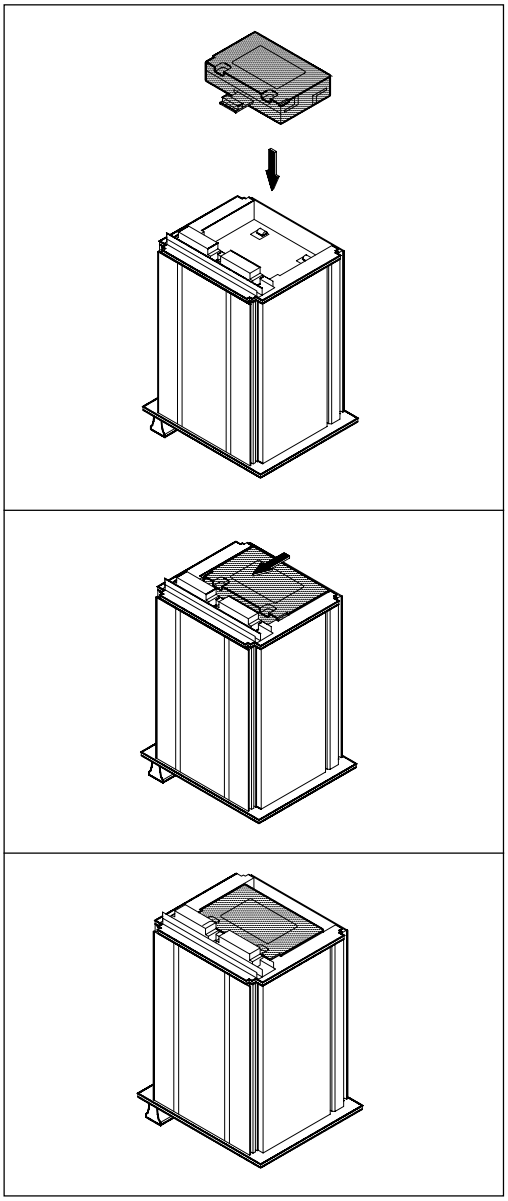
Mount the signal converter on the terminal box.

6.2.3 Remote installation Signal converter in 19" insert



1. Fit the SENSORPROM® memory unit on the connection board supplied with the signal converter. The SENSORPROM® unit is supplied with the sensor in the terminal box.
2. Mount the guide rails in the rack system as shown. Distance between guide rails is 20 TE. Guide rails are supplied with the rack system and not with the signal converter.
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", section 7.
5. Plug the signal converter into the rack system.

6.2.4 Add-on modules MAG 6000 only

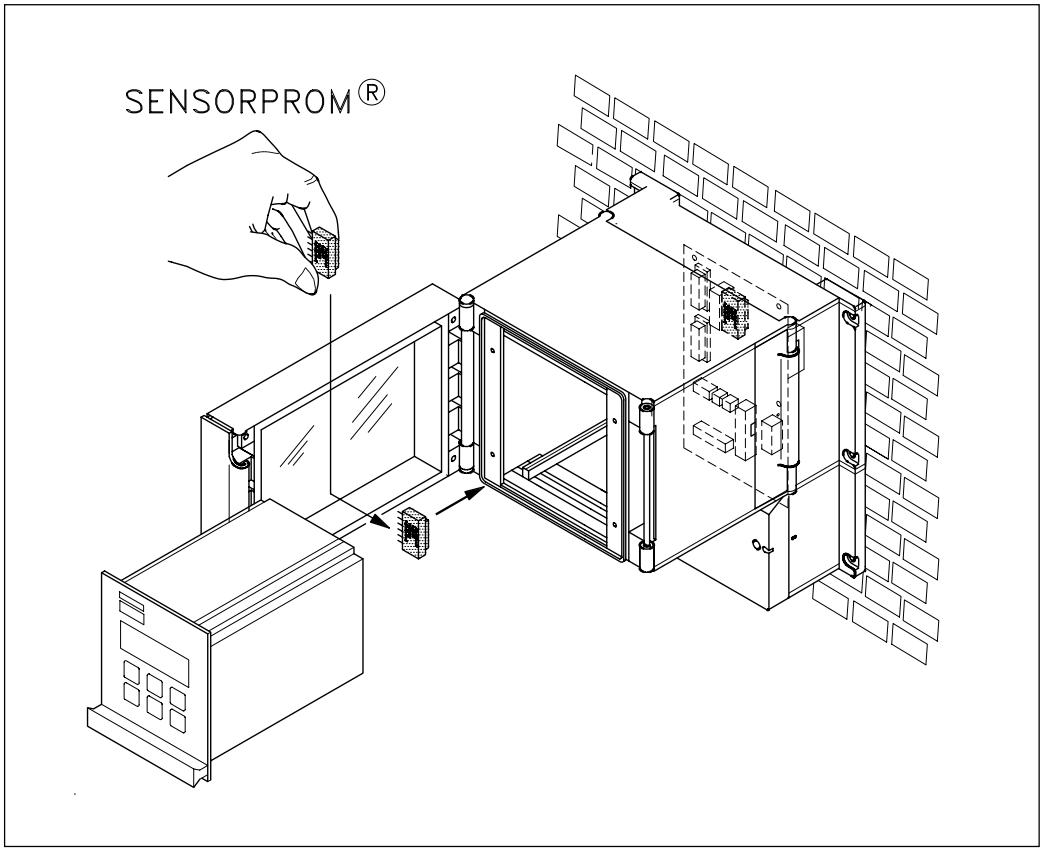


Unpack the add-on modules and locate it in the bottom of the signal converter as shown.

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

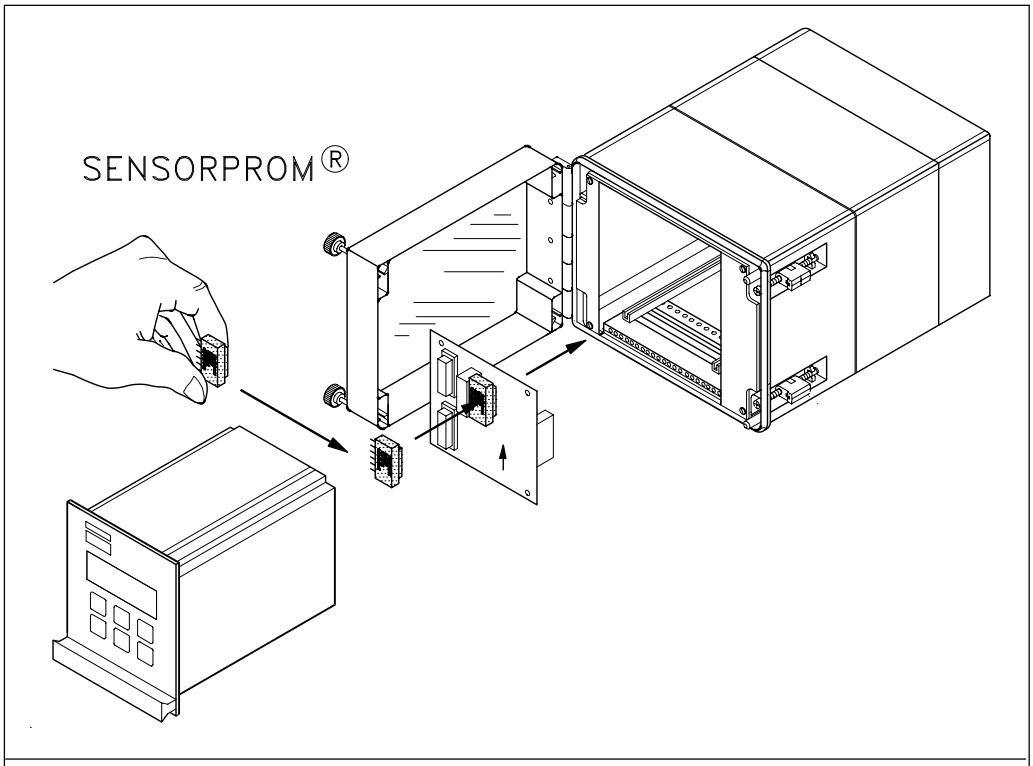
The add-on module has now been installed and the signal converter is ready to be installed on the terminal box.
Communication to the operator menu and electrically inputs and outputs are automatically established by power on.

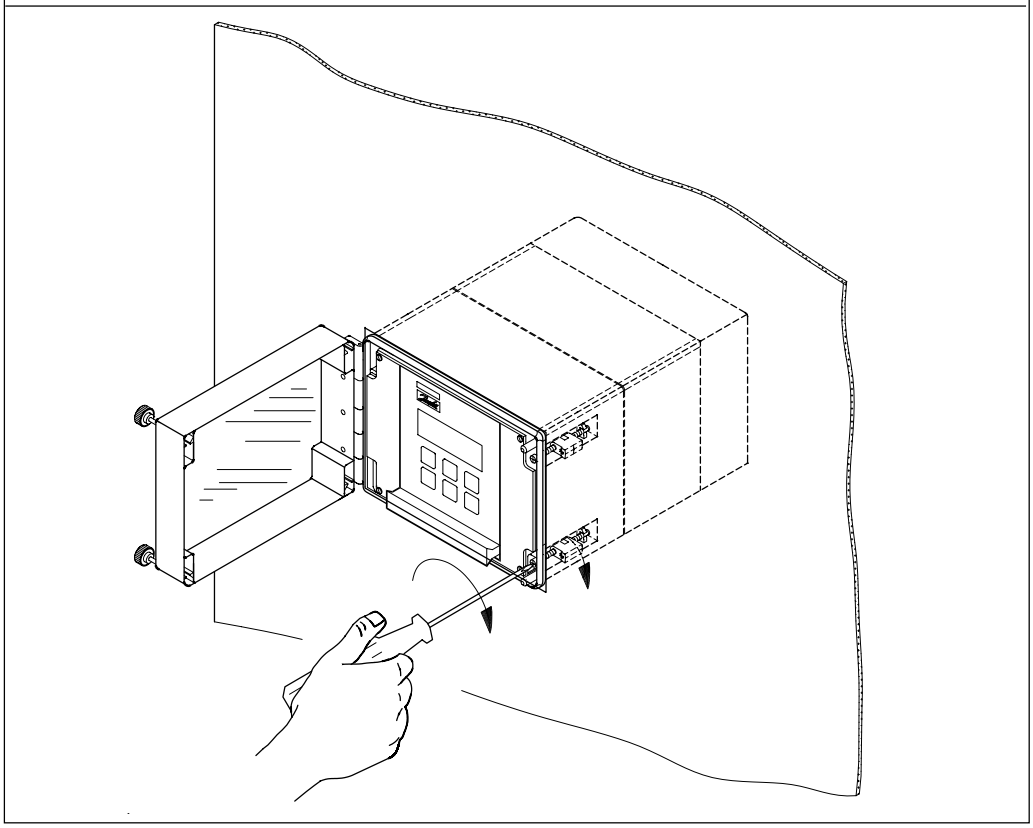
6.2.5 Installation in IP 65 wall mounting enclosure



1. Mount the IP 65 enclosure to 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 65 wall mounting boxes must be used.
3. Connect the cables to the terminals, see "Electrical connection", section 7.
4. Plug in the signal converter and close the cover.

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





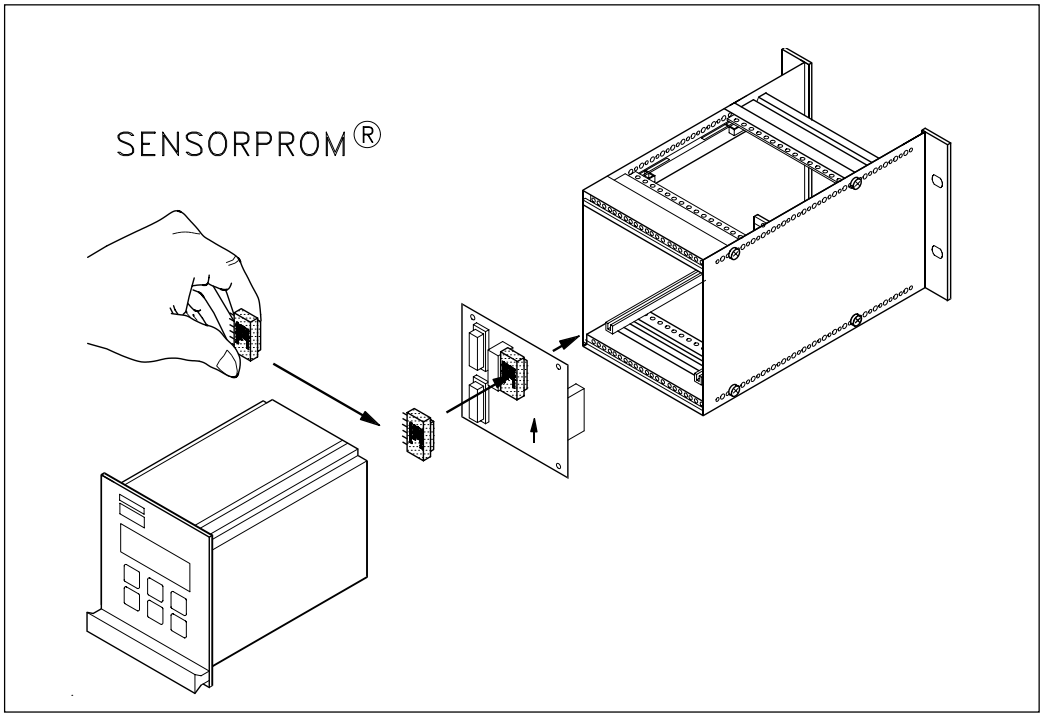
1. Mount the SENSORPROM® memory unit on the connection board as shown.
   The SENSORPROM® unit is supplied with the sensor in the terminal box.

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", section 7.

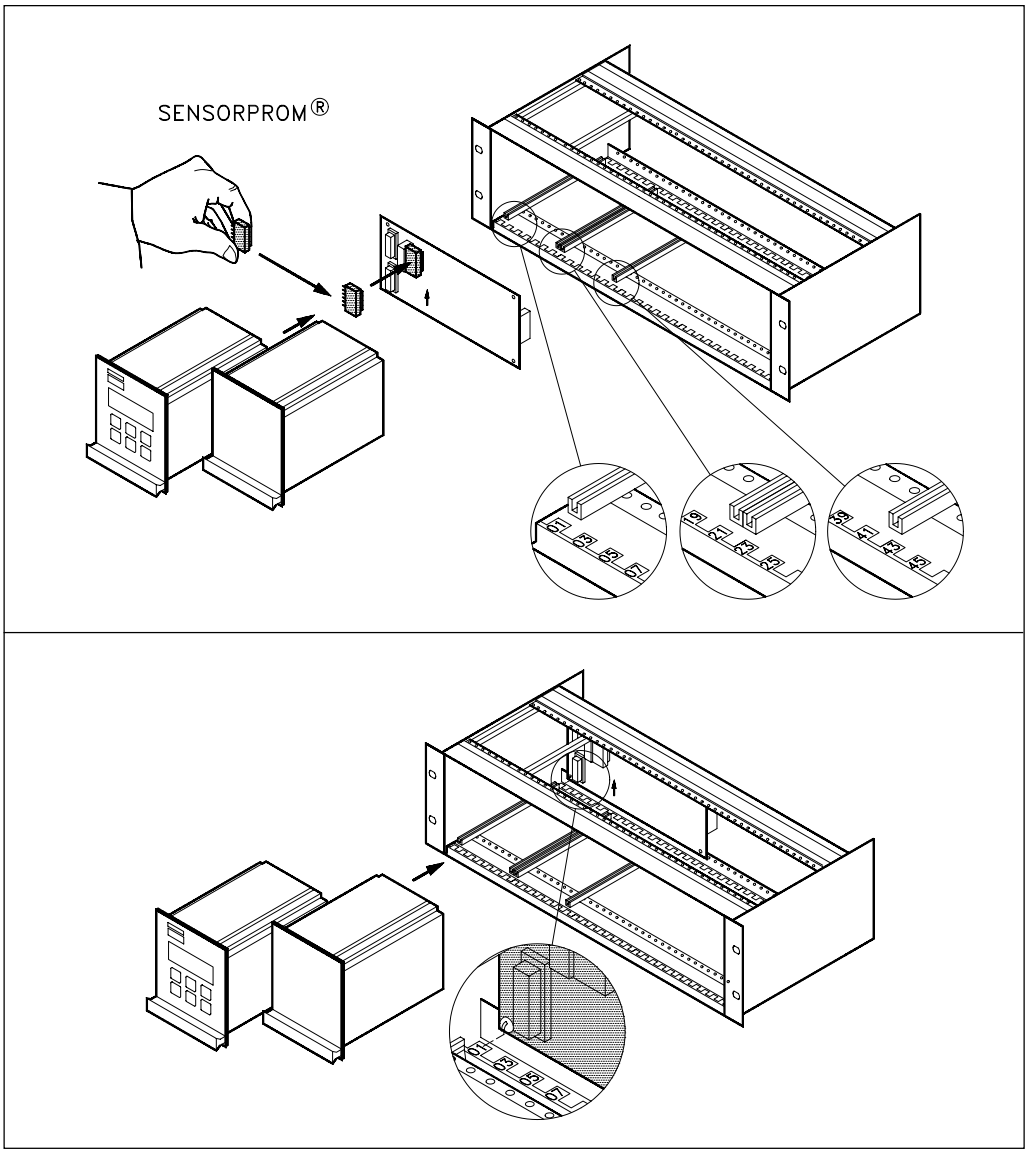
4. Plug in the signal converter and close the cover.

6.2.7 Installation in 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 in the back of the enclosure.
3. Connect the cables as shown under "Electrical connection", section 7.
4. Mount the enclosure in the back of a panel with four screws.
5. Plug in the signal converter.

6.3 Signal converter 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 signal converter is not used.

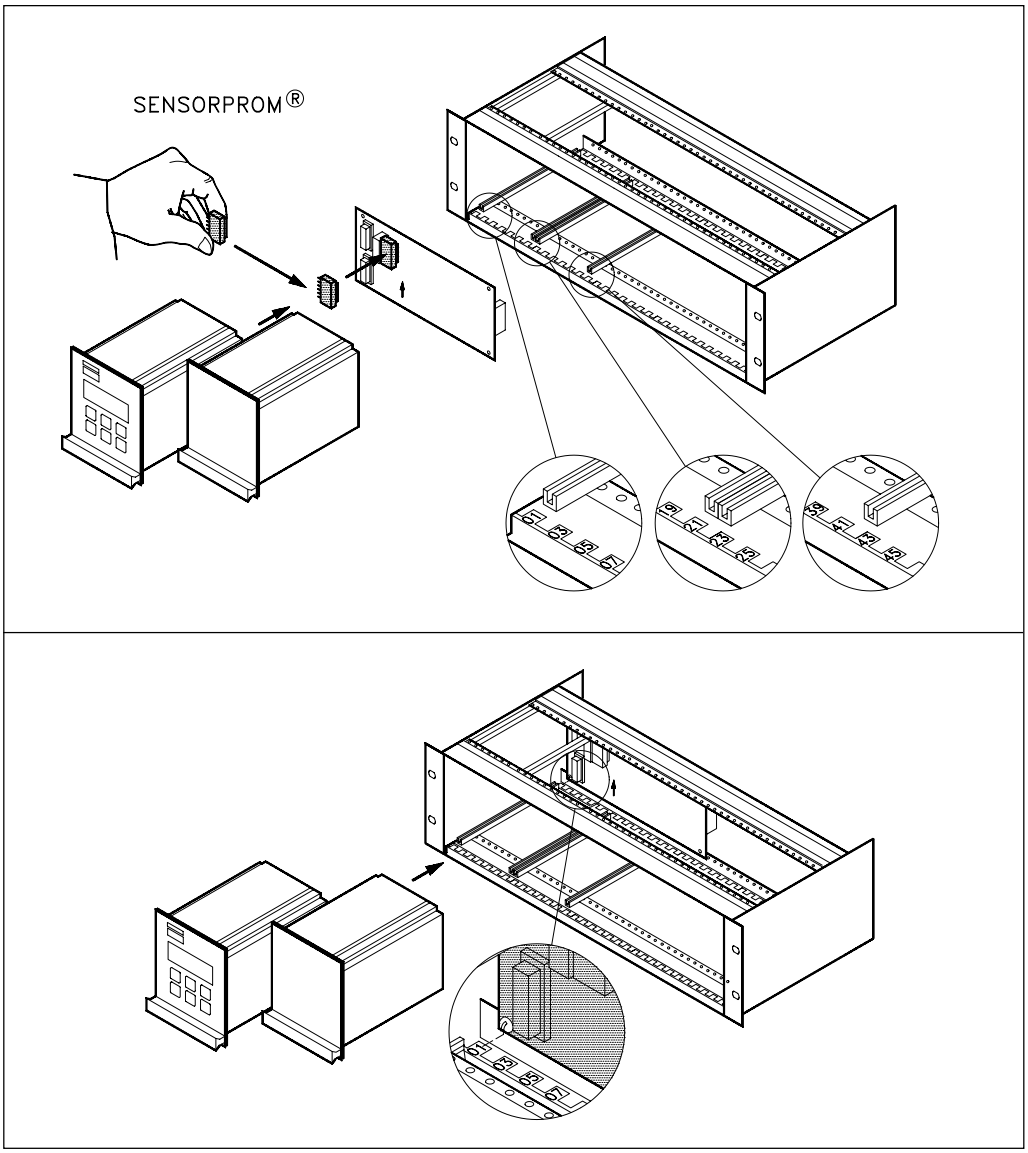
2. Mount the guide rails in the rack system as shown. Distance between guide rails is 20 TE. Guide rails are supplied with the rack system and not with the signal converter.

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", section 7.

5. Plug the signal converter and the safety barrier into the rack system.

6.4 Signal converter 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 signal converter is not used.

2. Mount the guide rails in the rack system as shown. Distance between guide rails is 20 TE. Guide rails are supplied with the rack system and not with the signal converter.

3. Mount the connection board as shown. The mounting screw must be installed just in line with the guide rails.

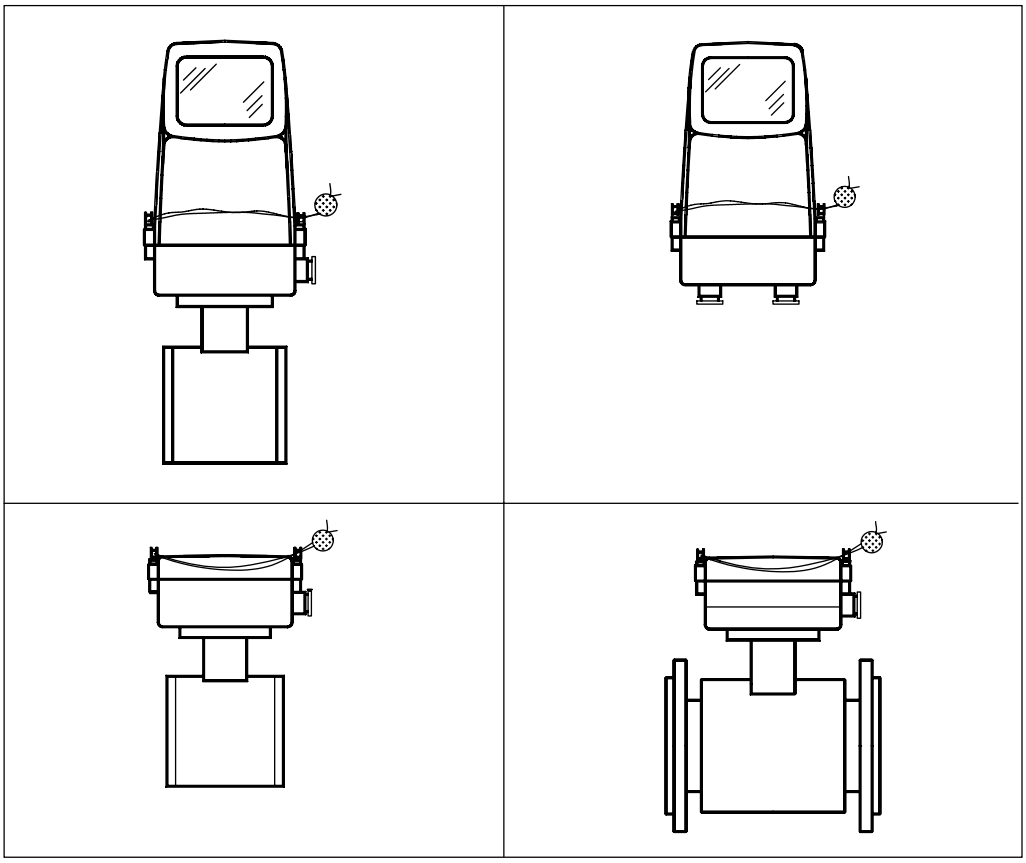
4. Connect the cables as shown under "Electrical connection", section 7.

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 signal converter in the rack system.

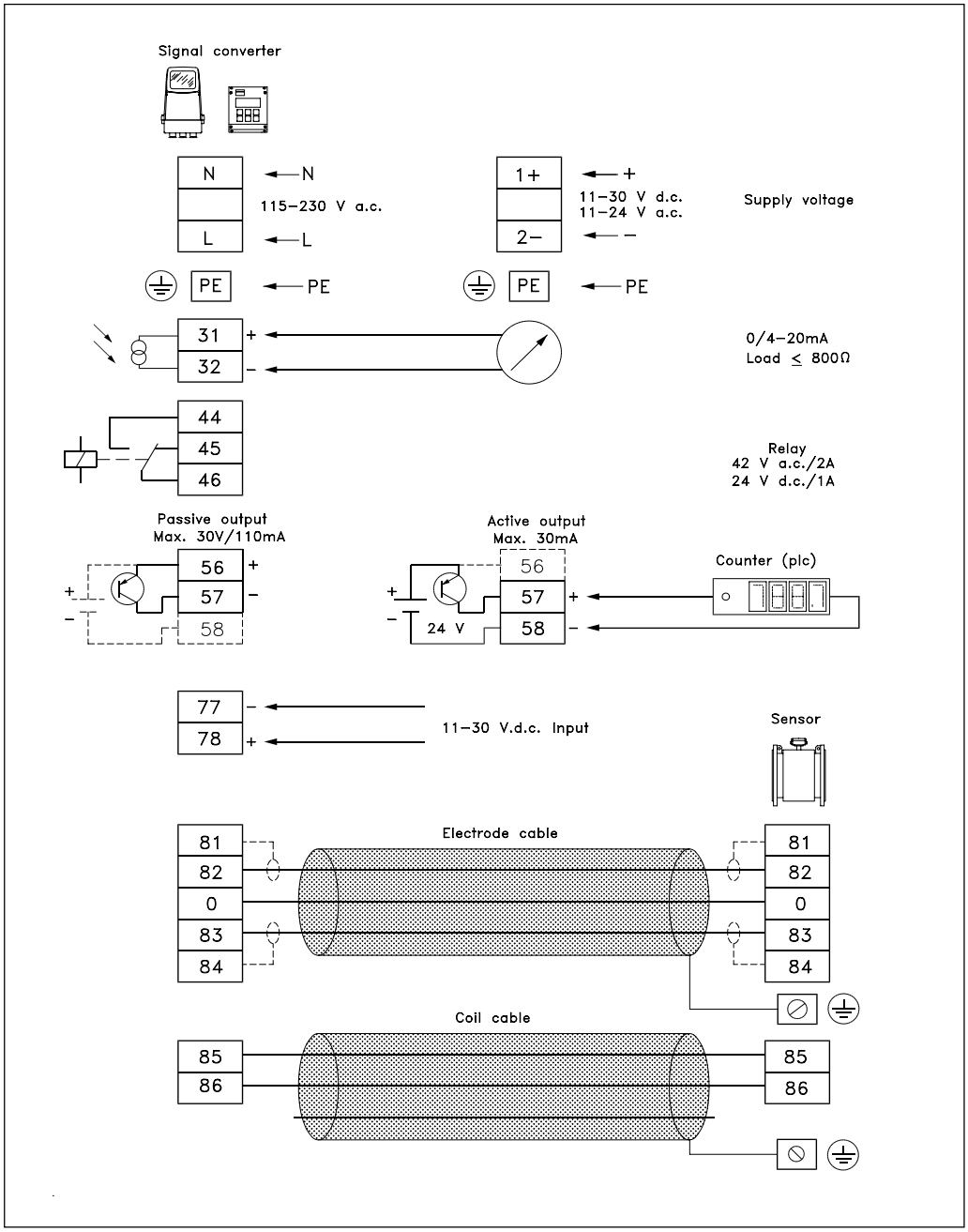
6.5
Signal converter
MAG 6000 CT
Sealing

The final sealing is 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.

7.1 Signal converter MAG 5000 and MAG 6000



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.
- Normally the external shield is not connected to the signal converter. In environments with strong electrical noise the external screen must be earthed in both ends.

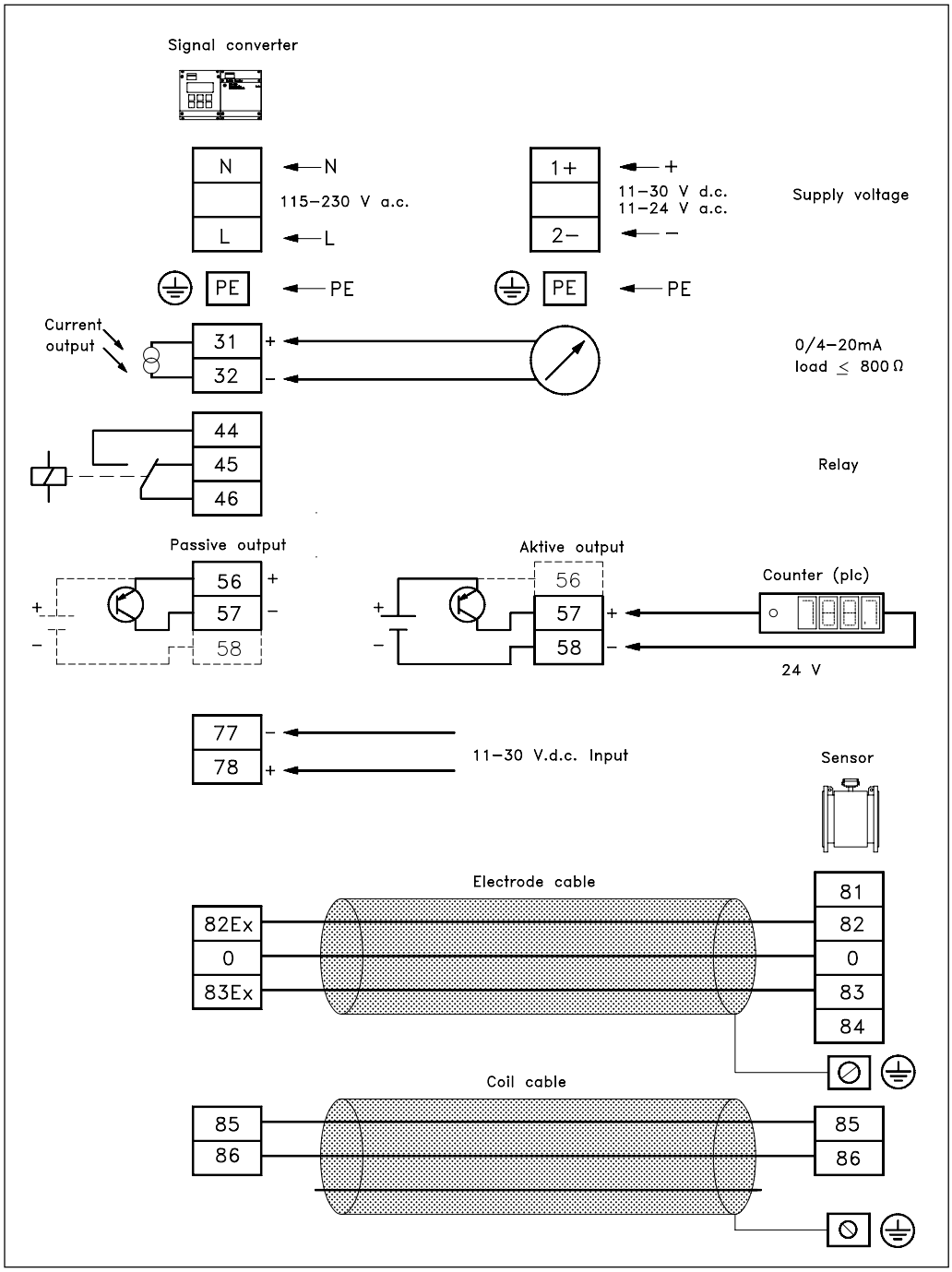
Cathodic protected piping

By compact mounting:
The signal converter must be supplied through an isolation transformer. The terminal "PE" must not be connected.
By remote mounting:
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.

Digital output

- If the internal resistance of the load exceeds 10kΩ, it is recommended to connect an external 10kΩ load resistor in parallel to the load.

7.2 Signal converter with safety barrier



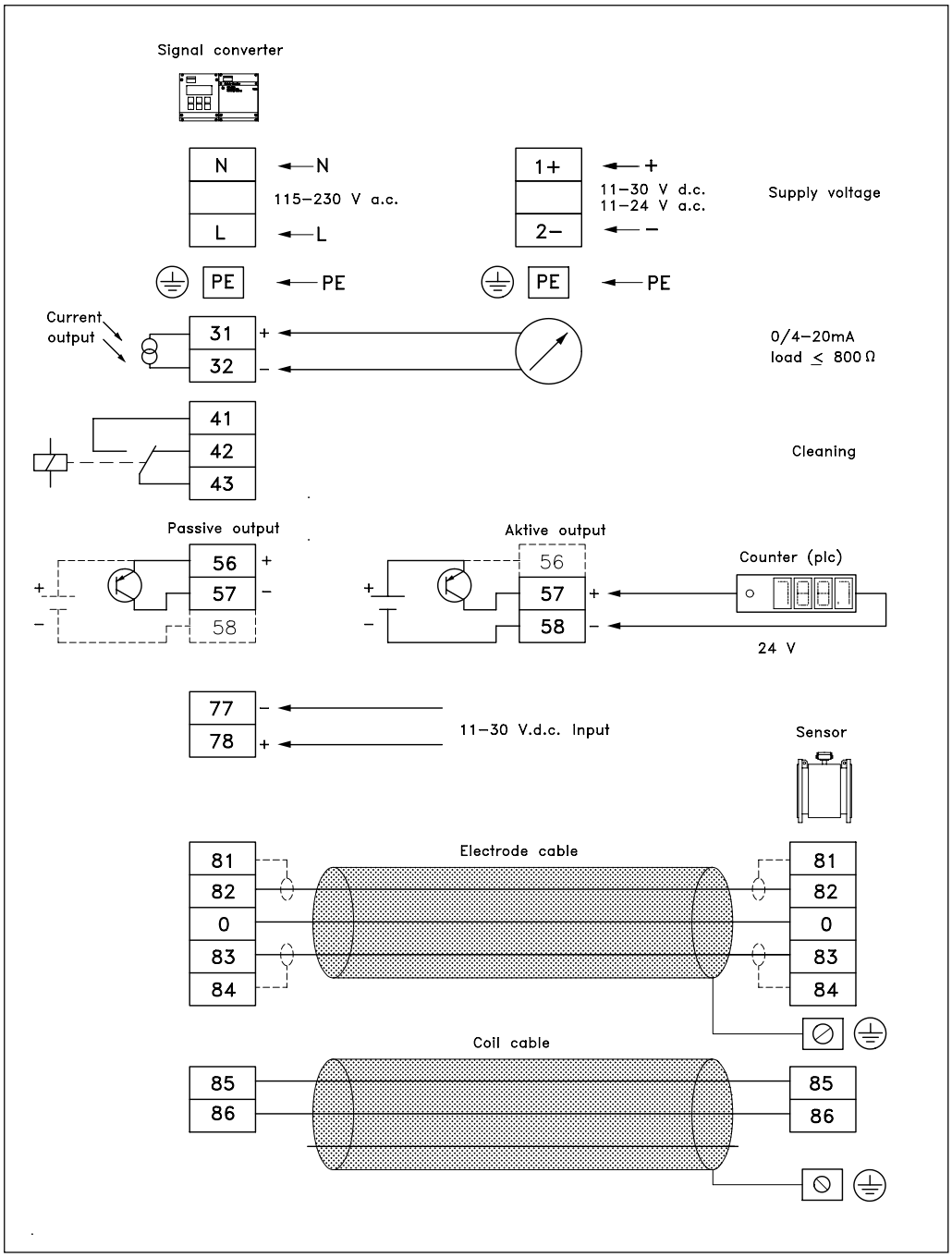
All cables and installations in hazardous areas must conform to the national code of practise.

The sensor and safety barrier must be connected to a potential equalising rail with an insulating copper wire according to national regulations. A cross section of 4 mm^2 (min.) must be used if not specified otherwise in national regulations.

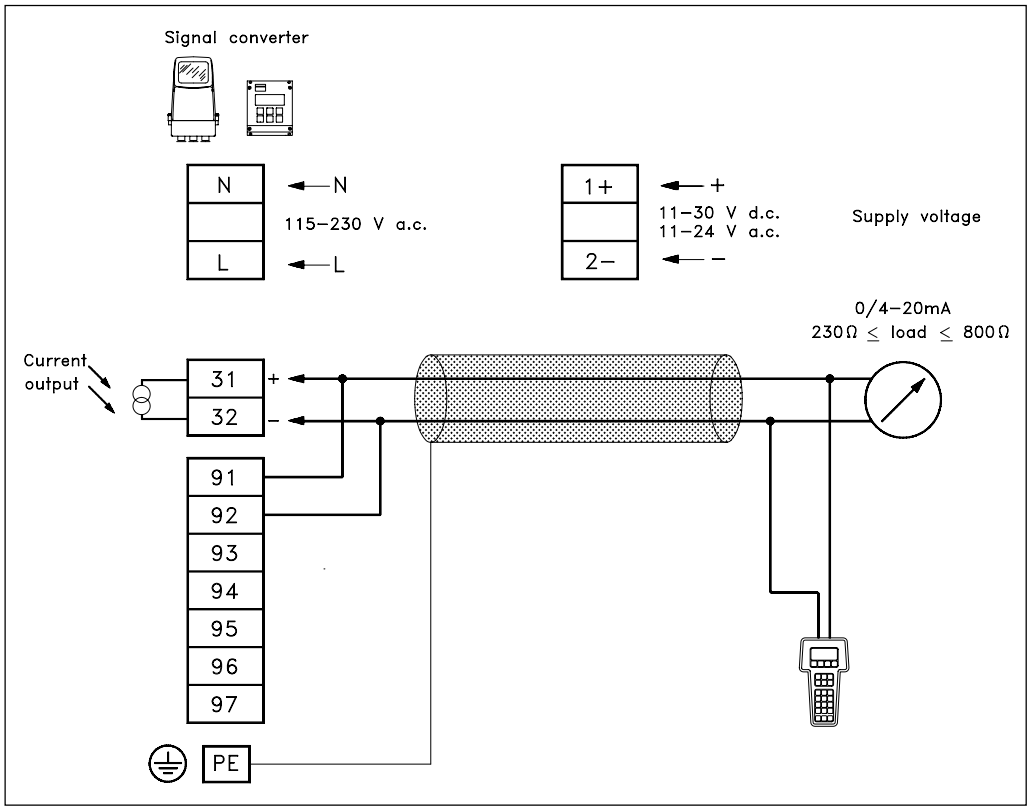
The screen of the cables between sensor and signal converter/safety barrier must be connected at the sensor end. The screen must never be connected at both signal converter and sensor end.

Cables must be in one length and unscreened cable ends must be kept as short as possible.

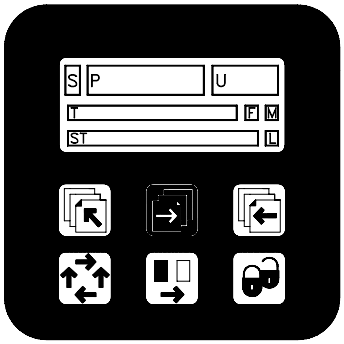
7.3 Signal converter with cleaning unit



7.4 HART® communication



8.1 Keypad and display layout



Keypad

The keypad is used to set the flowmeter. The function of the keys are as follows:

TOP UP KEY		This key (hold 2 sec.) is used to switch between operator menu and setup menu. In the converter 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 alphanumerically and indicates flow values, flowmeter settings and error messsages.

The upper line is for primary flow readings and will always show either flowrate, 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
Service mode	Output
Operator menu	External input
Product identity	Sensor characteristic
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 type of signal converter 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 signal converter 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 signal converter always starts in the 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.

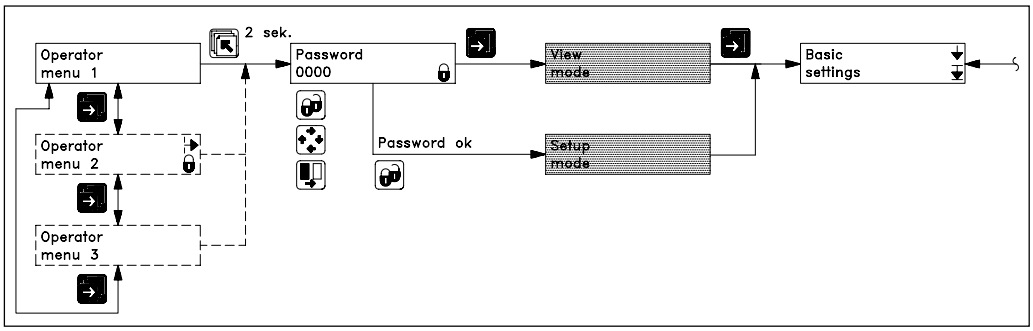
Access to the setup menu is gained by pressing the top up key for 2 seconds. The setup menu will operate in two modes:
〈 View mode
〈 Setup mode

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 protected with a password. 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 the 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)

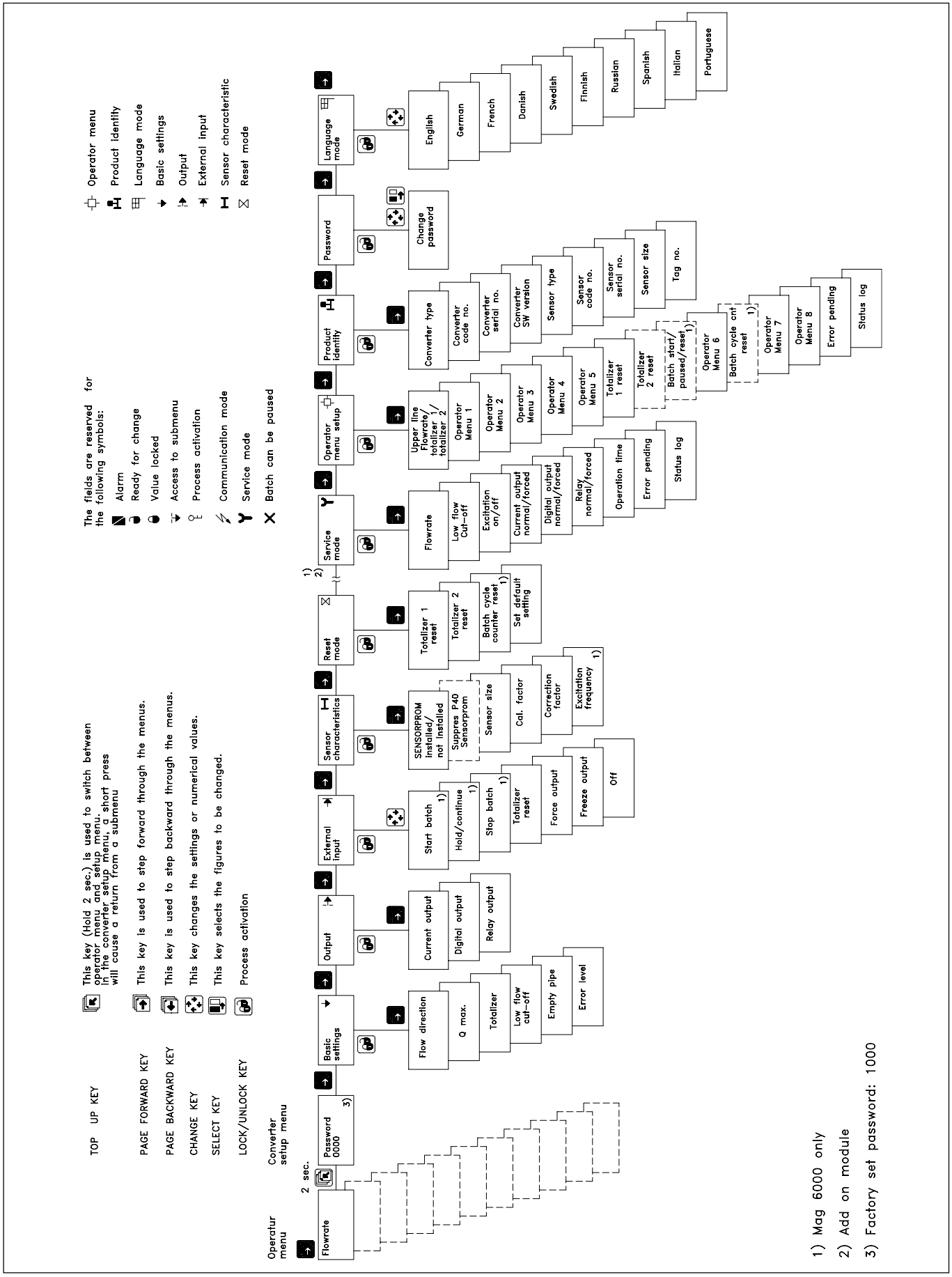
Access to view mode is always gained by pressing the forward key when in the password menu.

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

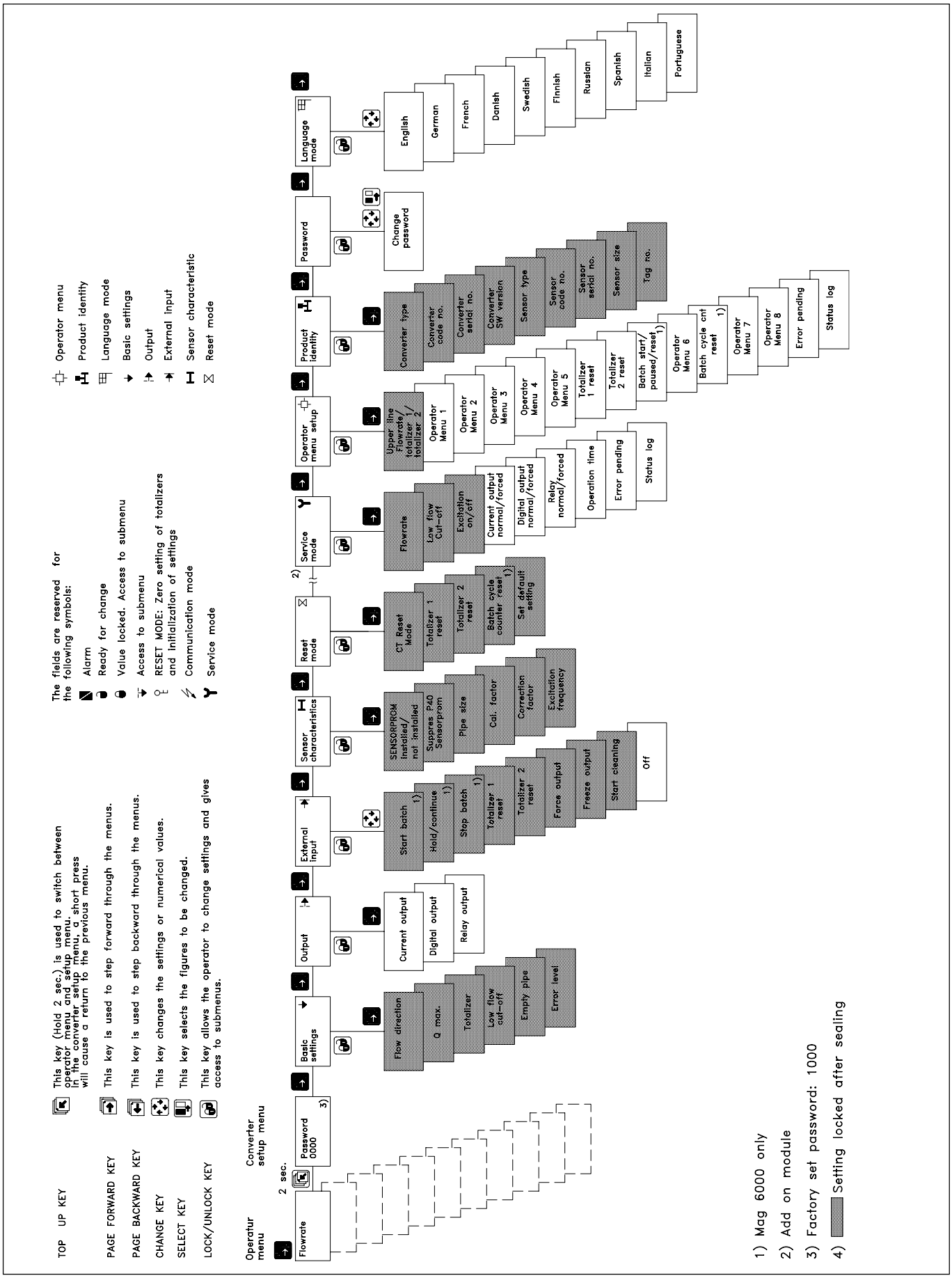
The factory setting of 1000 can be re-established as follows:
〈 Switch off power suppply
〈 Press the TOP UP key and switch on the power supply
〈 Release the key after ROM and RAM test are completed

The user code are now reset to 1000.

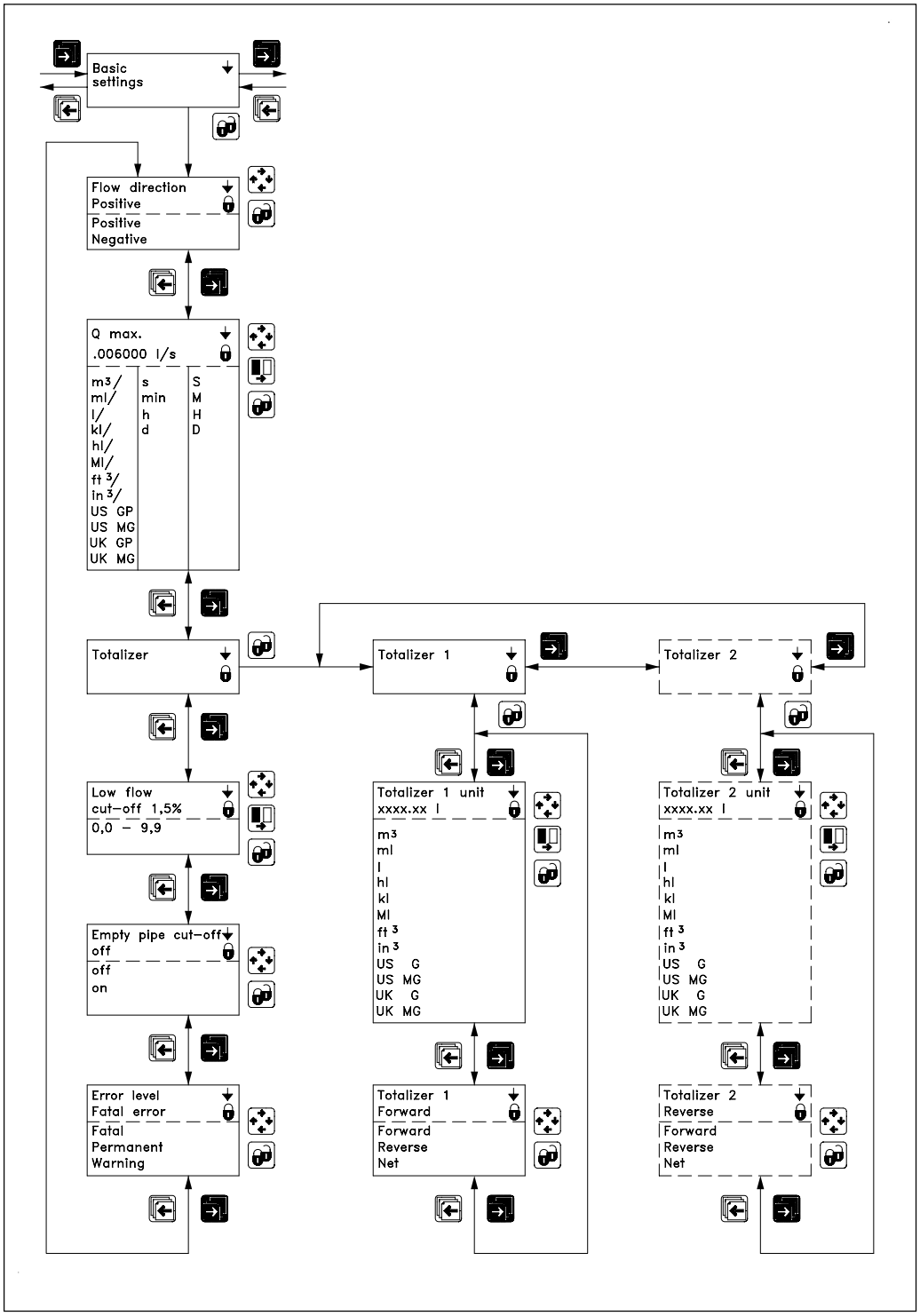
8.3.1 MAG 5000 and MAG 6000



8.3.2 MAG 6000 CT

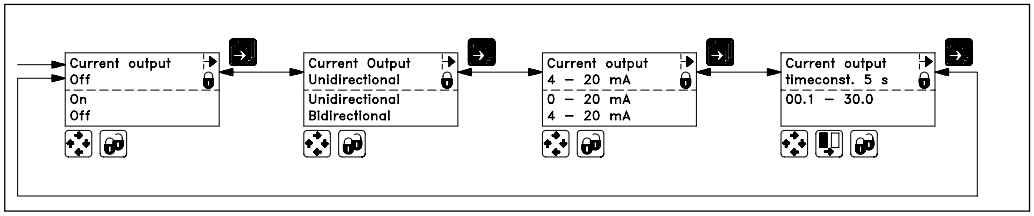


8.4.1 Basic settings



8.4.2 Outputs

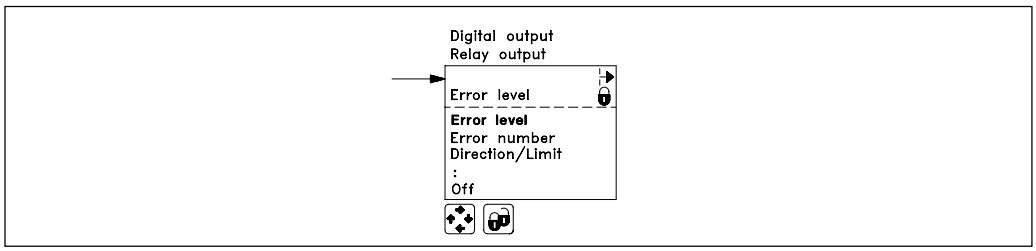
Current output



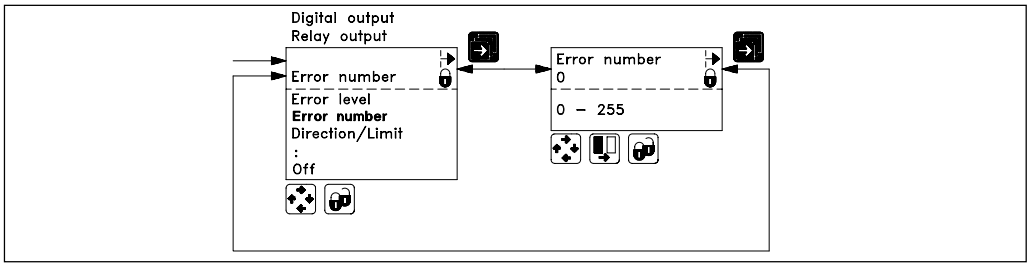
The current output must be set off when not used.

Digital and relay outputs

Error level

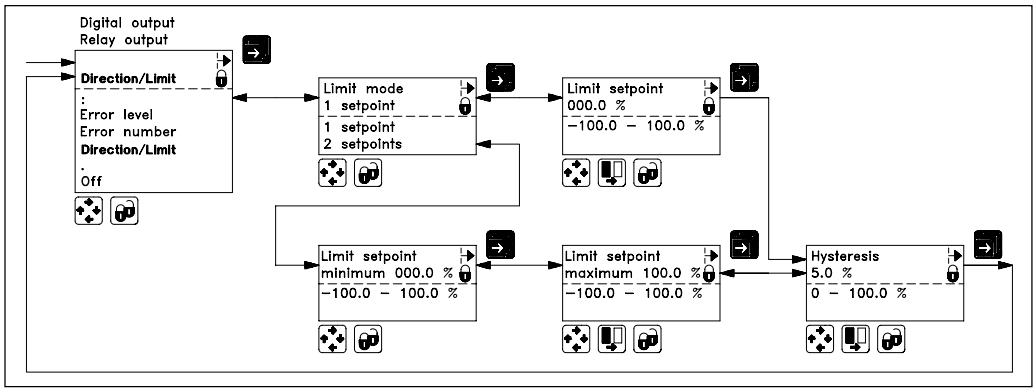


Error number



Error output is available in both digital as well as relay output.
Acceptance level is set in the basic settings.

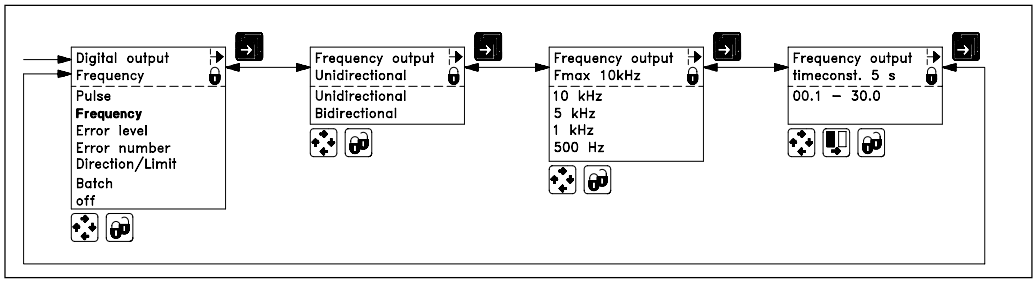
Limit/direction



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

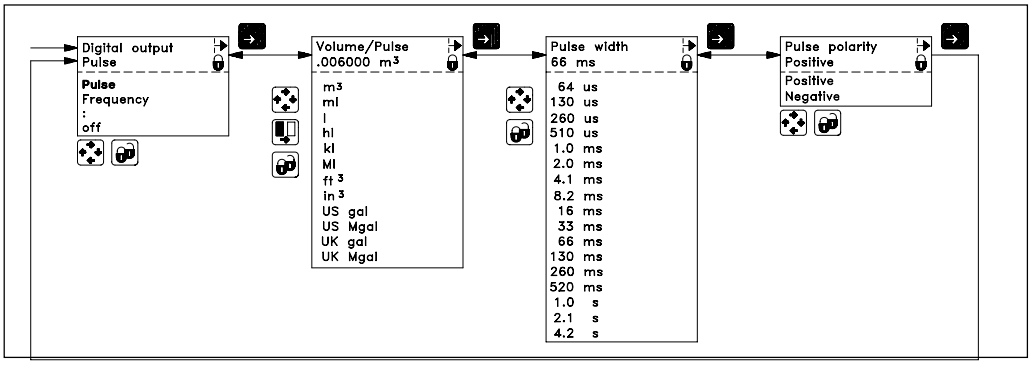
Direction mode: 1 setpoint a 0% flow; hysteresis 5%.
If 2 setpoints have to activate to separate outputs. 1 setpoint have to be selected individually for both digital and relay outputs.

Frequency



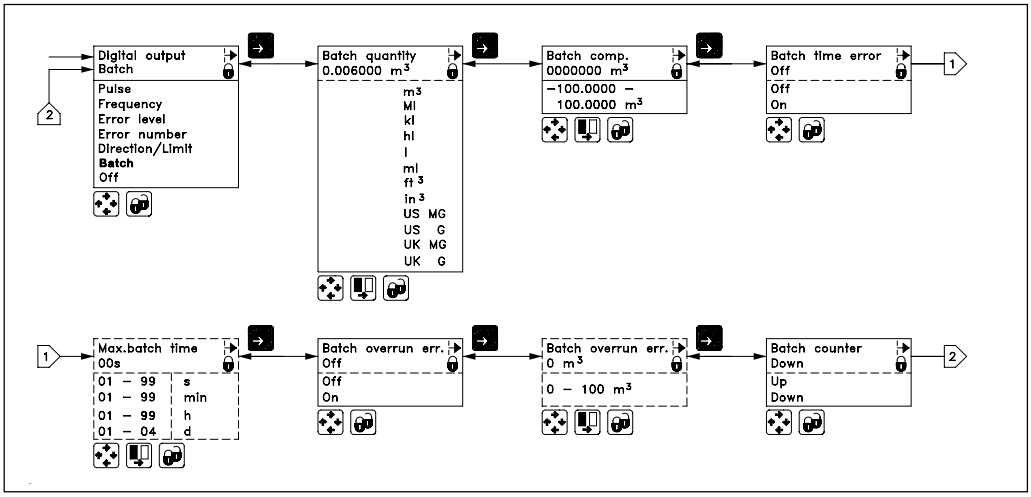
Frequency output can only be selected for the digital output.

Pulse



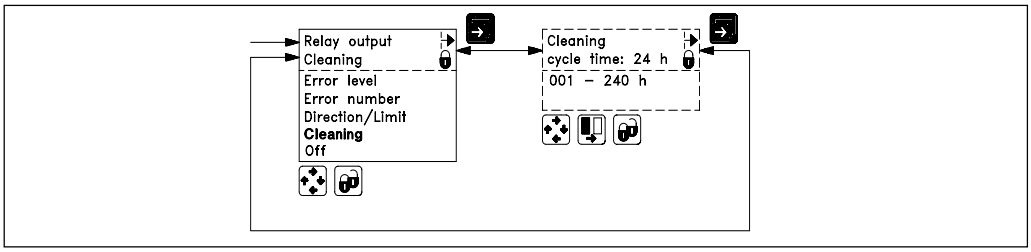
Pulse output can only be selected for the digital output.

Batch



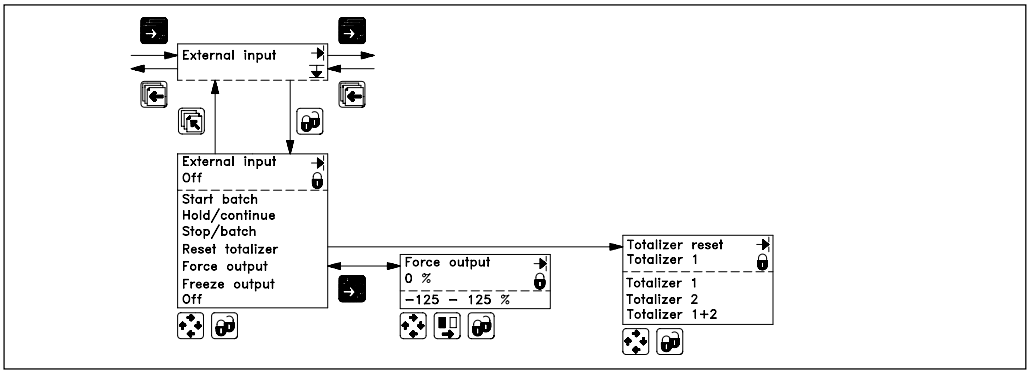
The batch function is available on MAG 6000 only.

Cleaning



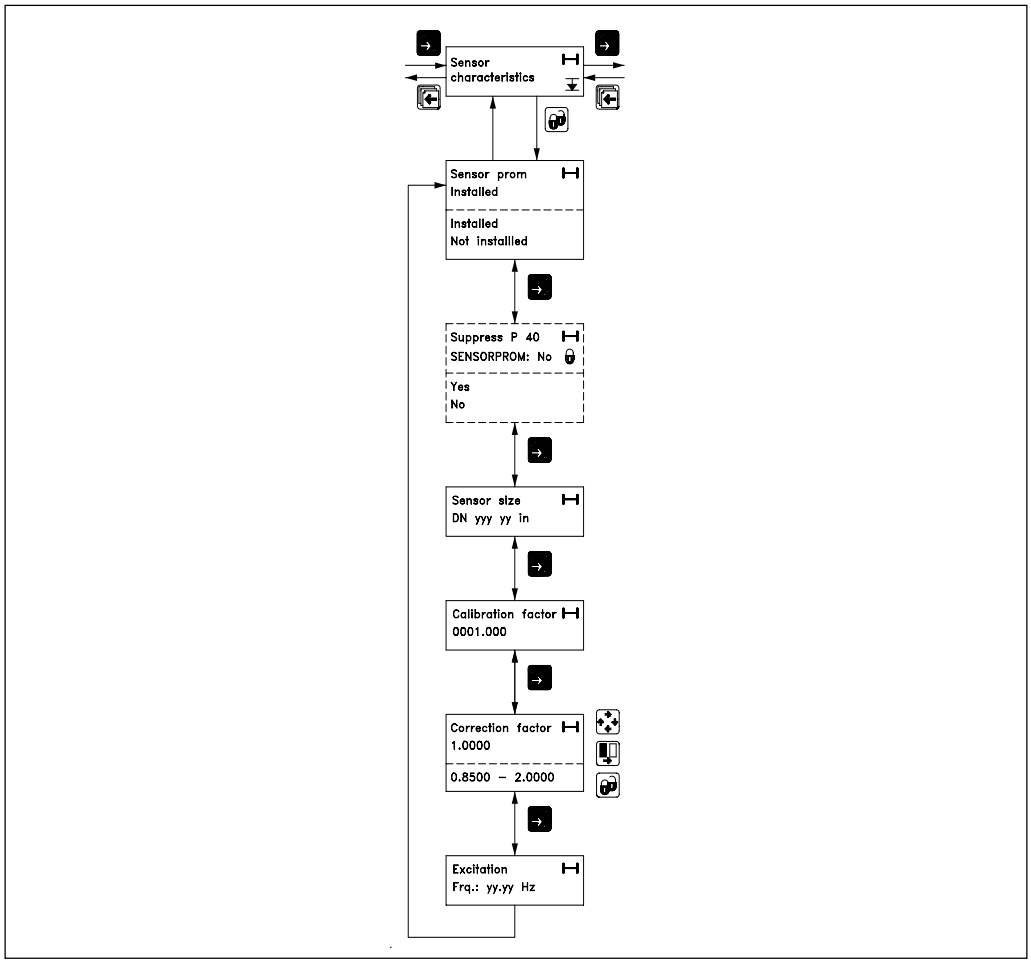
The relay output must always be used to operate the cleaning unit, when a cleaning unit has been installed together with the signal converter. The relay output cannot be used for other purposes.

8.4.3 External input

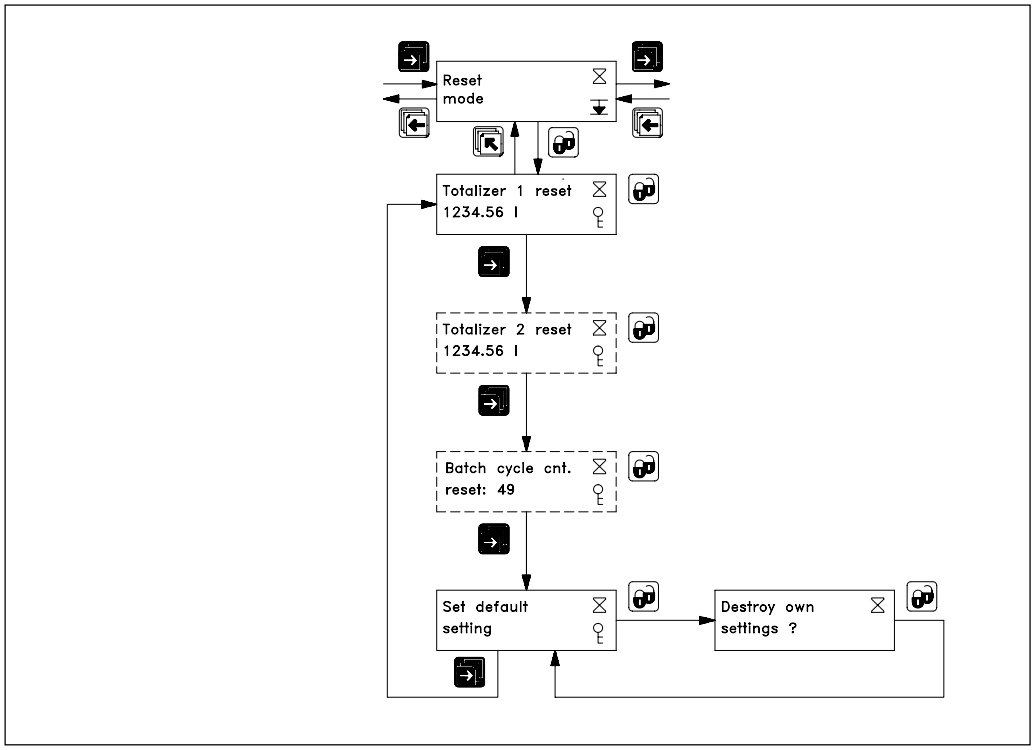


Batch control is available on MAG 6000 only.

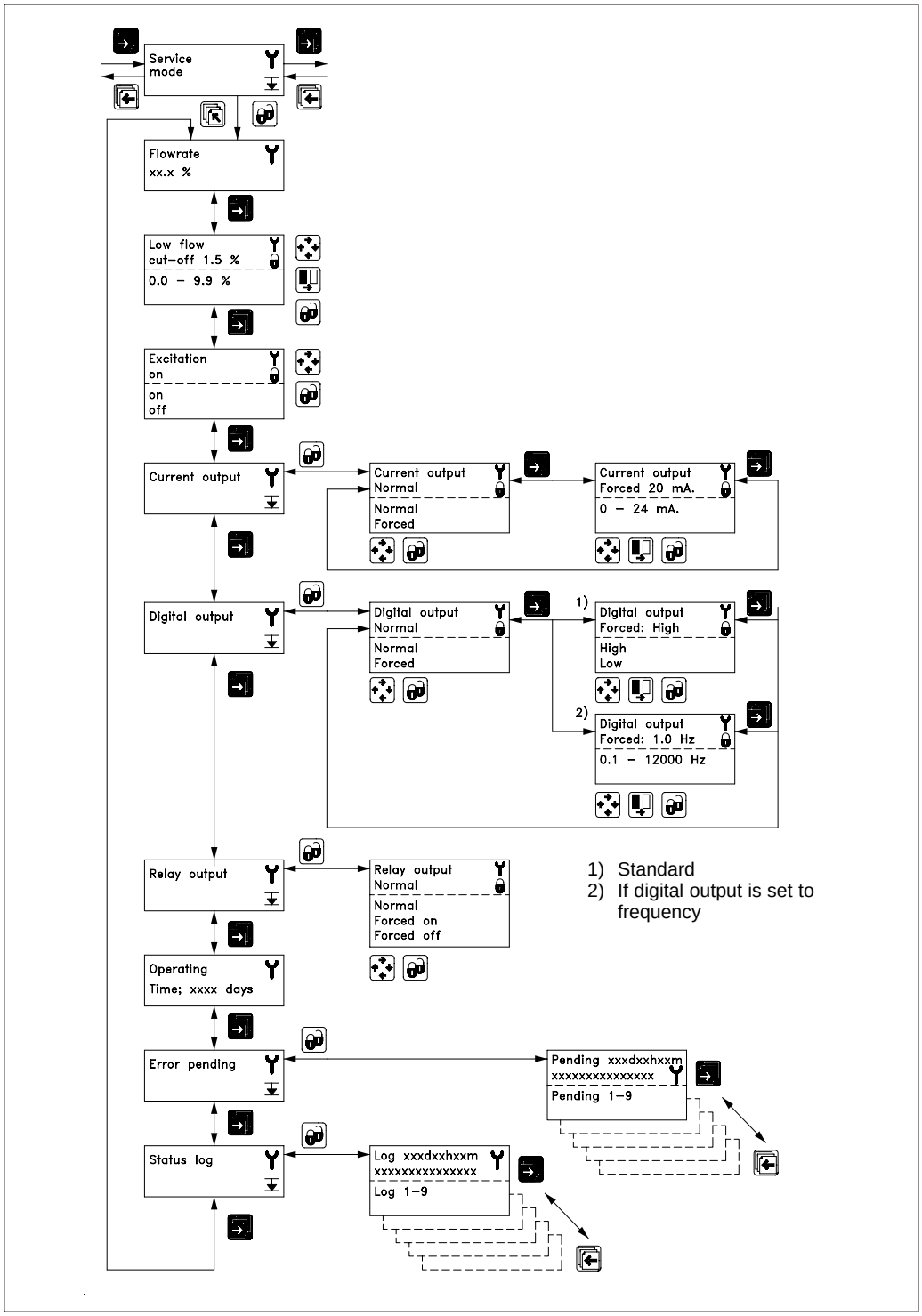
8.4.4 Sensor characteristics



8.4.5 Reset mode



8.4.6 Service mode



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

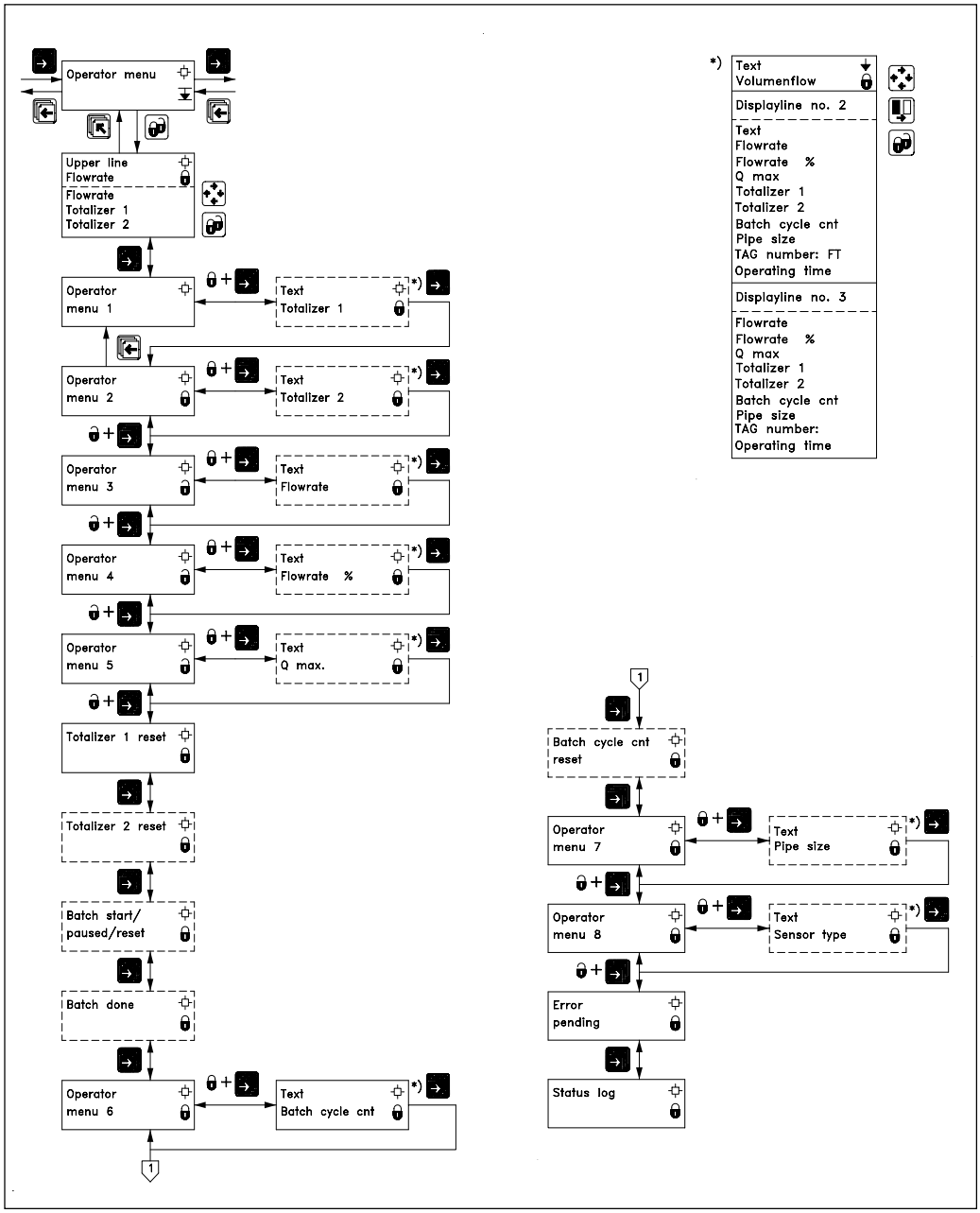
The error system
The error system is divided into an error pending list and a status log list. Time is gained as days, min. and hours since the error has occurred.

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

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

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

8.4.7 Operator menu setup



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

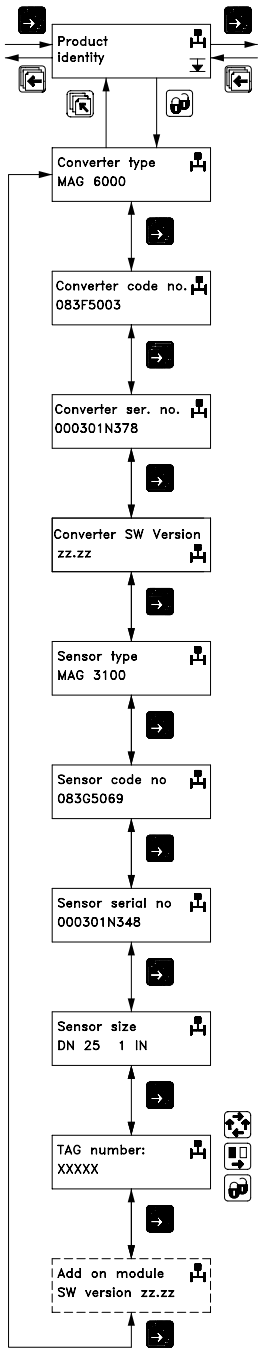
The two lower lines are for individual operator information. Information which the operator can scroll through with the forward key.

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

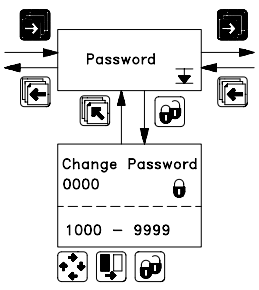
The lower line may be used for an additional flow reading to the reading already available in the upper line.

8.4.8 Product identity

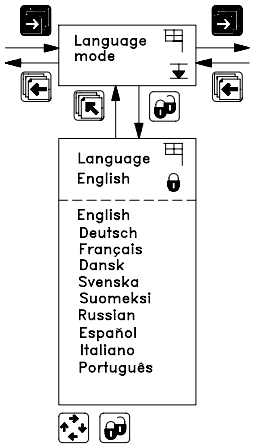


Software version of add-on module is only available if the add-on module has been installed.

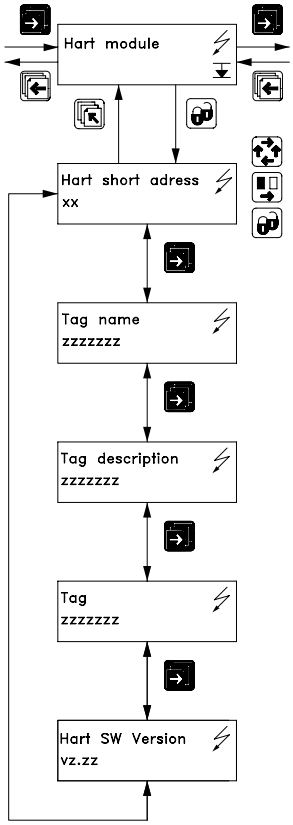
8.4.9 Change password



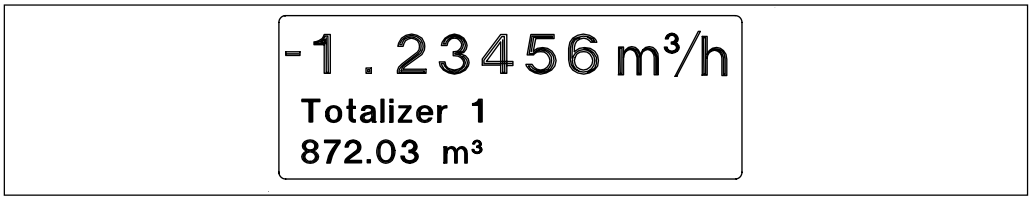
8.4.10 Language mode



8.4.11 HART communication (Add on module)



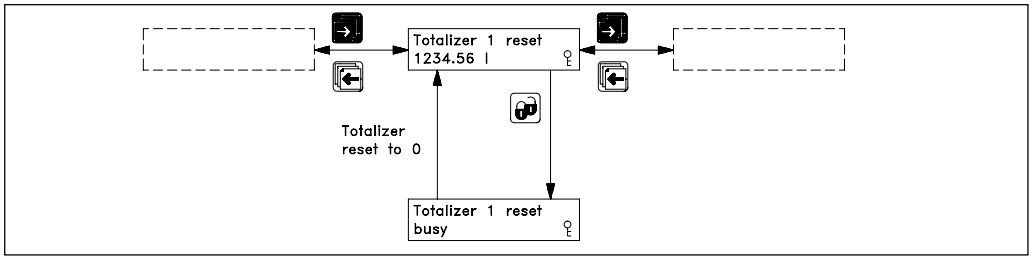
8.5.1 Flowrate



The 1st displayline will always be active and show the value enabled in the operator menu setup.
- Flowrate
- Totalizer 1
- Totalizer 2

The 2nd and 3th display lines are individually set in the operator menu. The page forward key steps through the enabled settings.
- Flowrate
- Totalizer
- Totalizer reset
- Batch control
- Batch cycle counter
- Batch cycle counter reset
- Pipe size
- Sensor type
- Pending errors
- Status log
- Tag no.

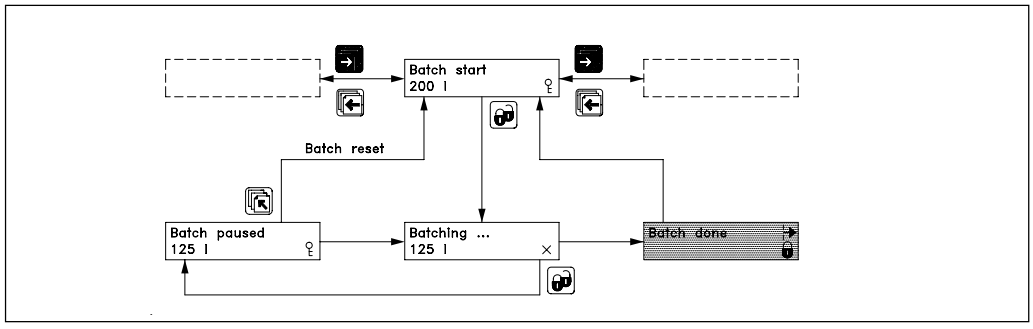
8.5.2 Totalizer



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 signal converter is delivered with factory settings ready to measure the actual flow.

Parameter	Factory setting	Settings available
Password		
Default value	0000	
Password	1000	1000 - 9999
Basic settings		
Flow direction	Positive	Positive, negative
$Q_{max.}$	Dim. dependent	Dim. dependent
- Volume units	Dim. dependent	m^3, ml, l, kl, hl, Ml, ft^3, in^3, USG, USMG, UKG, UKMG
- Time units	Dim. dependent	Sec., min., hour, day
Totalizer 1	Forward	Forward, reverse, net
- Totalizer 1 units	Dim. dependent	m^3, ml, l, kl, hl, Ml, ft^3, in^3, USG, USMG, UKG, UKMG
Totalizer 2	Forward	Forward, reverse, net
- Totalizer 2 units	Dim. dependent	m^3, ml, l, kl, hl, Ml, ft^3, in^3, USG, USMG, UKG, UKMG
Low flow cut off	1.5 %	0 - 9.9 %
Empty pipe	Off	Off, on
Error level	Warning	Fatal, permanent, warning
Output		
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[1)], frequency, pulse, error no., off
Relay output	Error	Error, direction/limit, cleaning, error no., off
Direction/limit switch	Off	1 setpoint/2 setpoints, - 100 - 100%
- Hysteresis	5%	0.0 - 100%
Batch[1)]	Off	
- Batch quantity	0	1 ml - 100.000 m^3
- Batch compensation	0	-100 - 100 m^3
- Batch counter	Down	Up/down
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	0 - 100.00 m^3
Electrode cleaning	Off	Off/cleaning
- Cleaning cycle time	24 h	1 - 240 h
External input		
External input	Off	Batch, reset totalizer, freeze output, forced output, off
- Batch		Start, hold/continue, stop
Sensor characteristics		
Correction factor	1	0.85 - 2.00
Language	English	English, German, French, Danish, Swedish, Finish, Spanish, Russian, Italian, Portugese
Operator menu		
Primary field	Flowrate	Flowrate, Totalizer 1, Totalizer 2
Title/subtitle line	Flowrate	Flowrate, Flowrate %, $Q_{max.}$, Totalizer 1, Totalizer 2, Totalizer 1 reset, Totalizer 2 reset, Batch start/ paused/stop, Batch cycle counter, Batch cycle counter reset, Sensor size, Sensor type, Error pending, Status log, Tag no.

[1)] Batch is available on MAG 6000 only

8.6.2 Dimension-dependent factory settings MAG 5000 and MAG 6000

DN		$Q_{max.}$				Volume/	Pulse	Totalizer
mm	[inches]	fac.set.	min.	max.	unit	pulse	unit	unit
6	$^5/_{16}$	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	l/h	10	l	l
40	$1^1/_2$	12	1.2	45	m^3/h	10	l	l
50	2	20	1.8	70	m^3/h	10	l	l
65	$2^1/_2$	30	3.0	119	m^3/h	100	l	l
80	3	50	4.6	180	m^3/h	100	l	l
100	4	120	7.1	282	m^3/h	100	l	l
125	5	180	11.1	441	m^3/h	100	l	m^3
150	6	250	16.0	636	m^3/h	100	l	m^3
200	8	400	28.3	1130	m^3/h	1	m^3	m^3
250	10	700	44.2	1767	m^3/h	1	m^3	m^3
300	12	1000	63.7	2544	m^3/h	1	m^3	m^3
350	14	1200	86.6	3463	m^3/h	1	m^3	m^3
400	16	1800	113.1	4523	m^3/h	1	m^3	m^3
450	18	2000	143.2	5725	m^3/h	1	m^3	m^3
500	20	3000	176.8	7068	m^3/h	1	m^3	m^3
600	24	4000	254.5	10178	m^3/h	10	m^3	m^3
700	28	5000	346.4	13854	m^3/h	10	m^3	m^3
750	30	6000	397.7	15904	m^3/h	10	m^3	m^3
800	32	7000	452.4	18095	m^3/h	10	m^3	m^3
900	36	9000	573.0	22902	m^3/h	10	m^3	m^3
1000	40	12000	707.0	28274	m^3/h	10	m^3	$m^3 \leftrightarrow 10$
1100	44	14000	855.3	34211	m^3/h	10	m^3	$m^3 \leftrightarrow 10$
1200	48	15000	1018.0	40715	m^3/h	10	m^3	$m^3 \leftrightarrow 10$
1400	56	25000	1385.5	55417	m^3/h	10	m^3	$m^3 \leftrightarrow 10$
1500	60	30000	1590.5	63617	m^3/h	10	m^3	$m^3 \leftrightarrow 10$
1600	64	35000	1809.6	72382	m^3/h	10	m^3	$m^3 \leftrightarrow 10$
1800	72	40000	2290.3	91608	m^3/h	10	m^3	$m^3 \leftrightarrow 10$
2000	80	45000	2827.5	113097	m^3/h	10	m^3	$m^3 \leftrightarrow 10$

8.7.1 Error handling

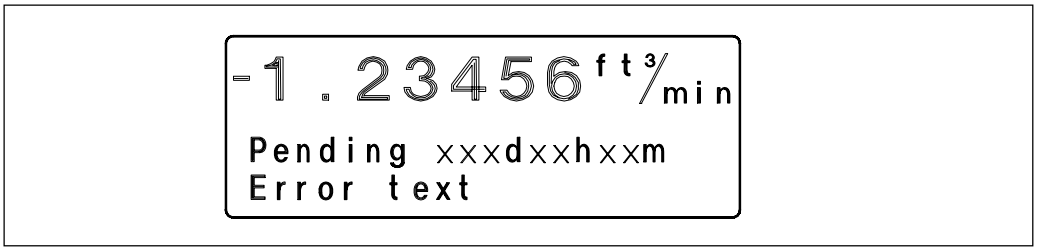
Error system
The converter system is equipped with an error and status log system with 4 groups of information.
- Information without a functional error involveded
- Warnings which may cause malfunction in the application. The cause of the error may disappear on its own
- Permanent errors which may cause 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 individual configured to a particular application. The acceptance level is set in the “basic setting” in the converter 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 are displayed in the title and subtitle line. The title line will show the time since occurrence of error. The subtitle line will flash between a error text and a remedy text. The error text will indicate type of error (I, W, P or F), Error no. and the 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 are always stored in the “status log”. The “status log” stores the last 9 message 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 an 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 will always operate together.
The analog output will turn 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 - *Power on* OK	Power on has happened	Active	Active
2	I2 - *Add-on Module* Applied	A new module has been applied to the system	Active	Active
3	I3 - *Add-on Module* Install	An add-on module is defect or has been removed. This can be an internal add-on module	Active	Active
4	I4 - *Param. corrected* OK	A less vital parameter in the converter has been replaced by its default value	Active	Active
20	W20 - *Totalizer 1* Reset manually	During initialisation the check of the saved totalize value has failed. It is not possible to rely on the saved totalizer value any more. The totalizer value must be reset manually in order to rely on future readings	Active	Active
20	W20 - *Totalizer 2* Reset manually	During initialisation the check of the saved totalize value has failed. It is not possible to rely on the saved totalizer value any more. The totalizer value must be reset manually in order to rely on future readings	Active	Active
21	W21 - *Pulse overflow* Adj. pulse settings	Actual flow is too big compared with pulse width and volumen/pulse	Reduced pulse with	Active
22	W22 - *Batch timeout* Check installation	Duration of Batching has exceeded a predefined max. time	Batch output on zero	Active
23	W23 - *Batch overrun* Check installation	Batch volume has exceeded a predefined maximum overrun volume	Batch output on zero	Active
24	*W24 - Batch neg. flow* Check flow direction	Negative flow direction during batch	Active	Active
30	W30 - *Overflow* Adj. volumeflow max.	Flow is above $Q_{max.}$ settings	Max. 120 %	Active
31	W31 - *Empty pipe*	Pipe is empty	Zero	Active
40	P40 - *SENSORPROM* Insert/change	SENSORPROM unit not installed	Active	Active
41	P41 - *Parameter range* 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 - *Current output* Check cables	Current loop is disconnected or the loop resistance is too big	Active	Active
43	P43 - *Internal error* Switch off and on	Too many errors occured at the same time Some errors are not detected correctly	Active	Active
60	F60 - *CAN comm. error* Converter/AOM	CAN bus communication error. An add-on module, the display module or the converter is defect	Zero	Inactive
61	F61 - *SENSORPROM err.* Replace	It is not possible to rely on the data in SENSORPROM unit any more	Active	Active
62	F62 - *SENSORPROM ID* Replace	The SENSORPROM unit ID do not comply with the product ID. The SENSORPROM unit is from another type of product MASSFLO, SONOFLO etc.	Zero	Inactive
63	F63 - *SENSORPROM* Replace	It is not possible to read from the SENSORPROM unit any more.	Active	Active
70	F70 - *Coil current* Check cables	Coil excitation has failed	Active	Active
71	F71 - *Internal error* Replace converter	Internal convertion error in ASIC	Active	Active

9.1 Trouble shooting MAG 5000 and 6000

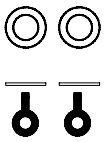
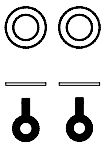
Symptom	Output signals	Error code	Cause	Remedy
Empty display	Minimum		1. Supply voltage	Check supply voltage
			2. MAG 5000/6000 defective	Replace MAG 5000/6000
No flow signal	Minimum		1. Current output deselected	Activate current output
			2. Digital output deselected	Activate digital output
			3. Reverse flow direction	Change direction
		F70	Incorrect or no coil current	Check cables/connections
		W31	Measuring pipe empty	Ensure that the measuring pipe is full
		F60	Internal error	Replace MAG 5000/6000
	Undefined	P42	1. No load on current output	Check cables/connections
			2. MAG 5000/6000 defective	Replace MAG 5000/6000
		P41	Initializing error wait 5 s and switch on again	Switch off MAG 5000/6000,
Indicates flow with no flow in pipe	Undefined		Measuring pipe empty Empty pipe cut-off is OFF	Select empty pipe cut-off Ensure that the measuring pipe is full
			Electrode cable is insuffi-ciently screened	Ensure that electrode cable is connected and sufficiently screened
Unstable flow signal	Unstable		1. Pulsating flow	Increase time constant
			2. Conductivity of medium too low	Use special electrode cable
			3. Electrical noise potential between medium and sensor	Ensure sufficient potential equalization.
			4. Air bubbles in medium	Ensure medium does not contain air bubbles
			5. High concentration of par-ticles or fibres	Increase time constant
Measuring error	Undefined		Incorrect installation	Check installation
		P40	No SENSORPROM®unit	Install SENSORPROM® unit
		F61	Deficient SENSORPROM® unit	Replace SENSORPROM® unit
		F62	Wrong type of SENSOR-PROM® unit	Replace SENSORPROM® unit
		F63	Deficient SENSORPROM® unit	Replace SENSORPROM®unit
		F71	Loss of internal data	Replace MAG 5000/6000
	Maximum	W30	Flow exceeds 100% of $Q_{max.}$	Check $Q_{max.}$ (Basic Settings)
		W21	Pulse overflow 〈 Volume/pulse too small 〈 Pulse width too large	Change volume/pulse Change pulse width
Loss of totalizer data	OK	W20	Initializing error	Reset totalizer manually

10.1 Sensor MAG 1100

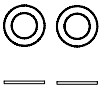
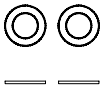
Description	Size	Code no.	Symbol
MAG 1100 Ceramic Al_2O_3 Temperature of medium max. 150°C Included: 2 EPDM gaskets, studs and nuts	DN 6 DN 10 DN 15 DN 25 DN 40 DN 50 DN 65 DN 80 DN 100 [1])	**083G4044** **083G4046** **083G4047** **083G4049** **083G4051** **083G4052** **083G4053** **083G4054** **083G4055**	
MAG 1100 (High temperature) Ceramic Al_2O_3 Temperature of medium max. 200°C Included: 2 graphite gaskets, studs and nuts	DN 15 DN 25 DN 40 DN 50 DN 80 DN 100 [1])	**083G4057** **083G4059** **083G4061** **083G4062** **083G4064** **083G4065**	
MAG 1100 Ex Ceramic Al_2O_3 Temperature of medium max. 120°C Included: 2 EPDM gaskets, studs and nuts	DN 6 DN 10 DN 15 DN 25 DN 40 DN 50 DN 65 DN 80 DN 100 [1])	**083G4024** **083G4026** **083G4027** **083G4029** **083G4031** **083G4032** **083G4033** **083G4034** **083G4035**	
MAG 1100/3000 Ex-d Ceramic Al_2O_3 Temperature of medium max. 120°C Included: 2 EPDM gaskets, studs and nuts	DN 6 DN 10 DN 15 DN 25 DN 40 DN 50 DN 65 DN 80 DN 100 [1])	**083G3054** **083G3056** **083G3057** **083G3059** **083G3061** **083G3062** **083G3063** **083G3064** **083G3065**	
MAG 1100 FOOD Ceramic Al_2O_3 Temperature of medium max. 150°C Enclosure IP 67	DN 10 DN 15 DN 25 DN 40 DN 50 DN 65 DN 80 DN 100	**083G2016** **083G2017** **083G2019** **083G2021** **083G2022** **083G2023** **083G2024** **083G2025**	
MAG 1100 FOOD PFA Temperature of medium max. 150°C Enclosure IP 67 2 EPDM gaskets	DN 10 DN 15 DN 25 DN 40 DN 50 DN 65 DN 80 DN 100	**083G5056** **083G5057** **083G5059** **083G5061** **083G5062** **083G5063** **083G5064** **083G5065**	

[1]) The studs supplied for DN 100 are for PN 10/16 only. For use with PN 25/40, see "Accessories".

Accessories

Description	Material	DN	Code no.	Symbol
Pipe connection 1/2" external thread 2 pipe connections 2 gaskets 12 M4 screws (12 mm)	AISI 316 (1.4436) EPDM	6, 10	**083G0080**	
Grounding ring 1 potential equalizing ring 3 teflon gaskets 1 earth strap 1 M6 screw	AISI 316 (1.4436)	6, 10 15 25 40 50 65 80 100	**083G0686** **083G0687** **083G0689** **083G0691** **083G0692** **083G0693** **083G0694** **083G0695**	
Grounding ring 1 potential equalizing ring 3 teflon gaskets 1 earth strap 1 M6 screw	Hastelloy C4	6, 10 15 25 40 50 65 80 100	**083G0696** **083G0697** **083G0699** **083G0701** **083G0702** **083G0703** **083G0704** **083G0705**	
Studs and Nuts for DN 100 PN 25/40 8 M20 studs 16 M20 nuts	AISI 304 (1.4305)	100	**083G0226**	

Gaskets for MAG 1100

Description	Material	DN	Code no.	Symbol
EPDM gaskets 2 gaskets 2 earth straps 3 M6 screws	EPDM	6, 10 15 25 40 50 65 80 100	**083G3116** **083G3117** **083G3119** **083G3121** **083G3122** **083G3123** **083G3124** **083G3125**	
PTFE gaskets 2 PTFE gaskets 2 earth straps 3 M6 screws	PTFE	6, 10 15 25 40 50 65 80 100	**083G0156** **083G0157** **083G0159** **083G0161** **083G0162** **083G0163** **083G0164** **083G0165**	
Graphite gaskets 2 gaskets	Graphite	6, 10 15 25 40 50 65 80 100	**083G0116** **083G0117** **083G0119** **083G0121** **083G0122** **083G0123** **083G0124** **083G0125**	

Gaskets for MAG 1100 FOOD

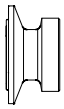
Description	Material	DN	Code no.	Symbol
EPDM gaskets 2 gaskets	EPDM	10 15 25 40 50 65 80 100	**083G2206** **083G2207** **083G2209** **083G2211** **083G2212** **083G2213** **083G2214** **083G2215**	
NBR gaskets 2 gaskets	NBR	10 15 25 40 50 65 80 100	**083G2216** **083G2217** **083G2219** **083G2221** **083G2222** **083G2223** **083G2224** **083G2225**	

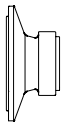
10.2 Adaptor, MAG 1100 FOOD (contains 2 adaptors, 2 clamp rings and 2 gaskets)

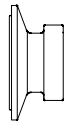
Adapter DN [mm]	D_o [mm]	D_i [mm]	Sensor DN [mm]	**Weld-in type**: Matching standard DIN 11850 Code no.	DS/ISO 2037 Code no.	SMS 3008 Code no.	BS 4825-1 Code no.	Tri-Clover Code no.	Symbol
10	13.0	10.0	10	**083G2116**	**083G2116**	**083G2116**	**083G2116**	-	
15	19.0	16.0	15	**083G2117**	**083G2117**	**083G2117**	**083G2117**	-	
15.9	15.9	13.5	15	-	-	-	-	**083G2107**	
20	23.0	20.0	15	**083G2118**	**083G2118**	**083G2118**	**083G2118**	-	
25	25.6	22.6	25	-	**083G2109**	**083G2109**	**083G2109**	-	
25	29.0	26.0	25	**083G2119**	-	-	-	-	
28	28.6	25.6	25	-	**083G2100**	-	-	-	
32	32.0	29.6	25	-	-	**083G2102**	-	-	
32	35.0	32.0	25	**083G2120**	-	-	-	-	
33.7	34.3	31.3	25	-	**083G2110**	**083G2110**	-	-	
38	38.6	35.6	40	-	**083G2111**	**083G2111**	**083G2111**	**083G2111**	
40	40.6	37.6	40	-	**083G2101**	-	-	-	
40	41.0	38.0	40	**083G2121**	-	-	-	-	
50	53.0	50.0	50	**083G2122**	-	-	-	-	
51	51.6	48.6	50	-	**083G2112**	**083G2112**	**083G2112**	**083G2112**	
63.5	64.1	60.3	65	-	**083G2113**	**083G2113**	**083G2113**	**083G2113**	
65	70.0	66.0	65	**083G2123**	-	-	-	-	
70	70.6	66.8	65	-	**083G2103**	-	-	-	
76	76.0	72.0	65	-	-	**083G2106**	-	-	
76.1	76.7	72.9	80	-	**083G2114**	**083G2114**	**083G2114**	**083G2114**	
80	85.0	81.0	80	**083G2124**	-	-	-	-	
88.9	88.9	84.9	80	-	**083G2104**	**083G2104**	-	-	
100	104.0	100.0	100	**083G2125**	-	-	-	-	
101.6	102.5	97.6	100	-	**083G2115**	-	-	-	
114.3	115.6	110.3	100	-	**083G2105**	-	-	-	

Adapter DN [mm]	D_o [mm]	D_i [mm]	Sensor DN [mm]	**Clamp type:** Matching standard DIN 32676 Code no.	DS/ISO 2852 Code no.	SMS 3016 Code no.	BS 4825-2 Code no.	Tri-Clamp® Code no.	Symbol
10	34.0	10.0	10	**083G2186**	**083G2186**	**083G2186**	-	-	
15	34.0	16.0	15	**083G2187**	**083G2187**	**083G2187**	-	-	
20	34.0	20.0	15	**083G2188**	**083G2188**	-	-	-	
25	50.5	22.6	25	-	**083G2189**	**083G2189**	**083G2189**	**083G2189**	
25	50.5	26.0	25	**083G2179**	**083G2179**	-	-	-	
33.7	50.5	31.3	25	**083G2190**	**083G2190**	**083G2190**	-	-	
38	50.5	35.6	40	-	**083G2191**	**083G2191**	**083G2191**	**083G2191**	
40	50.5	38.0	40	**083G2181**	**083G2181**	-	-	-	
50	64.0	50.0	50	**083G2182**	-	-	-	-	
51	64.0	48.6	50		**083G2192**	**083G2192**	**083G2192**	**083G2192**	
63.5	77.5	60.3	65	-	**083G2193**	**083G2193**	**083G2193**	**083G2193**	
65	91.0	66.0	65	**083G2183**	-	-	-	-	
76.1	91.0	72.9	80	-	**083G2194**	**083G2194**	**083G2194**	**083G2194**	
80	106.0	81.0	80	**083G2184**	-	-	-	-	
100	119.0	100.0	100	**083G2185**	-	-	-	-	
101.6	119.0	97.6	100	-	**083G2195**	-	-	-	

10.2
Adaptor, MAG 1100 FOOD
(continued)

Threaded type: Matching standard					Symbol
Adapter DN [mm]	D_o [mm]	D_i [mm]	Sensor DN [mm]	DIN 11851 **Code no.**	
10	28.0	10.0	10	**083G2156**	
15	34.0	16.0	15	**083G2157**	
20	44.0	20.0	15	**083G2158**	
25	52.0	26.0	25	**083G2159**	
32	58.0	32.0	25	**083G2160**	
40	65.0	38.0	40	**083G2161**	
50	78.0	50.0	50	**083G2162**	
65	95.0	66.0	65	**083G2163**	
80	110.0	81.0	80	**083G2164**	
100	130.0	100.0	100	**083G2165**	

Adapter DN [mm]	D_o [mm]	D_i [mm]	Sensor DN [mm]	**Threaded type**: Matching standard ISO 2853 **Code no.**	SS 3351 **Code no.**	BS 4825-4 (IDF) **Code no.**	Symbol
25	25	37.0	22.6	**083G2149**	**083G2149**	**083G2149**	
38	40	51.0	35.6	**083G2151**	**083G2151**	**083G2151**	
51	50	64.0	48.6	**083G2152**	**083G2152**	**083G2152**	
63.5	65	78.0	60.3	**083G2153**	**083G2153**	**083G2153**	
76.1	80	91.0	72.9	**083G2154**	**083G2154**	**083G2154**	
101.6	100	118.0	97.6	**083G2155**	**083G2155**	-	
101.6	100	126.0	97.6	-	-	**083G2145**	

Threaded type: Matching standard					Symbol
Adapter DN [mm]	D_o [mm]	D_i DN [mm]	Sensor [mm]	SMS 1145 **Code no.**	
25	40.0	22.6	25	**083G2139**	
32	48.0	29.6	25	**083G2140**	
38	60.0	35.6	40	**083G2141**	
51	70.0	48.6	50	**083G2142**	
63.5	85.0	60.3	65	**083G2143**	
76	98.0	72.0	65	**083G2144**	

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10.3 Sensor MAG 3100 and MAG 3100 Ex

Type No.: MAG 3100 – [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

1. Nominal size DN

15 (with PTFE and PN 40 only)	04
25	06
40	08
50	09
65	10
80	11
100	12
125	13
150	14
200	15
250	16
300	17
350	18
400	19
450	30
500	20
600	21
700	22
750	34
800	23
900	24
1000	25
1100	26
1200	27
1400	28
1500	29
1600	31
1800	32
2000	33

2. Liner material

Neoprene, standard (PN ≤ 100 bar)	1
EPDM with WRC approval [1]) (PN ≤ 40 bar)	2
PTFE (DN ≤ 600 mm, PN ≤ 40 bar)	3
Polyurethane (DN ≤ 600 mm)	4
Ebonite	6
Linatex® (PN ≤ 40 bar)	7

3. Pressure stage

DIN, PN 6 (standard on DN 1200 - 2000)	A
DIN, PN 10 (standard on DN 200 - 1100)	B
DIN, PN 16 (standard on DN 65 - 150)	C
DIN, PN 25 (option on DN 200 - 600)	D
DIN, PN 40 (standard on DN 15 - 50, option on DN 65 - 600)	E
DIN, PN 64 (DN 50 - 400) not with PTFE	Q
DIN, PN 100 (DN 25 - 350) not with PTFE	R
ANSI class 150 (DN 15 - 600)	F
ANSI class 300 (DN 15 - 600)	G
BS10, Table D	H
BS10, Table E	I
JIS, K10 (DN 50 - 1000)	K
JIS, K16 (DN 50 - 1200)	L
AS 2129, Table D	M
AS 2129, Table E	N
AWWA C-207, class D (DN 700 - 2000)	O
AS 4087 Class 14 (DN 50 - 1200)	P

4. Electrode material/Earthing electrodes [2])

AISI 316 Ti, ceramic coated	1
AISI 316 Ti, standard	2
Hastelloy C-276	4
Platinum/iridium (80/20)	5
Titanium	6
Monel	7
Tantalum	8
AISI 316 Ti, ceramic coated + earthing electrodes	A
AISI 316 Ti + earthing electrodes standard	B
Hastelloy C-276 + earthing electrodes	D

5. Flange and housing material

St. 37.2 flanges and housing (grey coating)	1
AISI 304 flanges/st. 37.2 housing (grey coating)	2
AISI 316/L flanges/housing (polished)	3

6. Enclosure/Temperature/Ex-version

IP 67 (3 m w.g. for 72 h) Tmax. ≤ 120°C)	1000
IP 67 (3 m w.g. for 72 h) 120°C < Tmax. ≤180°C [3])	2100
IP 67 (3 m w.g. for 72 h) Tmax. ≤120°C, DN 350 - 2000 EEx e ia IIC T4-T6	4000
IP 67 (3 m w.g. for 72 h) Tmax. ≤120°C, DN 15 - 300 EEx ia ib IIB T4-T6	4100
IP 67 (3 m w.g. for 72 h) T ≤ 120°C, DN 15 - 300 Compact EEx de	5000

[1]) Water Research Council, UK.

[2]) Earthing electrode material and measuring electrode material is identical.
Earthing electrodes are not ceramic coated.
Earthing electrodes are not yet available with PTFE liner.

[3]) Including protection flanges type E.

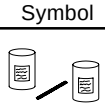
Earthing/protection flange type C (AISI 304) for all liners except PTFE

Flange	DIN 2501/BS 4504					ANSI B 16.5		BS 10	JIS B 2220	
Pressure stage / DN	PN 6	PN 10	PN 16	PN 25	PN 40	150 lb	300 lb	Table D/E	K 10	K 16
	083N...	083N...	083N...	083N...	083N...	083N...	083N...	083N...	083N...	083N...
25					8361	8361	8361	8361		
40					8362	8362	8362	8362		
50					8344	8344	8344	8344	8344	8344
65	8345		8345		8345	8345	8345	8346	8345	8345
80	8347		8347		8347	8347	8347	8347	8347	8347
100	8070		8025		8025	8025	8025	8025	8070	8025
125	8071		8071		8071	8071	8071	8071	8071	8071
150	8072		8008		8008	8008	8073	8008	8008	8325
200	8074	8011	8011	8011	8075	8011	8076	8011	8322	8011
250	8078	8013	8013	8013	8079	8013	8079	8013	8013	8324
300	8080	8012	8012	8081	8082	8012	8082	8012	8323	8081
350	8083	8039	8039	8084	8085	8039	8085	8039	8326	8327
400	8099	8100	8100	8101	8102	8100	8102	8100	8330	8331
450	8103	8103	8104	8104	8105	8104	8106	8104	8103	8333
500	8107	8107	8108	8108	8109	8107	8110	8108	8107	8335
600	8111	8111	8112	8112		8113	8114	8113	8337	8112
700	8300	8294	8294						8294	8339
800	8303	8304	8304						8304	8341
900	8306	8307	8307						8307	8342
1000	8309	8310	8310						8310	8343
1200	8312	8313	8313							
1400	8349	8353	8357							
1600	8350	8354	8358							
1800	8351	8355	8359							
2000	8352	8356	8360							

Earthing/protection flange type E (AISI 316) for PTFE liner only

Flange	DIN 2501/BS 4504					ANSI B 16.5		BS 10/AS 2129		JIS B 2220	
Pressure stage / DN	PN 6	PN 10	PN 16	PN 25	PN 40	150 lb	300 lb	Table D	Table E		
	083N...	083N...	083N...	083N...	083N...	083N...	083N...	083N...	083N...		
15					8365	8365	8365	8365	8365		
25					8271	8272	8272	8272	8272		
40					8278	8275	8275	8276	8276		
50					8282	8283	8283	8281	8281		
65	8284		8285		8286	8287	8287	8284	8284		
80	8288		8289		8290	8291	8292	8293	8293		
100	8116		8117		8118	8118	8119	8117	8117		
125	8120		8121		8122	8122	8123	8121	8121		
150	8124		8125		8126	8126	8127	8128	8128		
200	8129	8130	8130	8131	8132	8370	8133	8134	8134		
250	8135	8136	8137	8138	8139	8140	8141	8142	8143		
300	8144	8144	8145	8146	8147	8148	8149	8150	8151		
350	8152	8153	8154	8155	8156	8157	8158	8159	8153		
400	8160	8161	8162	8163	8164	8165	8166	8167	8161		
450	8168	8169	8170	8171	8172	8173	8174	8175	8176		
500	8177	8178	8179	8180	8181	8182	8183	8184	8185		
600	8186	8187	8188	8189		8190	8191	8192	8193		

Accessories

Description	**Code no.**	Symbol
Submersible kit (IP 68, 10 m w.g.) For use with standard MAG 3100, when sensor is buried or permanently submerged.	**085U0220**	

10.4 Sensor MAG 3100 W

DIN flanges	DN	PN	Code no. Neoprene liner	Code no. EPDM liner
Liner: Neoprene or EPDM Flanges: Mild steel, DIN 2501 Electrodes: AISI 316 Ti Grounding Electrodes: AISI 316 Ti Enclosure: IP 67	25	40	**083Z8000**	**083Z8100**
	40	40	**083Z8001**	**083Z8101**
	50	40	**083Z8002**	**083Z8102**
	65	16	**083Z8003**	**083Z8103**
	80	16	**083Z8004**	**083Z8104**
	100	16	**083Z8005**	**083Z8105**
	125	16	**083Z8006**	**083Z8106**
	150	16	**083Z8007**	**083Z8107**
	200	10	**083Z8008**	**083Z8108**
	200	16	**083Z8208**	**083Z8308**
	250	10	**083Z8009**	**083Z8109**
	250	16	**083Z8209**	**083Z8309**
	300	10	**083Z8010**	**083Z8110**
	300	16	**083Z8210**	**083Z8310**
	350	10	**083Z8011**	**083Z8111**
	350	16	**083Z8211**	**083Z8311**
	400	10	**083Z8012**	**083Z8112**
	400	16	**083Z8212**	**083Z8312**
	450	10	**083Z8013**	**083Z8113**
	450	16	**083Z8213**	**083Z8313**
	500	10	**083Z8014**	**083Z8114**
	500	16	**083Z8214**	**083Z8314**
	600	10	**083Z8015**	**083Z8115**
	600	16	**083Z8215**	**083Z8315**
	700	10	**083Z8016**	**083Z8116**
	800	10	**083Z8017**	**083Z8117**
	900	10	**083Z8018**	**083Z8118**
	1000	10	**083Z8019**	**083Z8119**
	1200	10	**083Z8021**	**083Z8121**

ANSI/AWWA flanges	Nominal size DN	Nominal size inch	Flange type	PN bar	Code no.
Liner: Neoprene Flange: Carbon steel (A 105/St. 37.2), ANSI Class 150 or AWWA C-207, Class D Electrodes: AISI 316 Ti Grounding electrode: AISI 316 Ti Enclosure: IP 67/NEMA 6 (3 m/10 ft w.g. for 72 h)	25	1"	ANSI 150	20	**083Z8600**
	40	1°"	ANSI 150	20	**083Z8601**
	50	2"	ANSI 150	20	**083Z8602**
	65	2 ° "	ANSI 150	20	**083Z8603**
	80	3"	ANSI 150	20	**083Z8604**
	100	4"	ANSI 150	20	**083Z8605**
	125	5"	ANSI 150	20	**083Z8606**
	150	6"	ANSI 150	20	**083Z8607**
	200	8"	ANSI 150	20	**083Z8608**
	250	10"	ANSI 150	20	**083Z8609**
	300	12"	ANSI 150	20	**083Z8610**
	350	14"	ANSI 150	20	**083Z8611**
	400	16"	ANSI 150	20	**083Z8612**
	450	18"	ANSI 150	20	**083Z8613**
	500	20"	ANSI 150	20	**083Z8614**
	600	24"	ANSI 150	20	**083Z8615**
	700	28"	AWWA	10	**083Z8616**
	750	30"	AWWA	10	**083Z8617**
	800	32"	AWWA	10	**083Z8618**
	900	36"	AWWA	10	**083Z8619**
	1000	40"	AWWA	10	**083Z8620**
	1100	44"	AWWA	10	**083Z8621**
	1200	48"	AWWA	10	**083Z8622**

10.5 Signal converter

Compact polyamid

Description	Version	Enclosure	Code no.	Symbol
Signal converter MAG 5000 Blind for compact and wall mounting	11-30 V d.c./ 11-24 V a.c.	IP 67, fibre-glass reinforced polyamide	**083F5006**	
	115/230 V a.c. 50/60 Hz	IP 67, fibre-glass reinforced polyamide	**083F5005**	
Signal converter MAG 5000 for compact and wall mounting	11-30 V d.c./ 11-24 V a.c.	IP 67, fibre-glass reinforced polyamide	**083F5002**	
	115/230 V a.c. 50/60 Hz	IP 67, fibre-glass reinforced polyamide	**083F5001**	
	115/230 V a.c. 50/60 Hz HART®	IP 67, fibre-glass reinforced polyamide	**083F5011**	

Description	Version	Enclosure	Code no.	Symbol
Signal converter MAG 6000 Blind for compact and wall mounting	11-30 V d.c./ 11-24 V a.c.	IP 67, fibre-glass reinforced polyamide	**083F5008**	
	115/230 V a.c. 50/60 Hz	IP 67, fibre-glass reinforced polyamide	**083F5007**	
Signal converter MAG 6000 for compact and wall mounting	11-30 V d.c./ 11-24 V a.c.	IP 67, fibre-glass reinforced polyamide	**083F5004**	
	115/230 V a.c. 50/60 Hz	IP 67, fibre-glass reinforced polyamide	**083F5003**	

Description	Version	Enclosure	Code no.	Symbol
Signal converter MAG 6000 CT for compact and wall mounting	11-30 V d.c./ 11-24 V a.c.	IP 67, fibre-glass reinforced polyamide	**083F5010**	
	115/230 V a.c. 50/60 Hz	IP 67, fibre-glass reinforced polyamide	**083F5009**	

Accessories MAG 5000 and MAG 6000

Description	Code no.	Symbol
Wall mounting unit for IP 67 version Wall bracket, 4 Pg 13.5 cable glands	**085U1001**	

Add-on module MAG 6000 only

Description	Code no.	Symbol
HART	**085U0226**	

Spare parts

Description	Version	Code no.	Symbol
Connection plate	12-24 V	**083F4113**	
	115-230 V	**083F4112**	

10.6 Signal converter 19"

Description	Version	Code no.	Symbol
Signal converter MAG 5000 for rack and panel mounting	11-30 V d.c./ 11-24 V a.c.	**083F5021**	
	115-230 V a.c. 50/60 Hz	**083F5020**	
Signal converter MAG 6000 for rack and panel mounting	11-30 V d.c./ 11-24 V a.c.	**083F5023**	
	115-230 V a.c. 50/60 Hz	**083F5022**	

Accessories

Description	Version	Code no.	Symbol
Cleaning unit for electrode cleaning 19" insert (21 TE)	115-230 V a.c. 50/60 Hz	**083F5036**	
Safety barrier [EEx ia/ib] IIB for MAG 3100 Ex DN ≤ 300 19" insert (21 TE)		**083F5035**	
Safety barrier [EEx ia] IIC for MAG 3100 Ex DN 350-2000 19" insert (14TE)		**083F5034**	
Panel mounting kit for 19" insert (21 TE) IP 65 enclosure in ABS plastic for panel-front mounting		**083F5030**	
Panel mounting kit for 19" insert (42 TE) IP 65 enclosure in ABS plastic for panel-front mounting		**083F5031**	
Back of panel mounting kit for 19" insert (21 TE) IP 20 enclosure in aluminium		**083F5032**	
Back of panel mounting kit for 19" insert (42 TE) IP 20 enclosure in aluminium		**083F5033**	
Front cover (7 TE)		**083F4525**	

Wall mounting units complete

Description	Version	Code no.	Symbol
MAG 6000 with IP 66 enclosure	115/230 V a.c. 50/60 Hz	**083F5026**	
MAG 6000 19" insert and cleaning unit complete mounted with IP 66 wall mounting enclosure	115/230 V a.c. 50/60 Hz	**083F5029**	
MAG 6000 19" insert and safety barrier complete mounted with IP 66 wall mounting enclosure, [EEx ia/ib] IIB	115/230 V a.c. 50/60 Hz	**083F5028**	
MAG 6000 19" insert and safety barrier complete mounted with IP 66 wall mounting enclosure, [EEx ia/e] IIC	115/230 V a.c. 50/60 Hz	**083F5027**	

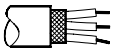
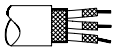
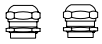
Wall boxes (Without backplates)

Description	Code no.	Symbol
IP 65 wall mounting enclosure for IP 20 19" inserts (21 TE)	**083F5037**	
IP 65 wall mounting enclosure for IP 20 19" inserts (42 TE)	**083F5030**	

Backplates

Description	Enclosure	Version	Code no.	Symbol
Signal converter	19"	12-24 V 115-230 V	**083F4117**	
Signal converter & ia, safety barrier	19"	12-24 V 115-230 V	**083F4118**	
Signal converter & ia/ib, safety barrier	19"	12-24 V 115-230 V	**083F4119**	
Signal converter & cleaning unit	19"	115-230 V	**083F4123**	
Signal converter	Wall unit	12-24 V 115-230 V	**083F4121**	
Signal converter & ia, safety barrier	Wall unit	12-24 V 115-230 V	**083F4122**	
Signal converter & ia/ib, safety barrier	Wall unit	12-24 V 115-230 V	**083F4120**	
Signal converter & cleaning unit	Wall unit	115-230 V	**083F4124**	

10.7 Accessories

Description	Length	Code no.	Symbol
Cable Standard electrode and coil cable, 3 x 1,5 mm² PVC	10 m 20 m 40 m 60 m 100 m 150 m 200 m 500 m	**083F0121** **083F0210** **083F0211** **083F0212** **083F0213** **083F3052** **083F3053** **083F3054**	
Cable Special electrode cable, double screened, PVC	20 m 40 m 60 m 100 m 150 m 200 m 500 m	**083F3095** **083F3094** **083F3093** **083F3092** **083F3056** **083F3057** **083F3058**	
Standard Pg 13.5 screwed cable entries for above cables (nickel-plated brass)	2-off	**083G0227**	
Standard Pg 13.5 screwed cable entries for above cables in black polyamide (100°C)	2-off	**083G0228**	
Sealing screws for sensor/signal converter	2-off	**085U0221**	
Stainless steel (AISI 316) terminal box with lid		**085U1000**	
Polyamid terminal box Complete incl. terminals excl. lid		**085U1002**	
Polyamid lid for terminal box		**085U1003**	
2 kB SENSORPROM® unit (Sensor serial no. must be specified by ordering)		**085U1005**	

10.8 Calibration

	Description	Code no. DN 3-65	Code no. DN 80-150	Code no. DN 200-500	Code no. DN 600-1200
Initial calibration	**Standard calibration** Each sensor calibrated twice at two calibration points Included in sensor scope of delivery				
	Matched pair Sensor and signal converter calibrated together with standard calibration	**085F7351**	**085F7351**	**085F7351**	**085F7351**
	Customer specified matched pair Sensor with signal converter are calibrated in max. 10 customer specified points	**085F7372**	**085F7373**	**085F7374**	**085F7375**
	Accredited matched pairs **Calibrations acc. to EN 45001** Sealing and labeling instruction must follow the order - PTB cold water - PTB other media than water - OIML 75 hot water - OIML 117 other media than water - OIML 117 cold water	**085F7382**	**085F7383**	**085F7384**	**085F7385**
	Accredited Delft matched pair **Calibration acc. to EN 45001** Sealing and labeling instruction as above	**N/A**	**085F7393**	**085F7394**	**085F7395**
Re-calibration	**Matched pair** Sensor and signal converter calibrated together with standard calibration	**085F7302**	**085F7303**	**085F7304**	**085F7305**
	Customer specified matched pair Sensor with signal converter are calibrated in max. 10 customer specified points	**085F7377**	**085F7378**	**085F7379**	**085F7380**
	Accredited matched pairs **Calibrations acc. to EN 45001** Sealing and labeling instruction must follow the order - PTB cold water - PTB other media than water - OIML 75 hot water - OIML 117 other media than water - OIML 117 cold water	**085F7387**	**085F7388**	**085F7389**	**085F7390**
	Accredited Delft matched pair **Calibration acc. to EN 45001** Sealing and labeling instruction as above	**N/A**	**085F7393**	**085F7394**	**085F7395**
Add-on	**Wittnes inspection** Any of above mentioned calibrations	**083F7361**			

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