SIEMENS

SITRANS F US SONOFLO®

Ultrasonic flowmeter
Sensor type SONO 3300 and SONO 3100
Signal converter type SONO 3000

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

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

Order no.: FDK:521H0409

SFIDK.PS.029.Q3.02

Siemens Flow Instruments range of ultra-sonic flowmeters	Mild steel Standard program	Stainless and mild steel Extended program	SONOKIT
Sensor	SONO 3300	SONO 3100	
Size [mm]	DN 50 - DN 300	DN 100 - DN 1200	DN 200 - DN 4000
Connection examples	DIN 2501 ANSI B 16.5 150 lbs RF ANSI B 16.5 300 lbs RF		None
Pressure [bar]	PN 10, PN 16, PN 40 Class 150, Class 300	PN 6, PN 10, PN 16, PN 25, PN 40 Class 150, Class 300	Max. PN 40
Media temperature max. [°C]	160	200	200
Transducer	Integrated transducers	SONO 3200 O-ring type Flange transducers	SONO 3200 O-ring type
Enclosure	IP 67	IP 68	IP 68
Approvals	EEx d II C T3-T6	EEx d IIC T2-T6	EEx d IIC T3-T6

Signal converters	SONO 3000			SONO 3000 Ex-d
Enclosure	IP 67	19" insert IP 00	19" insert IP 65	IP 67
Mounting	Compact or separate wall mounting	19" rack wall mounting and panel mounting		Compact or separate wall mounting
Accuracy (error limit)	0.5% of actual flow			
Materials	Polyamid	ALU	ABS Plastic	ASTM 316
Outputs	1 current 1 frq./pulse 1 relay	3 current 2 frq./pulse 2 relays	3 current 2 frq./pulse 2 relays	1 current 1 frq./pulse 1 relay
Display/counter	Alphanumeric: flow, quantity, error, mass flow, sound velocity, etc.			
Language	English, German, French			
Approval	Can be used with any EEx-approved sensor SONO 3100 and SONOKIT, when the SONO 3000 is placed in safe area			EEx de [ia/ib] IIC T6
Supply voltage	115/230 V a.c. 24 V a.c./d.c.			24 V a.c./d.c.

SITRANS F US SONOFLO®   **Contents**

Int

1. Introduction

Siemens Flow Instruments SITRANS F US SONOFLO® ultrasonic flowmeters are designed for measurement of:

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

SITRANS F US SONOFLO® ultrasonic flowmeters measure flow in standard volumetric and mass flow units. Measurement is independent of changes in liquid temperature, density, pressure and conductivity.

A time of flight flowmeter is designed for use on single phase liquids.

SONO 3000 measures with a high accuracy (better than ±0,5% of reading over a wide measuring range).

The sensor has been approved according to the EC Directive on the Pressure Equipment 97/23/EC of 29 May 1997 asssed to fluid in group 1, classified in category III, and designed according to prEN13480.

⚠ **Potential Hazards**
The ground wire must always be connected to the ground terminal in accordance with the diagram.

1.1 Precision measuring system	The ultrasonic flowmeter is a precision measuring system that is "user friendly", but must be installed in accordance with the instructions given in this handbook.
1.2 Handling	The sensor should be handled with care. Impact and shock can damage the piezoelectric crystals located in the transducers.

1.3 System overview

Sensor type	Signal converter	Outputs	Measurement
SONO 3300 DN 50 - DN 300	SONO 3000 Compact Standard housing	• 1 analog • 1 frequency-/pulse • 1 relay	
SONOKIT DN 200 - DN 4000	SONO 3000 Ex-d AISI 316 housing	• 1 analog • 1 frequency-/pulse • 1 relay	
SONO 3100 DN 100 - DN 1200	SONO 3000 19" insert	• 1 analog • 1 frequency-/pulse • 1 relay	• Volume flow rate • Total volume • Mass flow rate • Total mass • Sound velocity • Error indication
	SONO 3000 19" insert	• 3 analog • 2 frequency-/pulse • 2 relays	
	SONO 3300 19" IP 65	• 3 analog • 2 frequency-/pulse • 2 relays	

2.   Technical data

2.1 System accuracy
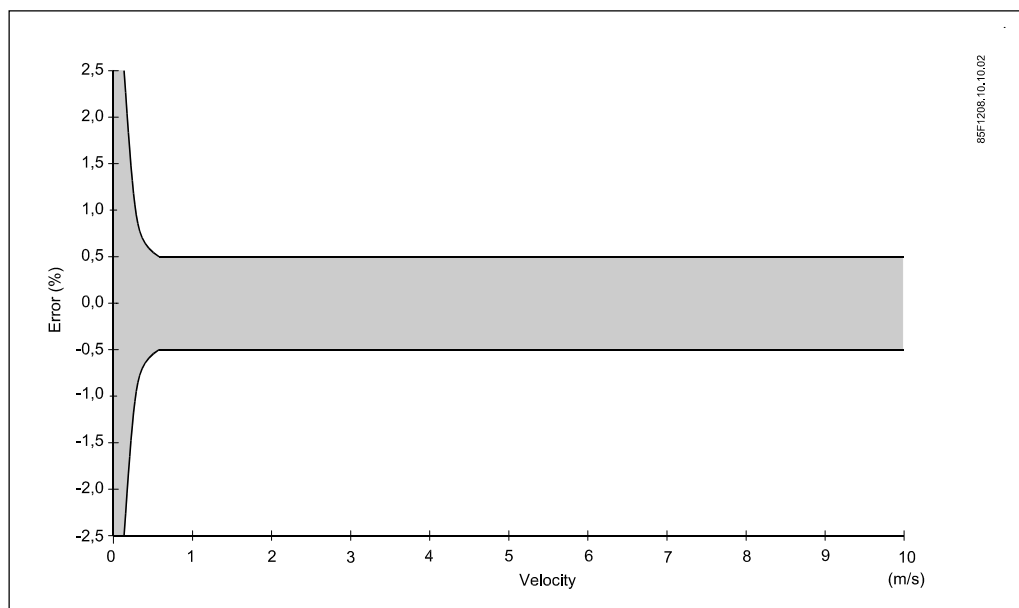
Reference conditions:

- Fluid: Water
- Fluid temperature: 22 ±5 °C
- Ambient temperature: 22 ±5 °C
- Supply voltage: 115-230 V a.c. +10% to −15%

                                 24 V d.c. +25% to −15%, 24 V a.c. ±15%

- Straight length: 20 × Di

Rangeability: 0-1 m/s to 0-10 m/s

Repeatabilty: Better than 0.25% in the range from 0.5 m/s to 10 m/s

Linearity: Better than 0.4% for Reynolds number > 5000
                                 Better than 1% for Reynolds number 1000 < Re < 5000

Additional effects of deviations from reference conditions

1. Current output: As frequency output ±(0.1% of actual flow +0.05% FSO)

2. Effect of ambient temperature: Display/frequency/pulse output: < 0.005% SPAN/K

3. Current output: < ±0.0075% SPAN/K

4. Effect of supply voltage: 0.005% of measuring value at 1% change

5. SONO 3300 DN 50 and DN 65 ±0.5% for Reynolds numbers 1000 < Re < 5000 ±1.5%

6. System accuracy SONO 3100 2-track ±0.15% F.S.O.

7. Theoretical calibration SONOKIT: ±0.5% to ±1.5%

2.2 Signal converter SONO 3000

Tech. data

		Terminal connection
Analog output	Individually galvanically isolated, isolation voltage 500 V	31 and 32
Measurement of: (optional via menu)	Volume flow, sound velocity	33 and 34
Current	0-20 mA or 4-20 mA	35 and 36
Load	< 800 ohm	
Time constant	0.8-30 s adjustable	
Frequency/pulse output	Individually galvanically isolated, isolation voltage 500 V	50, 51 and 52
Measurement of: (optional via menu)	Volume flow, sound velocity, total volume, total mass	54, 55 and 56
Frequency	0-10 kHz	
Time constant	0.8-30 s adjustable	
Pulse width	50 µs, 500 µs, 5 ms, 20 ms, 50 ms, 100 ms, 500 ms, 1 s, 5 s	
Active: Output mode	24-30 V d.c./max. 25 mA, (50 µs to 5 s)	
	(50 ms E.Mech., max. 75 mA if F < Hz)	
	24-30 V d.c./max. 50 mA, (500 Hz to 10 kHz)	
Passive: Output mode	5-30 V d.c.	
	Max. current 200 mA	
Output mode	Output can be either active or passive depending on electrical connection	
Relay	Change-over relay (error indication, flow direction, sound velocity limit)	44, 45 and 46
Load	42 V, 0.5 A	
Time constant/Hysteresis	5 s/0.5 % F.S.O.	
Cut off: Low flow	0-9.9 % F.S.O.	
Supply voltage and power consumption	115-230 V a.c. +10% to −15%, 50-60 Hz, 10-20 VA	PE, N and L
	24 V d.c. +25/−15%, 24 V a.c. ±15%, 10 VA,	PE, N and L
	cable impedans < 10 ohm at 24 V	PE, 1 and 2
Internal counters (totalizers)	Two internal counters. Selectable uni- or bidirectional counting (Net flow)	
Measurement of	Total volume	
Display	Back-lit with alphanumerical text, 2 x 16 digits for indication of: measured values, totalization, settings, error codes and alarms	

Enclosure IP 67

Enclosure	IP 67 to IEC 529	
Material	Fibre glass reinforced polyamide	
Mechanical vibration	2G 1-800 Hz sinusoidal in all directions to IEC 68-2-6	
Ambient temperature	Operation: −20 °C to +55 °C	
	Storage: −40 °C to +85 °C	
CE-mark EMC	CENELEC	Emission EN 50081-1	Immunity EN 50082-2
Low voltage	According to EN 60730		

Enclosure IP 20, front of panel

Enclosure	IP 20 to IEC 529 and DIN 40050	
Material	Standard 19" insert in aluminium/steel (DIN 41494)	
Mechanical vibration	1G 1-800 Hz sinusoidal in all directions to IEC 68-2-6	
Ambient temperature	Operation: +0 °C to +55 °C	
	Storage: −40 °C to +85 °C	
Supply voltage and power consumption	115/230 V a.c. +10% to −15%, 50-60 Hz, 10-20 VA	PE, N and L

Tech. data

Enclosure IP 65,
wall mounting

Enclosure		IP 65 to IEC 529 and DIN 40050	
	Material	Standard 19" insert in aluminium/steel (DIN 41494)	
	Mechanical vibration	1G 1-800 Hz sinusoidal in all directions to IEC 68-2-6	
	Ambient temperature	Operation: +0 °C to +55 °C	
		Storage: −40 °C to +85 °C	
Supply voltage and power consumption		24 V d.c. +25/−15%, 24 V a.c. ±15%, 15 VA, cable impedance < 7 ohm at 24 V	PE, N and L
		115/230 V a.c. +10% to −15%, 50-60 Hz, 10-20 VA	PE, 1 and 2

Ex-d version
wall mounting

Enclosure	Compact mounted	IP 67 to IEC 529 and DIN 40050	
	Separate mounted	IP 65 to IEC 529 and DIN 40050	
	Material	AISI 316 and Duplex	
	Dimensions	See page 32	
	Weight	Approx. 11 kg	
	Mechanical vibration	2G 1-800 Hz sinusoidal in all directions to IEC 68-2-6	
	Ambient temperature	Operation: −20 °C to +55 °C	
		Storage: −40 °C to +85° C	
Supply voltage and power consumption		24 V d.c. +25/−15%, 24 V a.c. ±15%, 10 VA,	PE, N and L
		cable impedans < 10 ohm at 24 V	PE, 1 and 2
Description of Ex-approval		EEx de [ia/ib] II C T6	
		Flame proof Enclosure "d"	
		Outputs intrinsically safe class "ia"	
		Display/keypad intrinsically safe class "ib"	
		Power and sensor connections are increased safe "e"	
		Separate version: DEMKO No. 94C.113341X	

Enclosure 19" insert

Enclosure		IP 00 to IEC 529 and DIN 40050	
	Material	Standard 19" insert in aluminium/steel (DIN 41494)	
	Dimensions	Width: 142 mm	
		Height: 128 mm	
		Module depth: 190 mm	
	Weight	2.8 kg	
	Mechanical vibration	1G 1-800 Hz sinusoidal in all directions to IEC 68-2-6	
	Ambient temperature	Operation: +0 °C to +55 °C	
		Storage: −40 °C to +85 °C	
Supply voltage and power consumption		24 V d.c. +25/−15%, 24 V a.c. ±15%, 15 VA,	PE, N and L
		cable impedans < 7 ohm at 24 V	PE, 1 and 2

Tech. data

2.3 Sensor SONO 3300

Description	2-track sensor with flanges and integrated transducers
Nominal size	DN 50, DN 65, DN 80, DN 100, DN 125, DN 150, DN 200, DN 250, DN 300 (2" to 12")
Liquid temperature	Separate version: −10 °C to +160 °C
	Compact version: −10 °C to +120 °C
	Compact EEx d: −10 °C to +160 °C
Ambient temperature	Separate version: −40 °C to +160 °C
	Compact version: −20 °C to +55 °C
	In stock: −40 °C to +70 °C
Enclosure	Standard version: IP 67
	Ex version: Compact EEx de [ia/ib] IIC T5-T6
	Ex version: Separate EEx de [ia/ib] IIC T6
Process connections PN designated EN 1092-1-type 11, B	DN 50 to DN 300 PN 40
	DN 100 to DN 300 PN 16
	DN 200 to DN 300 PN 10
Class designated EN 1759-1-type 11, B	DN 125 to DN 300 (5" to 12") class 150 (PN 20)
	DN 50 to DN 300 (2" to 12") class 300 (PN 50)
Transducer	Integrated version welded into pipe
Materials Pipe	DN 50 to DN 150: Steel
	DN 200 to DN 300: Steel EN 1.0345-P235GH
Flange Class: ASTM A105	DN 50 to DN 1200: PN: EN 1.0025-S235JRG2
Transducer	Stainless steel
Material certificate	The sensor is supplied as standard with a Siemens Flow Instruments certificate of conformity (standard). Material certificate on wetted parts on request
NDT examination report	Available on request
Max. flow velocity DN 50 to DN 300	10 m/s

2.4 Sensor SONO 3100

| Description	2-track sensor fitted with four SONO 3200 transducers
Nominal size	DN 100 to DN 1200 (4" to 48")
Liquid temperature	Standard version: −10 °C to +200 °C
Ambient temperature	Standard version: −20 °C to +200 °C
Enclosure	Ex version: EEx d IIC T2-T6, IP 68
Process connections PN designated EN 1092-1-type 11, B	DN 100 to DN 1200 PN 6/10/16
	DN 100 to DN 1000 PN 25
	DN 100 to DN 500 PN 40
Class designated EN 1759-1-type 11, B	DN 100 to DN 600 class 150 & class 300
Materials Pipe	Steel EN 1.0345-P235GH
	Steel EN 1.4404
Flange	PN: EN 10025-S235JRG2, 1E1
	PN: EN 10222-5-1.4404, 13E0
	Class: ASTM A105, 1.1
	Class: ASTM F316L, 2.3
Transducer element	Stainless steel ASTM 316 or similar
Material certificate	The sensor is supplied as standard with a Siemens Flow Instruments certificate of conformity (standard). Material certificate on wetted parts on request
NDT examination report	Available on request
Max. flow velocity DN 100 to DN 1200	10 m/s

2.5 SONOKIT mounting kit

Introduction	1-track or 2-tracks sensor supplied as a kit for mounting on existing pipelines	
Description	DN 200 to DN 4000 (8" to 160")	
Line pressure	Max. 40 bar	
Liquid temperature	Standard version:	−20 °C to +200 °C
Enclosure	Standard version:	IP 68
	Ex version:	EEx d IIC T3-T6, IP 68
Materials	Standard version:	PA 6.6 100 °C
Terminal box		AISI 316 200 °C
Transducer element	Standard version:	AISI 316 200 °C
Material of existing pipeline		
Steel	Transducer holder:	St. 37.2 or simular
	Mounting plates:	St. 37.2 or simular
Concrete	Transducer holder:	ASTM 316 or simular
	Mounting plates:	(Not included)
Stainless steel	Transducer holder:	ASTM 316 or simular
	Mounting plates:	ASTM 316 or simular
Pipe wall thickness		
Steel pipe (AISI 316 and St. 37.2 or corresponding material)	Transducer and holder available in length L = 160 Allowing a pipewall thickness up to 20 mm	
Concrete pipe	Transducer available in lengths L = 230 Allowing a pipewall thickness up to 200 mm	

2.6 Coaxial cable for SONO 3300, 3100/ 3000

Coaxial cable (75Ω)	1 x ∅ 0.8 mm copper conductor with shield
Outside diameter	∅ 5.8 mm
Length	Max. 250 m between sensor and signal converter
Material (outside jacket)	Black PE
Ambient temperature	−10 °C to +100 °C
Coaxial cable (75Ω)	1 x ∅ 0.65 mm copper conductor with shield
Outside diameter	∅ 5.3 mm
Length	Max. 100 m between sensor and signal converter
Material (outside jacket)	Brown FEP
Ambient temperature	−200 °C to +200 °C
Multi coaxial cable (75Ω)	4 x coax
Outside diameter	9 mm
Length	Max. 20 m
Material (outside jacket)	Black PVC
Ambient temperature	0 °C to +70 °C
Multi coax cable (75Ω)	4 x ∅ 0.30 mm copper conductor with shield and joint jacket
Outside diameter	∅ 7.9 mm
Length	Max. 10 m
Material (outside jacket)	Black PTFE
Ambient temperature	−50 °C to +200 °C

2.7 Sizing table
    (DN 50 to DN 4000)
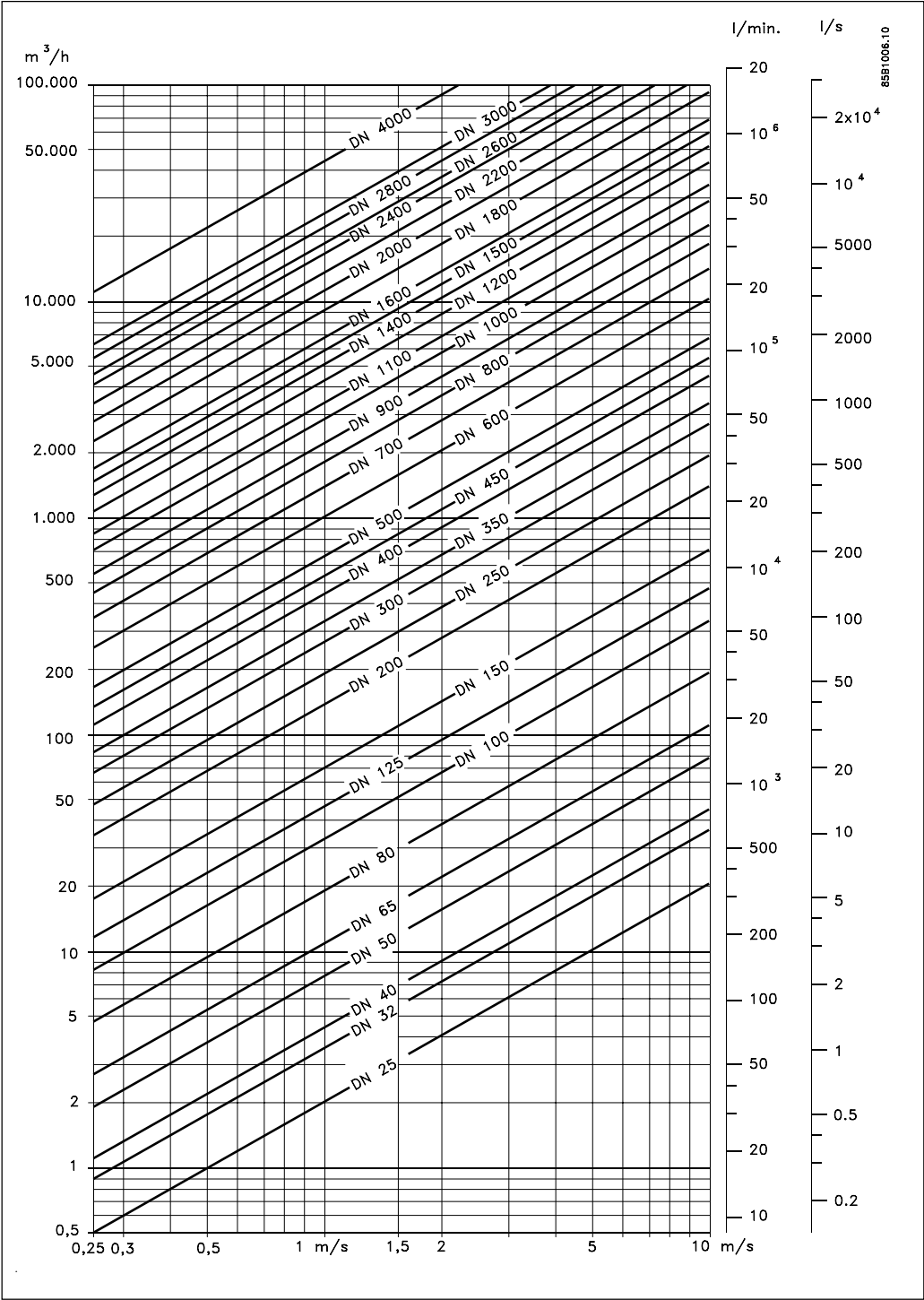
3. Dimensions and weight	
3.1 Signal converter SONO 3000 IP 67	*Signal converter wall mounted*

Signal converter wall mounted

Ø8 (0.3)
Ø12 (0.5)
Ø8 (0.3)
71 (2.8)
13 (0.5)
71 (2.8)
13 (0.5)
190 (7.45)
240 (9.45)
154 (6.06)
105 (4.13)
10 (0.4)
170 (6.69)
85F1491.11
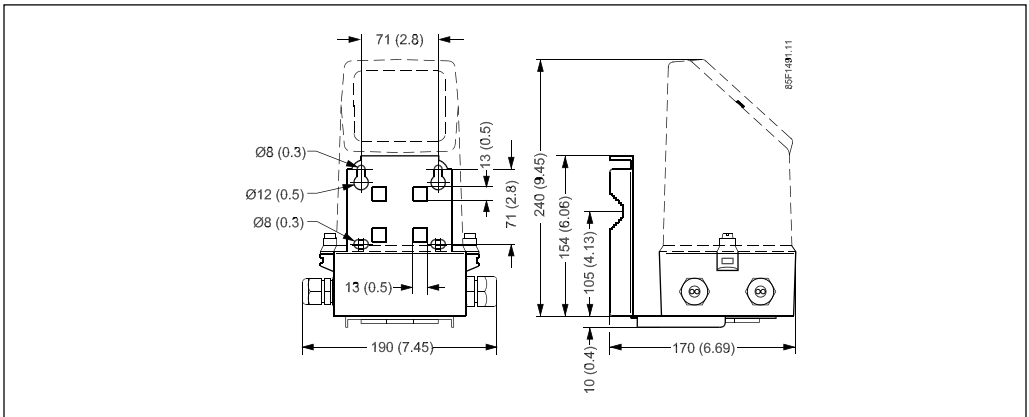
Weight: SONO 3000 approx. 2.0 kg

Signal converter shown with wall bracket

85F1505.10
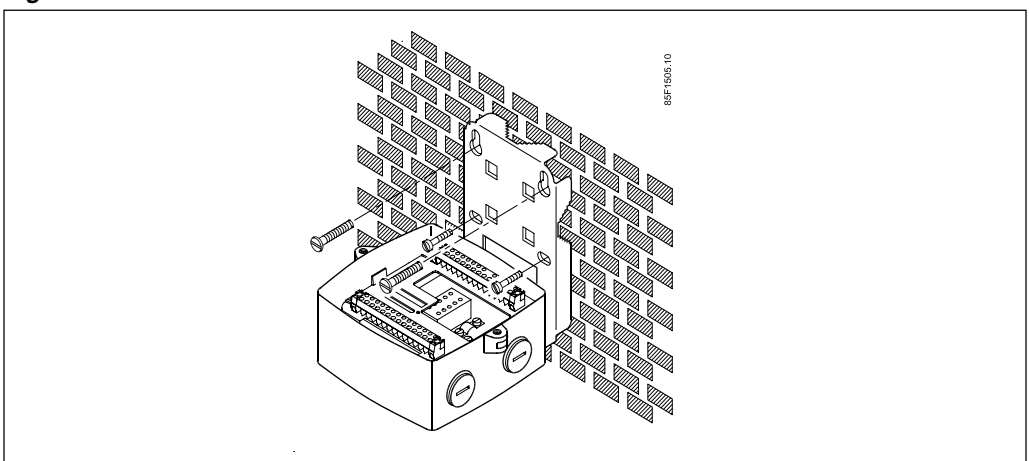
Weight: Wall bracket with pipe clamp approx. 1.6 kg

3.2 Sensor SONO 3100

A. *Transducer holder*
B. *Transducer element*
C. *Terminal box*

85B1060.10
85B914.10
85F930.10

$L_6 / L_{10} / L_{16} / L_{25} / L_{40}$
L
H
B
D_6 / D_{40}
D_u
θ
A**

Dim. & weight

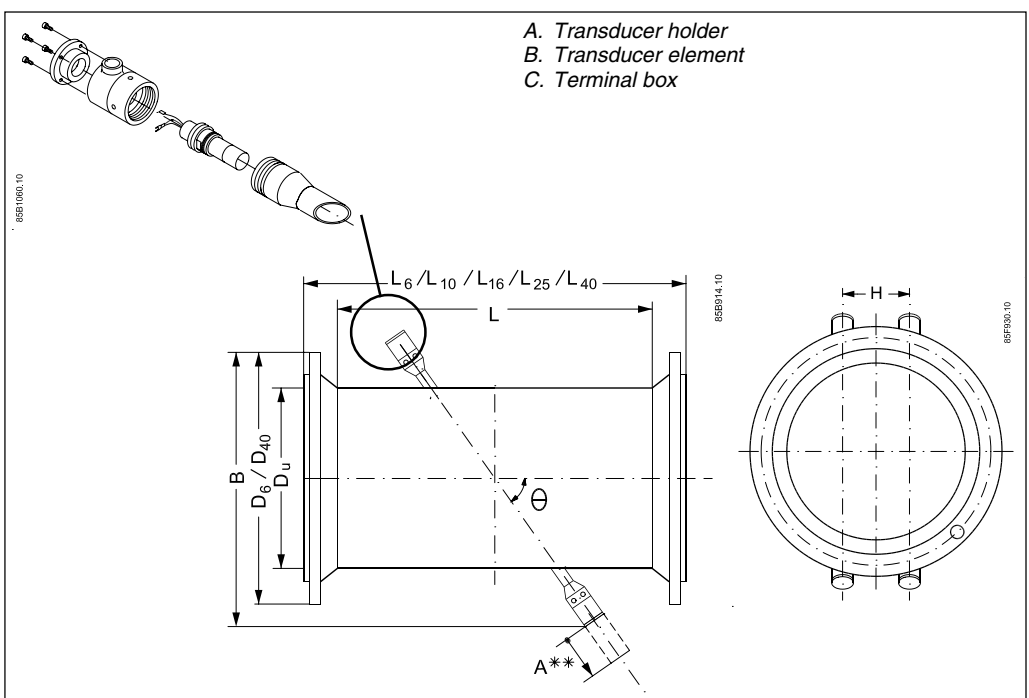| DN	D_u (mm)	L (mm)	B (mm)	θ [°]	H (mm)	PN 6 W_6*) (mm)	D_6 Flange dia. (mm)	L_6 (mm)	PN 10 W_{10}*) (mm)	D_{10} Flange dia. (mm)	L_{10} (mm)	PN 16 W_{16}*) (mm)	D_{16} Flange dia. (mm)	L_{16} (mm)	PN 25 W_{25}*) (mm)	D_{25} Flange dia. (mm)	L_{25} (mm)	PN 40 W_{40}*) (mm)	D_{40} Flange dia. (mm)	L_{40} (mm)
100	114.3	860	305	30	48.2	-	-	-	3.6	220	960	3.6	220	960	3.6	235	990	3.6	235	990
125	139.7	862	325	30	59.3	-	-	-	4.0	250	970	4.0	250	970	4.0	270	990	4.0	270	990
150	168.3	862	350	30	71.7	-	-	-	4.5	285	970	4.5	285	970	4.5	300	1010	4.5	300	1010
200	219.1	668	430	45	92.9	-	-	-	6.3	340	790	6.3	340	790	6.3	360	820	6.3	375	840
250	273.0	714	480	45	117.2	-	-	-	6.3	395	850	6.3	405	850	7.1	425	890	7.1	450	920
300	323.9	607	525	45	139.4	-	-	-	7.1	445	740	7.1	460	760	8.0	485	790	8.0	515	830
350	355.6	639	550	45	152.8	-	-	-	8.0	405	770	8.0	520	800	8.0	555	840	8.8	580	880
400	406.4	703	600	45	175.7	-	-	-	8.0	565	850	8.0	580	875	8.8	620	925	11.1	660	975
500	508.0	797	690	45	222.2	-	-	-	7.1	670	950	8.0	715	980	10.0	730	1050	14.2	755	1080
600	610.0	912	705	60	268.1	-	-	-	7.1	780	1075	8.8	840	1105	11.0	845	1165	-	-	-
700	711.0	937	895	60	312.8	-	-	-	8.0	895	1100	8.8	910	1140	12.5	960	1190	-	-	-
800	813.0	967	985	60	358.7	-	-	-	8.0	1015	1150	10.0	1025	1180	14.2	1085	1240	-	-	-
900	914.0	1007	1070	60	402.3	-	-	-	10.0	1115	1200	10.0	1125	1230	16.0	1185	1300	-	-	-
1000	1016.0	1060	1160	60	448.2	-	-	-	10.0	1230	1250	10.0	1255	1300	17.5	1320	1370	-	-	-
1200	1220.0	1100	1350	60	539.1	8	1340	1280	11.0	1455	1330	12.5	1485	1360	-	-	-	-	-	-

*)   Wall thickness

A**) Space required for replacement of transducer with special tool: 700 mm. See *"Accessories"* chapter 4.10 and *"Tools for SONO 3100 and SONOKIT"* chapter 10.9.1 **"Extraction tool"** for replacement for transducers without pressure shut-down.

3.3 SONO 3100 approximate system weights [kg]

2-track	Flange type			Weight (kg)	
DN	PN 6	PN 10	PN 16	PN 25	PN 40
100		32	32	35	35
125		38	38	44	44
150		45	45	52	52
200		59	58	70	79
250		73	75	96	117
300		83	92	114	151
350		98	113	145	191
400		119	141	191	275

2-track	O-ring type			Weight (kg)	
DN	PN 6	PN 10	PN 16	PN 25	PN 40
500		153	207	284	379
600		193	276	363	
700		262	303	480	
800		329	400	650	
900		428	475	835	
1000		500	594	1078	
1200	470	732	902		

Weight of system incl. process flanges and transducers.

3.4 Sensor SONO 3300
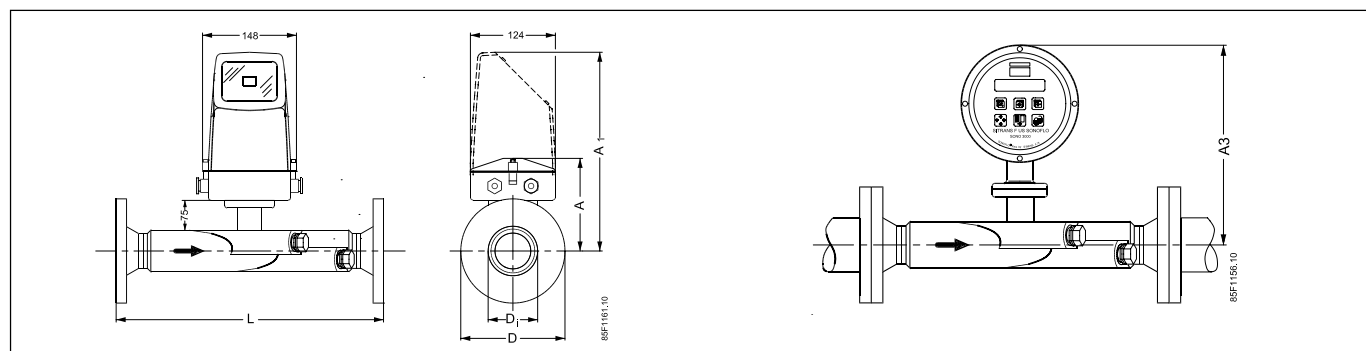
| DN	DIN 2632/2633/2635									ANSI									Without SONO 3000 A (mm)	With SONO 3000 A1 (mm)	A3	Weight*) DIN PN 40 kg	ANSI Cl. 300 kg
	PN 10			PN 16			PN 40			150 lb			300 lb										
	L	D	Di	L	D	Di	L	D	Di	L	D	Di	L	D	Di								
50							475	165	52.6	510	152	52.6	520	165	52.6				180	272	234	14	17
65							475	185	62.7	510	178	62.7	520	190	62.7				186	278	240	16	20
80				380	200	82.5	400	200	78.0	420	191	78.0	440	210	78.0				193	283	245	19	23
100				375	220	102.4	400	235	90.2	420	229	102.4	440	254	102.4				205	297	259	25	35
125				375	250	128.3	400	270	102.4	440	254	128.3	460	279	128.3				218	310	272	29	40
150				360	285	154.2	400	300	128.3	430	279	154.2	450	318	154.2				232	324	286	35	50
200	400	340	207.3	400	340	207.3	450	375	206.5	480	343	202.7	500	381	202.7				256	348	310	54	72
250	400	395	260.4	400	405	260.4	500	450	258.8	490	406	254.5	520	444	254.5				283	375	337	85	98
300	400	445	309.7	420	460	309.7	500	515	307.9	550	483	306.3	580	521	306.3				309	401	363	115	142

*)   When mounting the signal converter, the weight increases by 2 kg, with the EEx signal converter, the weight increases by 10 kg.

| 4. | **Sensor installation** | **To ensure optimum performance it is essential that the following instructions are followed.** |

4.1   Location

The SONO 3300/3100 sensor can be installed both inside or outside, even in exposed conditions.
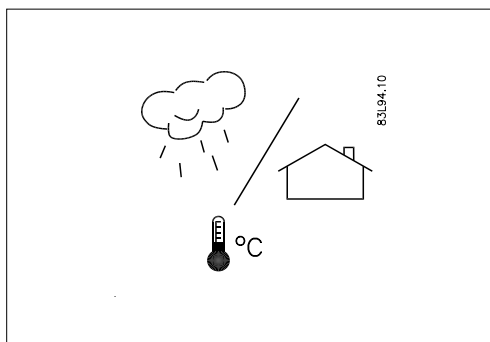
The sensor is suitable for media and ambient temperatures from −50 to +160°C. Cryogenic version from −196 to +100°C and high temperature versions from −40 to +200°C are also available. Temperature limitations are stated on the data plate on the sensor.
The enclosure rating is IP 67 or better. SONO 3100 is IP 68 as standard.

When there are large temperature differences between the media and the ambient conditions, the sensor must be isolated to prevent 2-phase flow which will result in measuring inaccuracy.
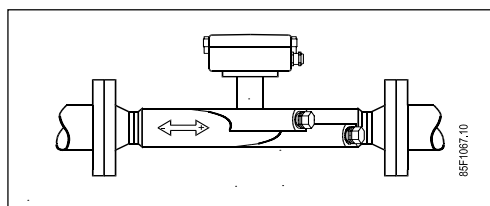
4.2   Gas bubbles
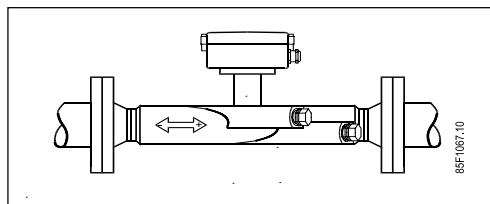
Avoid quantities of air collecting in the sensor as these will affect measurement. When air is present, installation of an air separator upstream of the meter is recommended.

4.3   Direction of flow

The double arrow marked on the sensor "+" and "-". + indicates the flow direction if the electrical connection is made in accordance with the descriptions in the handbook.
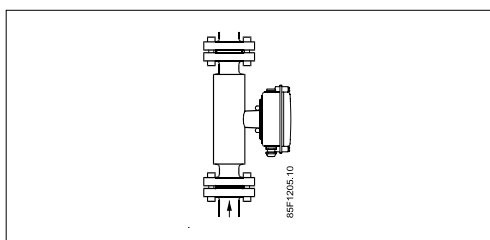
4.4   Full pipes
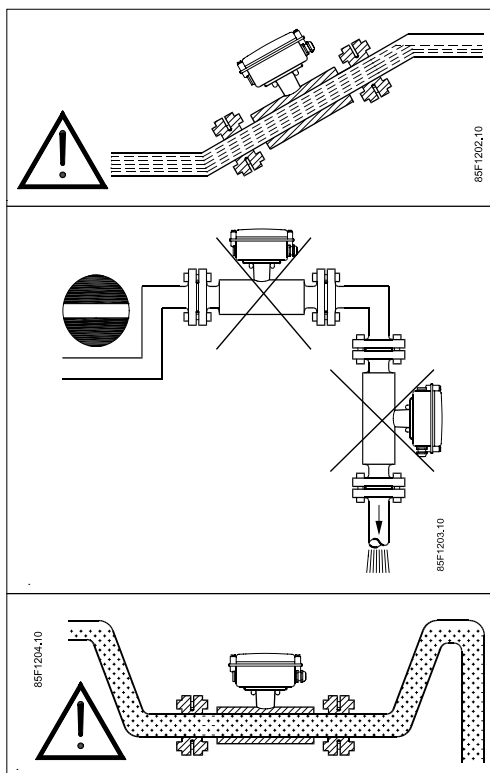
The sensor must always be completely full of liquid.

The following installations should be avoided:
• installation at the highest point in the system
• installation in vertical pipes with free outlet

With partially full pipes or pipes with free outlet, the flowmeter should be located in a U-tube.
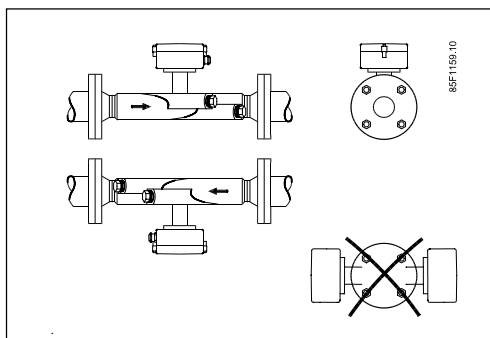
4.5   Installation in vertical pipes

Recommended direction of flow: upwards. This will minimize the effect of gas/air bubbles on the measurement.
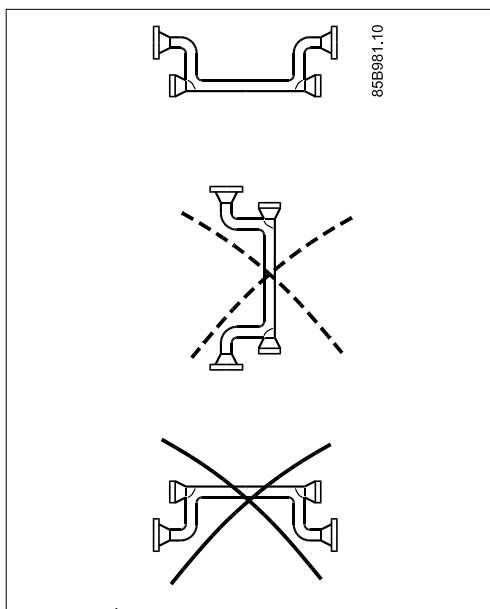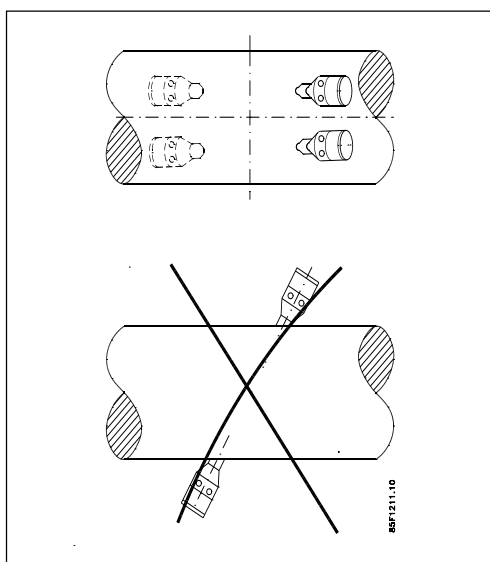

U-shaped sensor type SONO 3100 must only be mounted in a vertical position when the medium can be guaranteed free of air bubbles and particles, otherwise loss of signal can occur.

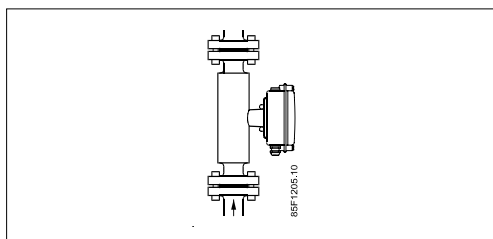**4.6   Installation in horizontal pipes**

The sensor must only be mounted as shown in the figure.
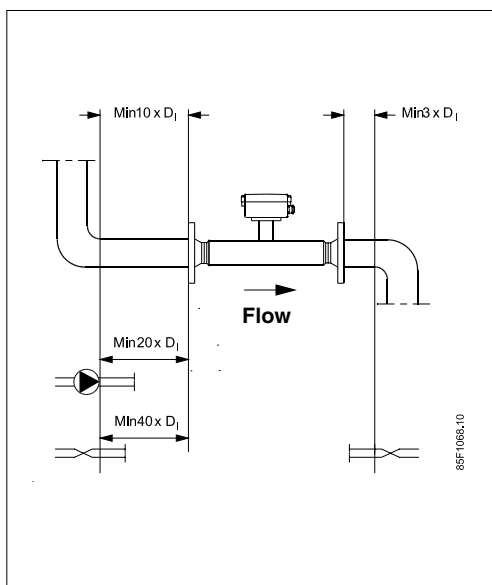Note the position of the terminal box.

Sensor type SONO 3100 without terminal box must not be mounted with the transducers in the vertical plane.

SFIDK.PS.029.Q3.02

4.7   Measuring liquids containing abrasive or other particles

It is preferable to mount the sensor in a vertically inclined line to minimize wear.

4.8   Inlet and outlet conditions

To maximise performance it is necessary to have straight inlet and outlet conditions, and a certain distance between meter, bends, pump and valves. It is also important to centre the flowmeter in relation to pipe flanges and gaskets.

Valves must always be placed after the flowmeter. The only exception is when installing the sensor in a vertical pipe. In this case a valve below the sensor is necessary to allow the zeropoint adjustment. It is important to select a valve, which has no impact on the flow when fully open.

Recommended inlet:
Fully open valve without any restriction to the flow: min. 10 x pipe diameter.
Partly open valve: min. 40 x pipe diameter.
Pumps: min. 20 x pipe diameter.
Bends: min. 10 x pipe diameter.
Recommended outlet: 3 x pipe diameter.
If more bends than one, please contact Siemens Flow Instruments for advice.

4.9   Permissible pressure and temperature

Maximum permissible pressure and temperature for Siemens Flow Instruments ultrasonic flowmeters can be seen on the sensor label.

Flanges according to PN
Flanges and joints as well as related pressure/temperature (p/t) classification have been described in EN 1092.
For steel group 1E1: Table 15
For stainless steel group 13E0: Table 18

Flanges according to ANSI Class
Flanges and joints as well as related pressure/temperature (p/t) classification have been described in EN 1759-1.
For steel group 1.1 ASTM A105, class 150: Table 16
For steel group 1.1 ASTM A105, class 300: Table 1
For stainless steel group 2.3 F304 L/316 L, class 150: Table 16
For stainless steel group 2.3 F304 L/316 L, class 300: Table 1

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

Warning!
Exposing the sensors to pressures/temperatures above the limits stated may cause damage. The sensor construction does not allow any other external action other than what is normal during common mounting in the pipeline. Provide for earthquakes, action of the air etc.

The transducer holders must not be used for any other purpose.

4.10   Corrosion

The meters have been designed according to EN 13480 with an additional corrosion layer of approx. 1 mm for steel sensors. Stainless steel sensors do not have an additional layer. The customer is responsible for checking that the actual medium can be used with the sensor material chosen.

Sensor inst.

4.11 Installation of transducer type SONO 3200	The transducer type SONO 3200 for use with sensor type SONO 3100 and retrofitting kit type SONOKIT.

The transducer type SONO 3200 for use with sensor type SONO 3100 and retrofitting kit type SONOKIT.
Transducer type SONO 3200 are available in two variants:

Flange type:
The transducer has a DIN flange with grove for fitting to a corresponding flange welded onto the pipe.

O-ring type:
The transducer has a screwed union connection for fitting in a counterflange welded onto the pipe. The union and pipe are sealed with an O-ring. This type is used in SONOKIT.
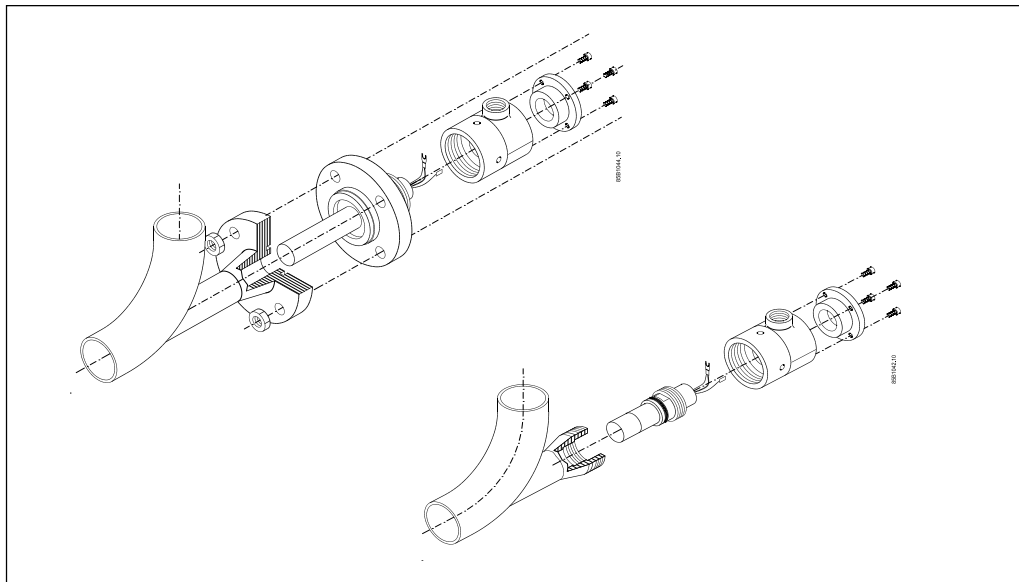
The transducer holders are welded directly to steel pipes or cast into the walls of concrete pipes and are flushed with the internal wall.
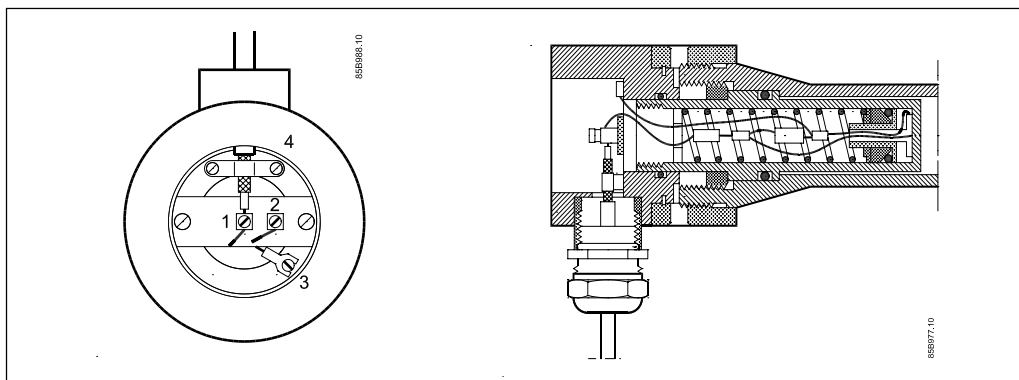
The terminal housing is fastened on the transducer holder by a union.
Stress at the connection leads must be avoided when feeding them through the terminal housing.
The core without the spade terminal is connected to terminal no. 2.
The core with the spade terminal is connected to the transducer using screw, pos. 3.
Mount inner core in terminal 1, and fix transducer cable and screen in cable clip 4.

Note:
When disassembling the terminal housing, the leads must be loosened from the terminal board. It is not necessary to remove the transducer cable.
The terminal housing must be held in position while the union is loosened to remove the terminal housing from the transducer holder.
If the terminal housing is rotated, the leads to the crystals may be damaged.

4.12 Accessories	***Extraction tool*** Transducer SONO 3200 O-ring type can be removed from the pipe section without draining the pipe using the extraction tool.

Extraction tool specification
Connection: BSP 1 1/2 internal
Max. pressure: 40 bar
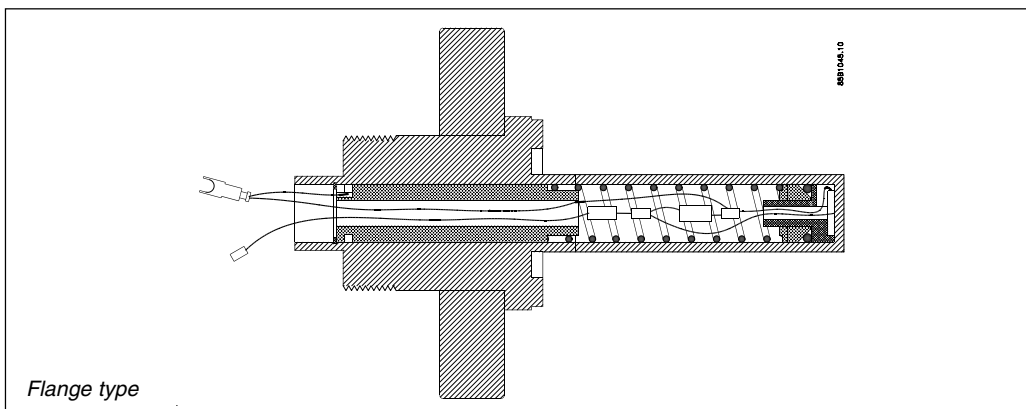Space required for:
50 mm transducers 1200 mm
160 mm trandsducer 1400 mm

4.13 Transducer SONO 3200	Transducers are available in two versions: Flange type or O-ring type. Transducers are constructed in three parts: 1. Terminal housing 2. Transducer element 3. Transducer insert *(See also chapter 10.4)*

|	
4.13.1 Transducer element 	 *Flange type*

Terminal box, transducer element and insert are identical in both versions.
The ultrasonic pulse is produced by sound energy being transmitted, via the window, to/from the liquid. The sound source is a piezoelectric crystal in the insert.
The insert, consisting of a spring and piezo crystal, can be removed from the transducer element during operation. No draining is necessary as the transducer element remains in the pipe.
When exchanging the transducer insert everything must be kept extremely clean to avoid dirt between crystal and window.
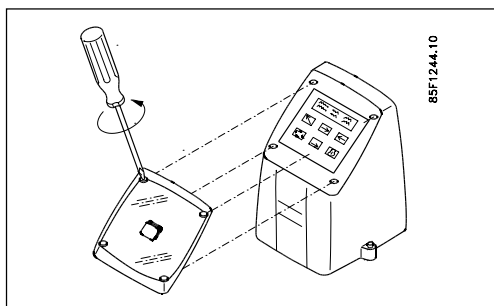

O-ring type

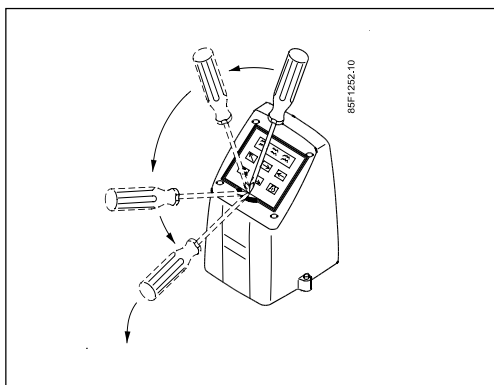|	
4.13.2 Transducer insert 	 *Transducer insert*
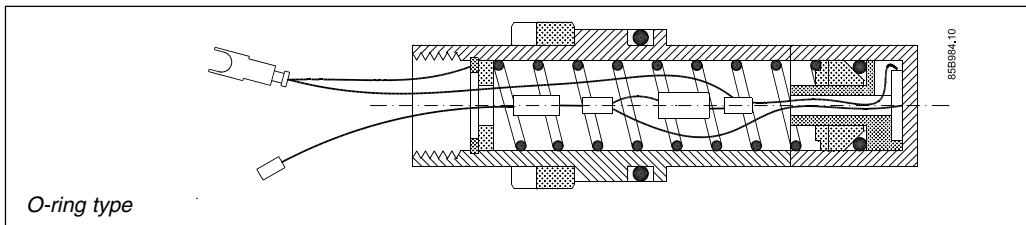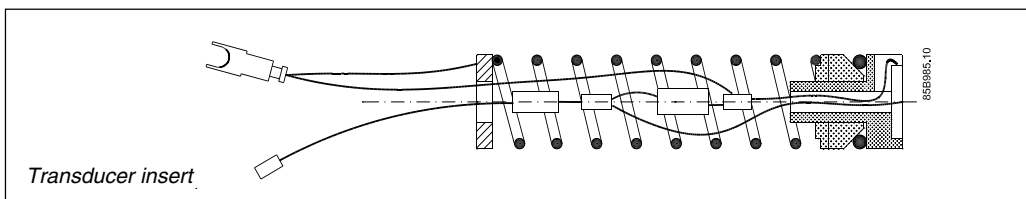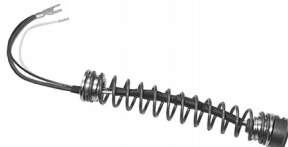
Signal conv. inst.

**5. Signal converter installation**

5.1 Signal converter compact version

Removal of display window (24 V version)
All signal converter readings are accessed by pressing the rubber button on the display window. When setting the converter or turning the keypad the display window must be removed.

Turning the keypad (24 V version)
1. Insert a screwdriver under the lower edge of the keypad.
2. Remove the keypad.
3. Check to ensure that the gasket is mounted correctly.
4. Turn the control pad. The top corner must always be inserted first. Press the keypad well down into the gasket recess.
5. Now, with thumb pressure, ease the gasket edge over the keypad while pressing lightly on the centre of the pad.
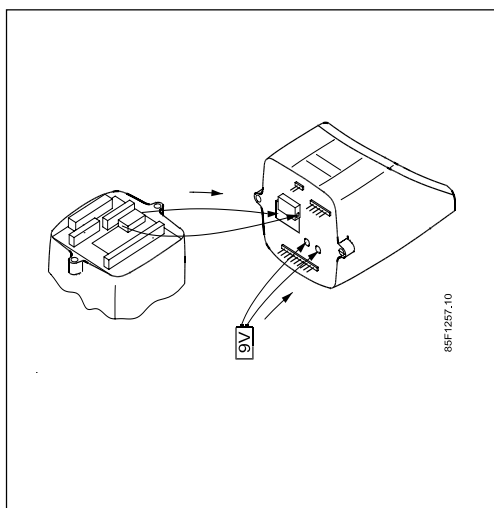
Setting prior to installation
By using a 9 V alkaline battery the flowmeter can be set before final installation. This is especially advantageous if the flowmeter is to be installed before the system is put into operation.
1. Fit the SENSORPROM® unit from the sensor terminal box under the signal converter as shown. Connect the battery.
2. To protect the pins, place the signal converter in the packaging base supplied.
3. Set the signal converter as described under "Starting up".
   The SENSORPROM® unit is now programmed with the required settings.
4. Remove the battery and replace the SENSORPROM® unit in the terminal box. The flowmeter is now ready for operation.
5. Mount the signal converter.

SONO 3000 24 V IP 67, order no. 7ME3150-1AA20-1AA0, is delivered with a 24 V terminal mounted on the bottom plate. This 24 V terminal replaces the 230 V terminal on the termination plate on SONO 3300 sensors or on the wall mounting kit FDK:085F5027.

SONO 3300 and wall mounting kit is supplied with 230 V terminals as standard.

5.2   Installation of the signal converter in compact mode
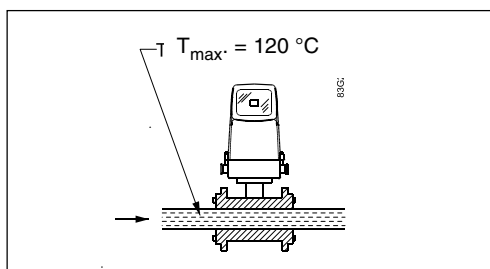
With **compact** installation the temperature of the liquid must not exceed +120°C and the ambient temperature must not exceed +50°C. The signal converter in compact version can be installed indoors or outdoors.
The ambient temperature must not exceed –20 and 50°C. The signal converter must not be exposed to direct sunlight. Use a shield if necessary.
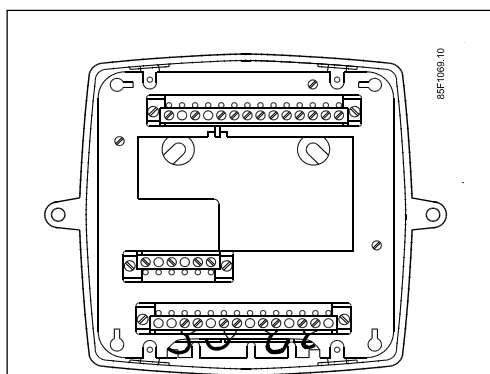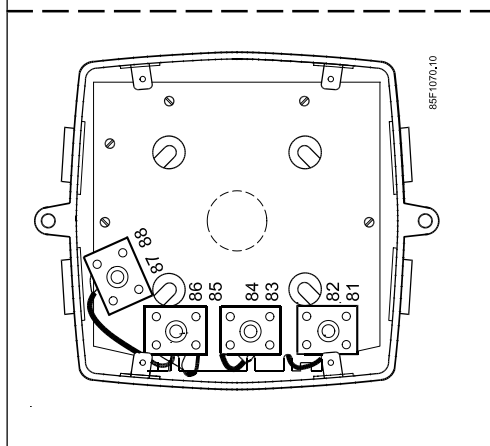

Terminal box
1. Remove and keep terminal box lid.
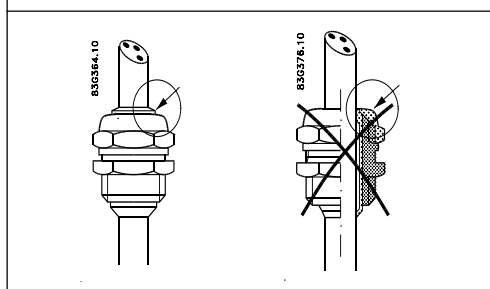2. Turning the terminal box.
   Lift and move the plate with terminal blocks to one side to give access to the screws. Remove the two diametrically opposed screws and loosen the remaining two. Turn the terminal box to the required position and retighten the screws.
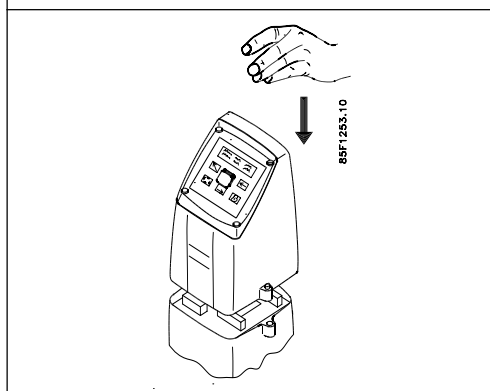
   Warning:
   If all four screws are removed at the same time there is a risk of damaging the leads to the sensor.

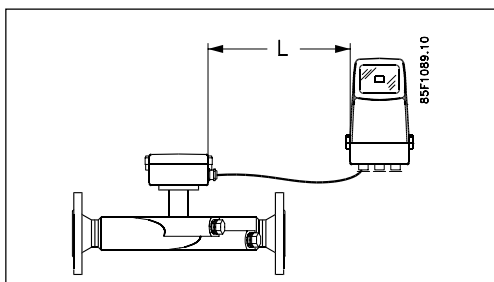3. Connect cables as shown under "Electrical connection".

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

5. Plug the signal converter into the terminal box.

Signal conv. inst.

Signal conv. inst.

### 5.3 Remote installation of the signal converter

With **remote** installation, the distance between sensor and signal converter must not exceed 20 m when using multi-coaxial cable. Is a longer distance required use of coaxial cable is recommended.

5.4 Wall bracket for use with multicoaxial cable

Terminal box   *Terminal box*   *Wall bracket*
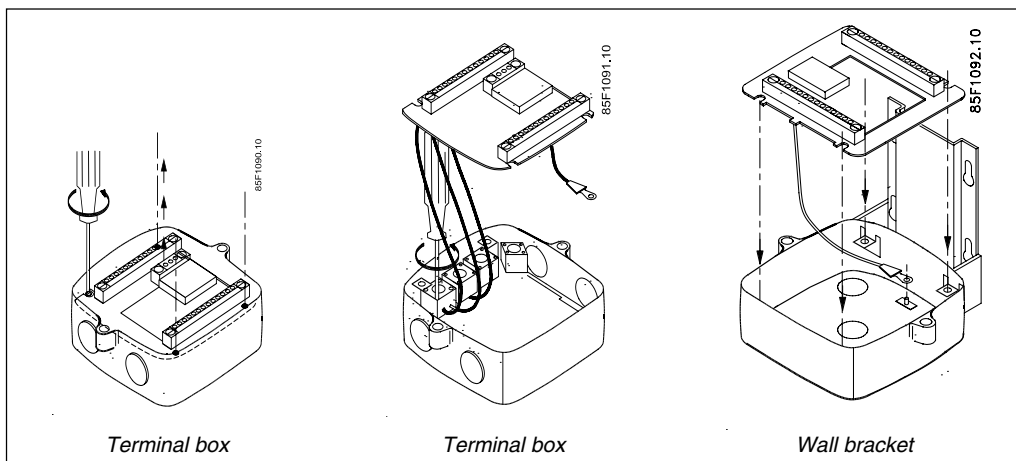
1. Release the earth lead from the bottom of the terminal box.
   Remove and keep all the leads connecting the terminal box to the plate carrying the terminal boards.
   Move the plate to the wall bracket and fit the earth lead in the base of the wall bracket.

There are two types of wall brackets. One for a twisted cable pair and one for 4 coaxial cables.

Terminal box   *Wall bracket*
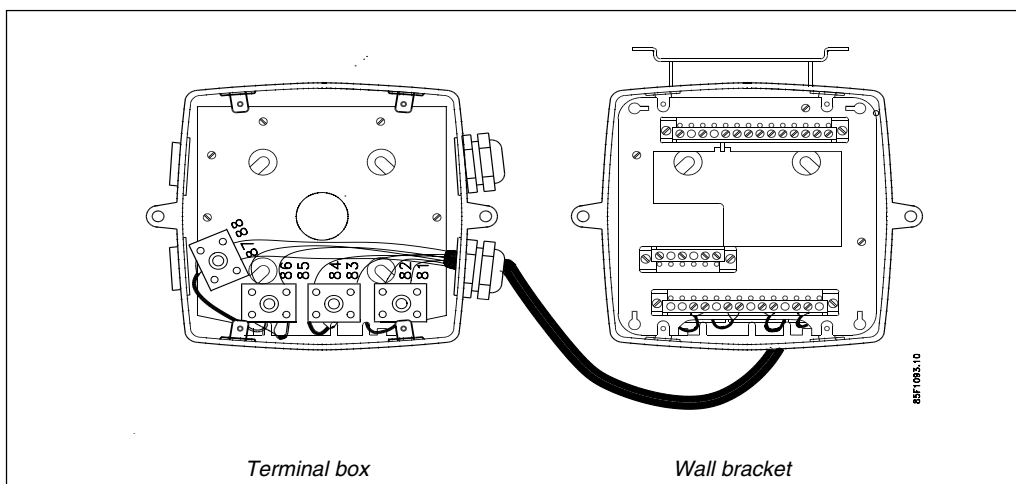
SONO 3300/3000 remote IP 67

2. **Wall bracket for mounting of multi coax cable:** Always use the cable entry nearest the associated terminal so that unscreened lead ends from one cable do not cross those from the other cable.

5.5 Wall bracket for use with 4 single-core coaxial cables
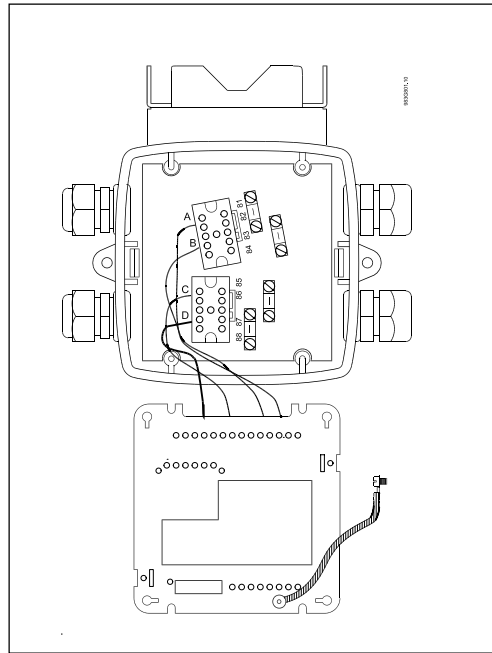

3. Connect track 1 to transducers C and D and track 2 to transducers A and B. See "Electrical connections" for more details.

Signal conv. inst.

5.6   19" insert

The 19" insert is designed for installation in a 19" rack. The insert has a width of 28 TE (142 mm), a height of 3 U (128 mm) and a module depth of 160 mm.

The insert can be installed directly in a 19" rack or on a wall in the IP 65 version. An optional mounting kit for *front of panel* mounting and *back of panel* mounting is available. The various types of installation are shown on the following pages.

5.6.1 Installation in 19" rack
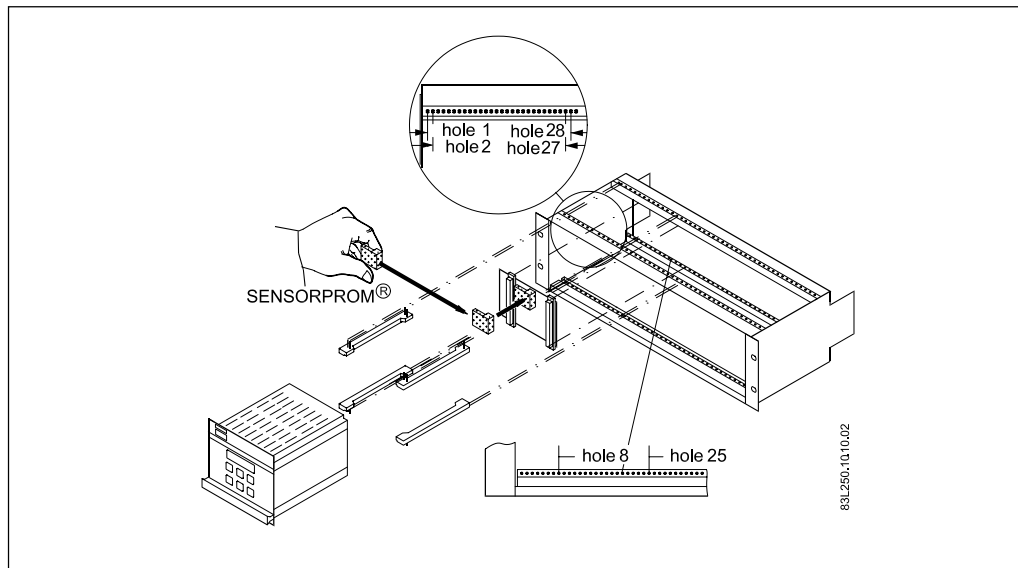
1. Fit the SENSORPROM® unit on the "mother board" (The SENSORPROM® unit is located in the terminal box of the SONO 3300 sensor).

2. Mount the "mother board" and the guide rails in the rack system as shown.

3. Connect the cables as shown under "Electrical connection".

4. Plug the signal converter into the rack system.

5.6.2 Signal converter in IP 65 version
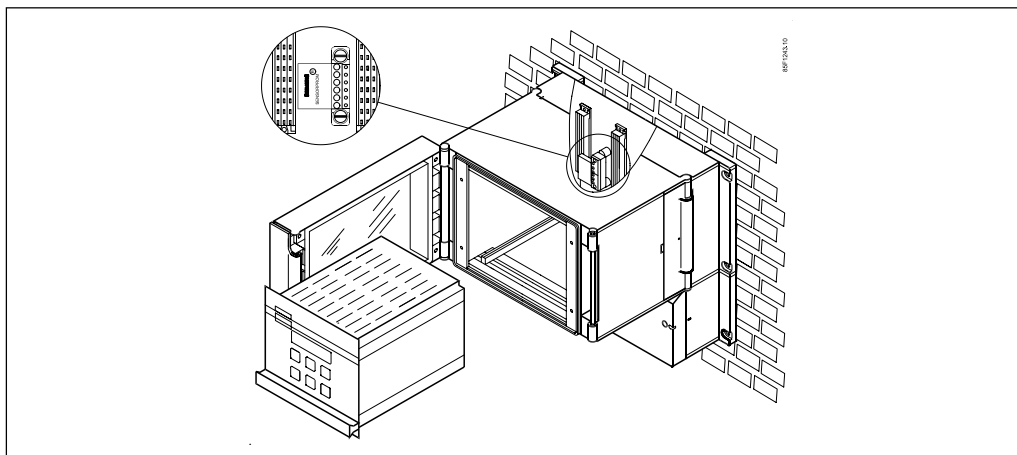
1. Mount the IP 65 housing to the wall with four screws.

2. Remove the signal converter from the IP 65 housing and mount the SENSORPROM® unit on the "mother board" located in the back of the housing.
(The SENSORPROM® unit is located in the terminal box of the sensor).

3. Connect the cables to the terminals accessible in the connection box located separately under the housing, see "Electrical connection".

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

5.6.3 Front of panel mounting
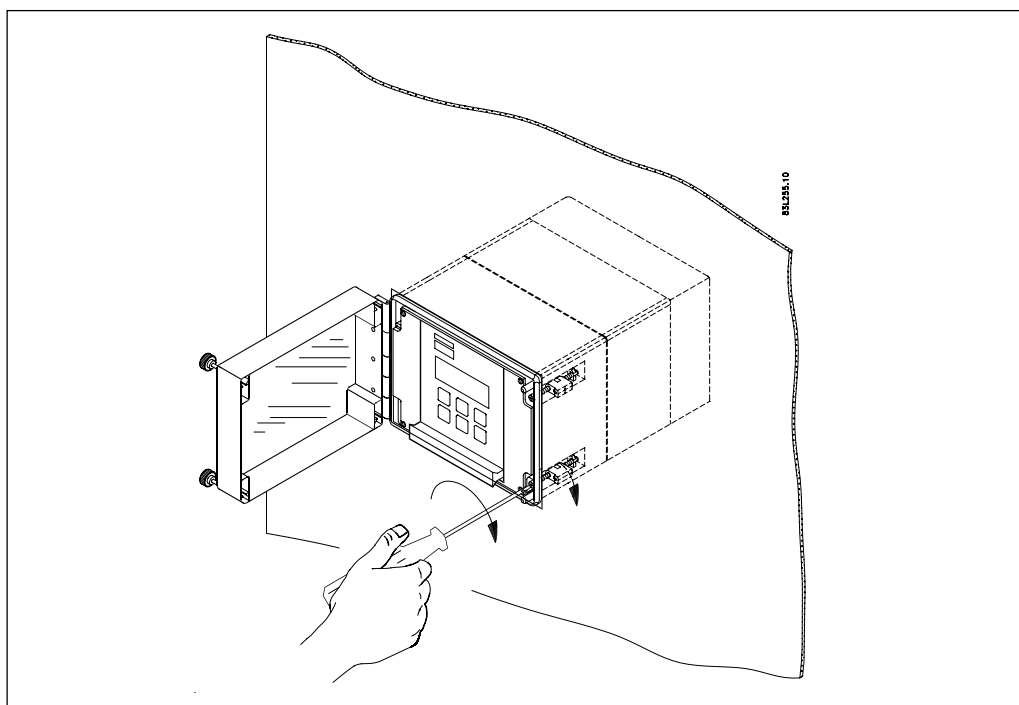
1. Mount the connection plate in the panel set using 4 screws.

2. Mount the panel set as shown in the figure.

3. Fit the SENSORPROM® unit on the connection plate of the signal converter.
   (The SENSORPROM® unit is located in the terminal box of the sensor).

4. Insert the signal converter into the frame and fasten with the four screws accessible from the front panel.

5. Connect the cables as shown under "Electrical connection".

**5.6.4 Back of panel mounting**
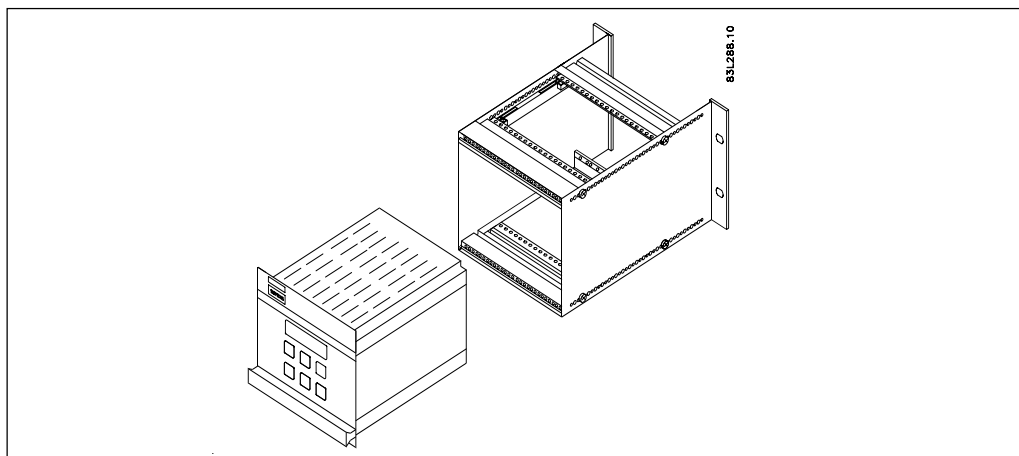
1. Mount the connection plate in the back of the panel with four screws.

2. Fit the SENSORPROM® unit on the connection plate.
   (The SENSORPROM® unit is located in the terminal box of the sensor).

3. Connect the cables as shown under "Electrical connection".

4. Mount the back of panel housing with four screws.

5. Insert the signal converter into the panel.

Signal conv. inst.

5.7 Signal converter SONO 3000 19" rack

Signal converter as insert for 19" rack module
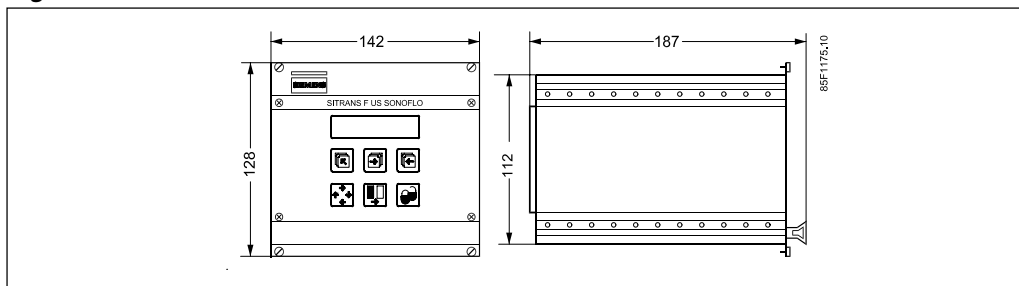
Weight: SONO 3000 approx. 2.8 kg

SONO 3000 19" rack module shown with IP 65 wall mounting enclosure
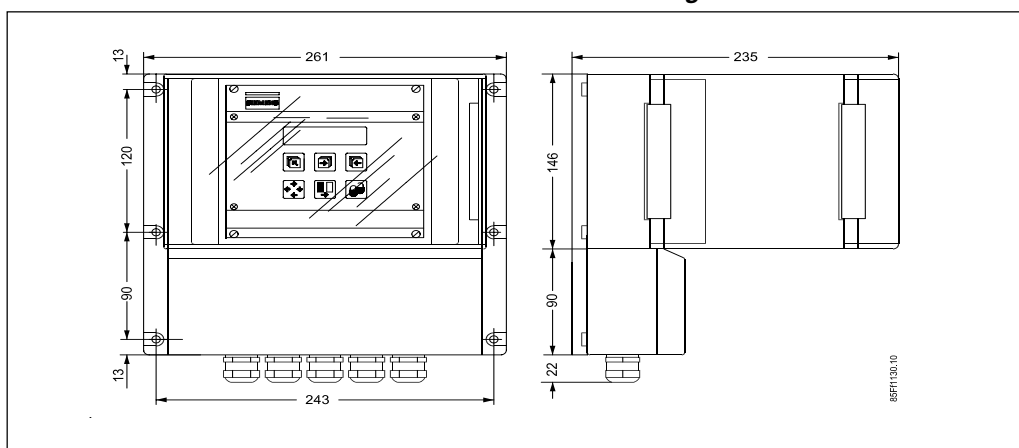
Weight: 19" rack module with IP 65 wall mounting enclosure approx. 3.5 kg

SONO 3000 IP 65 panel mounting kit for 19" rack module
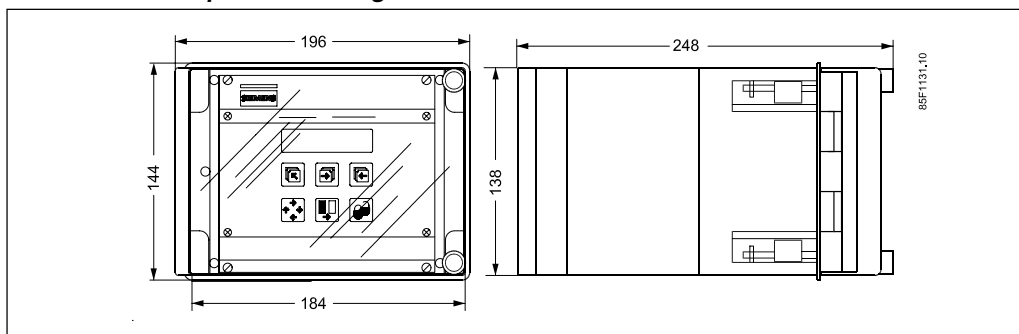
Weight: Panel mounting kit approx. 2 kg

SONO 3000 19" rack module with back of panel mounting kit
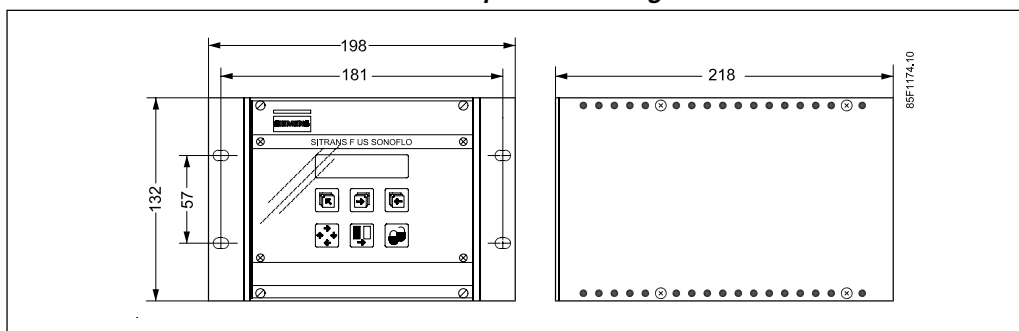
Weight: SONO 3000 19" rack module with back of panel mounting kit approx. 1 kg

5.8   Connection board 19" insert
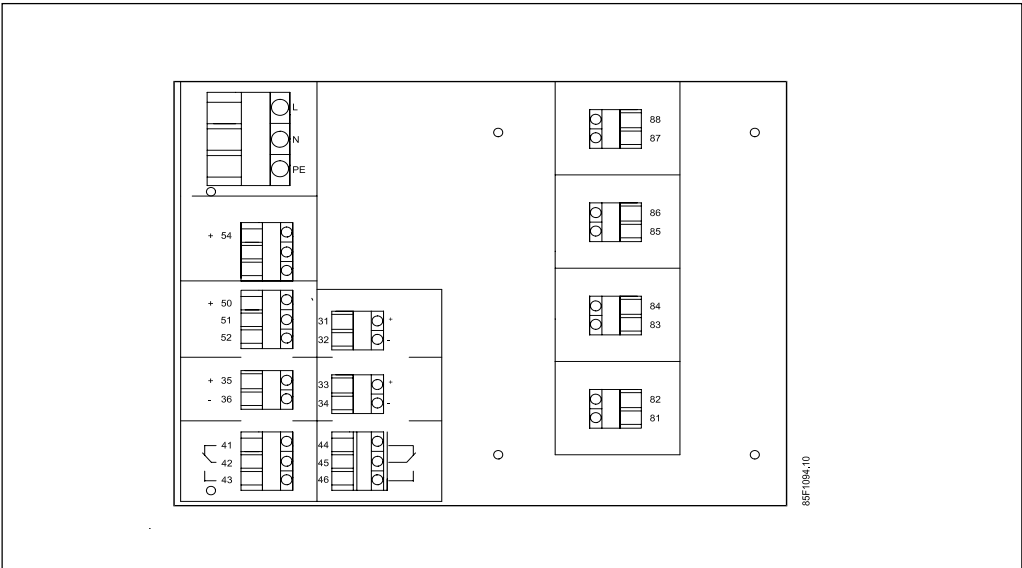
5.9   IP 65 wall mounting box connection
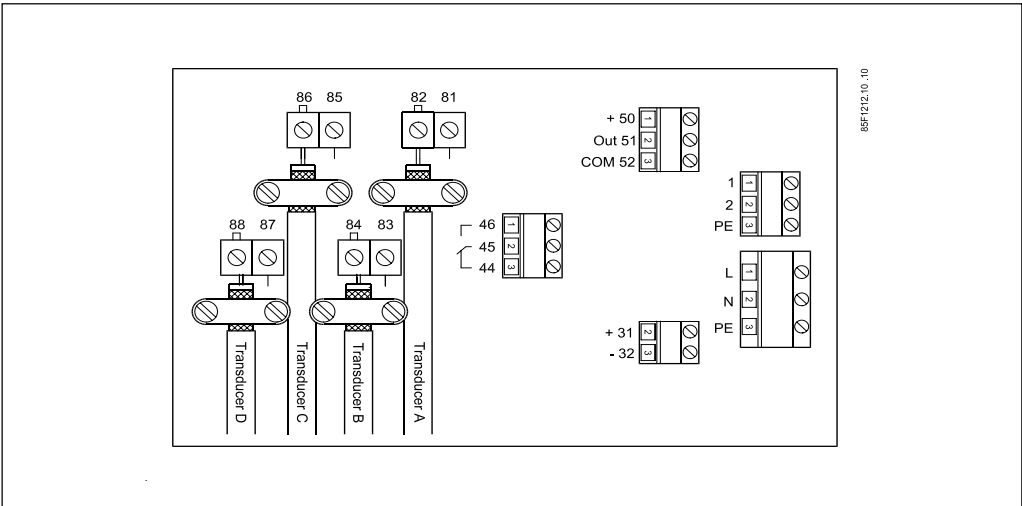
The number of connection opportunities depends on the version type.

5.10 Setting the voltage selector 19" insert
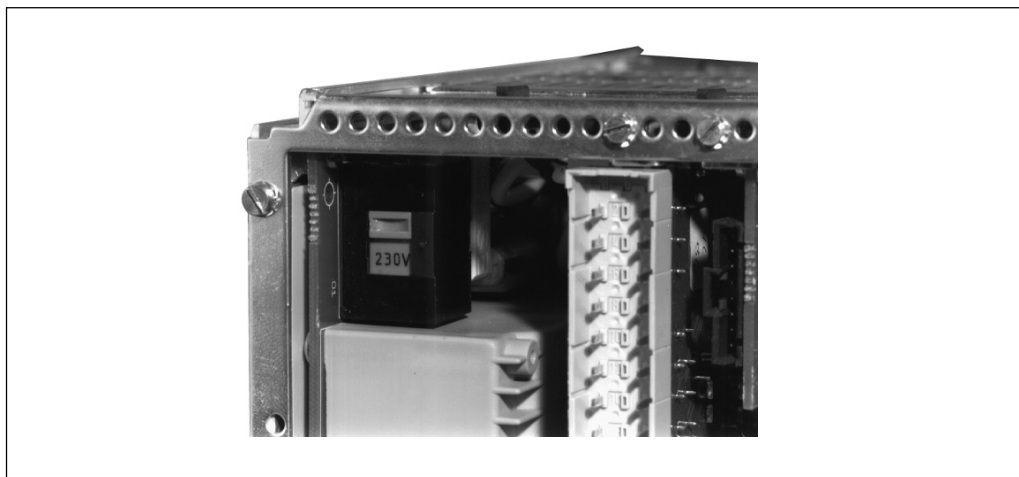
The voltage selector is located on the back of the signal converter. Settings of 115 V a.c. or 230 V a.c. can be chosen.

5.11 Location of SENSORPROM® flow memory unit

19" insert
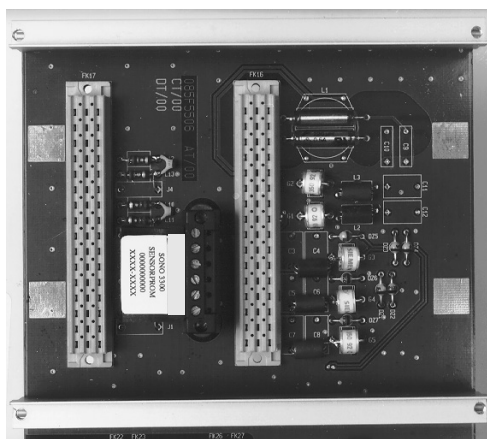
The SENSORPROM® unit is fitted to the cable connection board, see fig.
The SENSORPROM® unit is sensor specific and is being packed in the terminal box of the sensor or by sensor SONO 3100 fixed at the data plate.
To identify the SENSORPROM® unit a label indicates the sensor type and serial number. This number can also be found on the sensor data plate.
In addition, the identity can be read on the SONO 3000 under the menu "SENSOR CHARACTERIS-TICS". At start up it should always be checked that the identity in the menu matches the identity on the data plate placed at the sensor.

19" insert in
IP 65 box
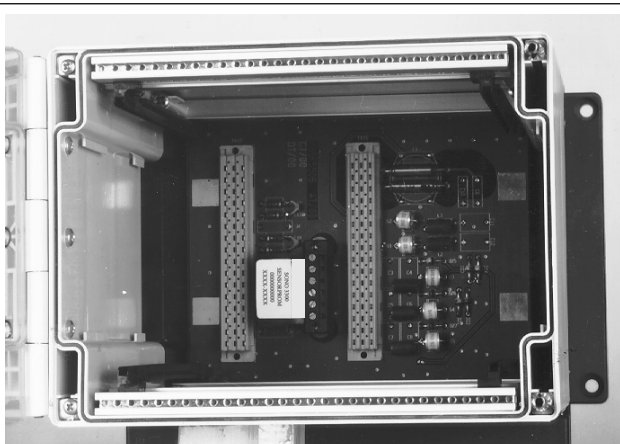
5.12 SONO 3000 Ex version		An Ex version of the SONO 3000 can be installed in areas of high explosion risk as a compact unit or mounted remotely where installation conditions demand, i.e. the sensor and signal converter can be installed separately at a distance of up to 15 m.

5.12.1 Introduction

Compact installation   Separate installation
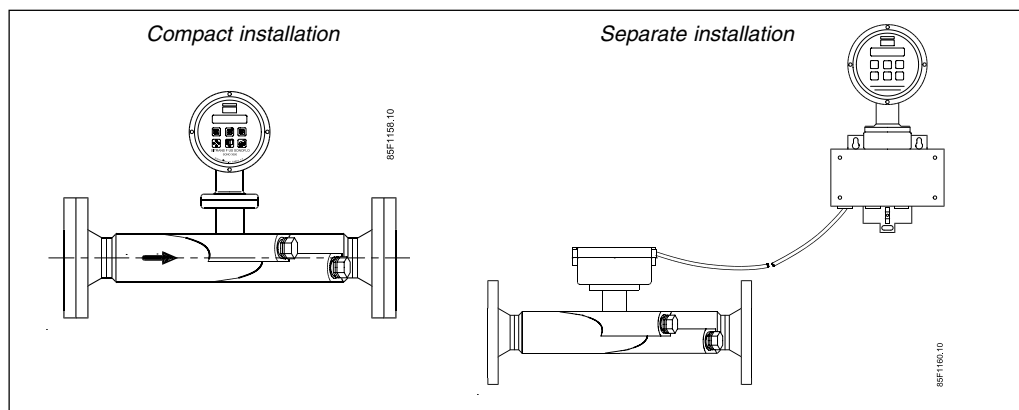
5.12.2 Description of system

The system holds the following Ex approval: **EEx de [ia/ib] IIC T6**. The signal converter is mounted in the cylindrical enclosure which is protected to category "d" (flame proof).
All electrical connections are made in the terminal housing in the front of the sensor. The terminal housing is classified "e" (increased safety).
The connection terminals for the 24 V a.c./d.c. voltage supply meet the demands of increased safety category "e".
The connection terminals for current, frequency/impulse output and fault relay are intrinsically safe to the "ia" category.
The display and keypad are intrinsically safe to the "ib" category for use during operation.

5.12.3 Installation of compact version

As shown, the compact version is attached to the sensor. In a horizontal plane the signal converter can be turned through 0-360° by loosening the four allen screws mounted in the base.
It is also possible to rotate the display/keypad in a vertical plane in steps of 90° by dismantling the four allen screws mounted on the outer edge of the front cover so that the display/keypad can be positioned as required. If the signal converter is turned more than 360° the cables will be damaged.

Horizontal positioning   Vertical positioning
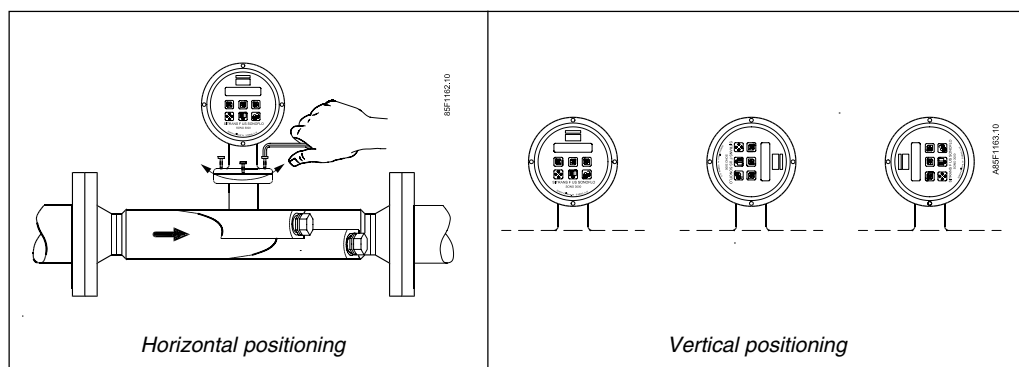
5.12.4 Electrical connection of compact version

Electrical connections are made through the front of the signal converter, in the terminal housing. This housing is accessed by dismantling the four allen keys located on the outer edge of the front cover, as shown in the figure.
The cover is retained via a wire, giving free access to the cable terminals.
The terminal housing is equipped with 1 PG 13.5 EEx e gland and 1 PG 13.5 EEx i gland. The mains cable is fed through the black PS gland (black indicates increased safety "e") located in the left-hand side as viewed from the front.
The outputs are fed through the blue PG gland (the colour blue indicates intrinsically-safe circuit "i") located on the right-hand side. According to the Ex document issued, use of other unions is permitted provided that these are as a minimum EEx-approved in category "e".
Electrical connection is made according to the connection diagram.

5.12.5 Electrical connection for "flameproof housing" compact version
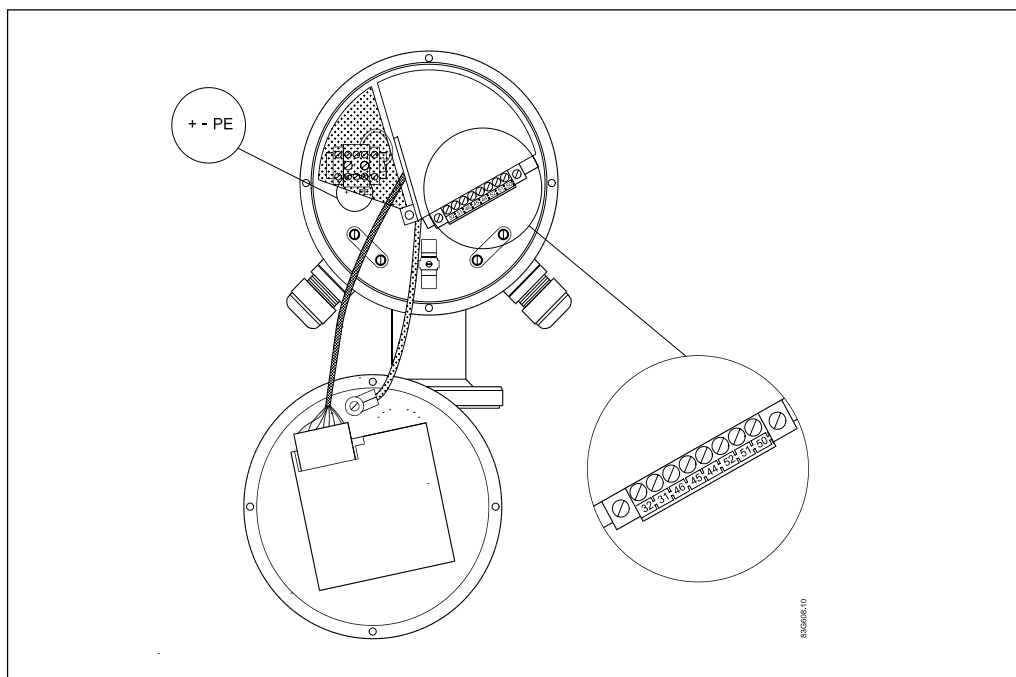
5.12.6 Electrical connection diagram compact version
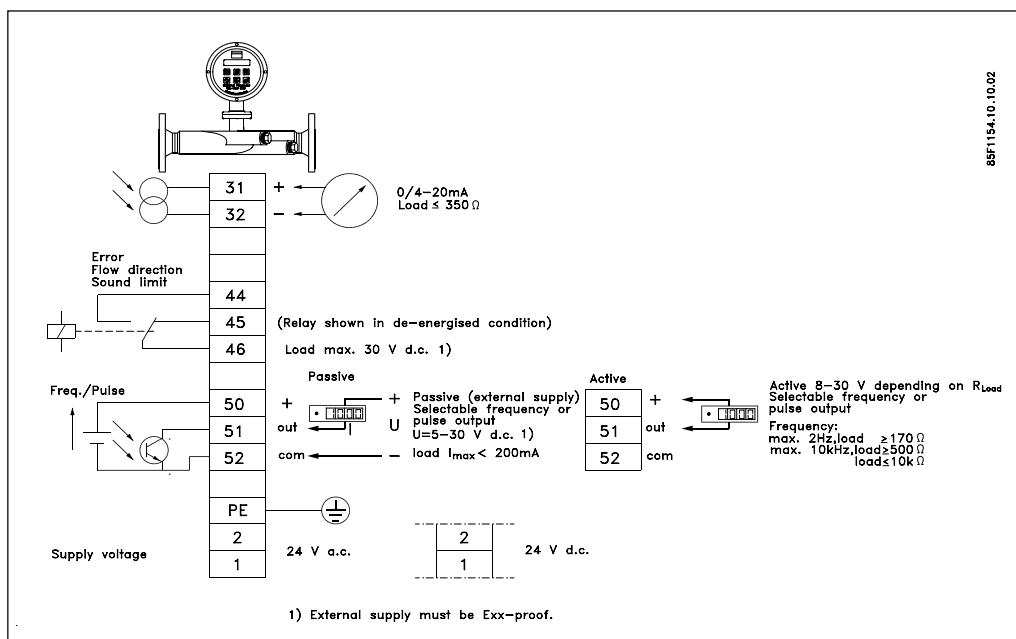
| | 31 | + | 0/4−20mA |
| | 32 | − | Load ≤ 350 Ω |

Error
Flow direction
Sound limit

	44	
	45	(Relay shown in de−energised condition)
	46	Load max. 30 V d.c. 1)

Passive

Active

Freq./Pulse

	50	+	+	Passive (external supply)		50	+	Active 8−30 V depending on R_{Load}
	51	out	U	Selectable frequency or pulse output $U=5-30$ V d.c. 1)		51	out	Selectable frequency or pulse output
	52	com		load $I_{max} < 200$mA		52	com	Frequency: max. 2Hz,load ≥170 Ω max. 10kHz,load≥500 Ω load≤10kΩ

| | PE | ⏚ |
| | 2 | 24 V a.c. | | 2 | | 24 V d.c. |
Supply voltage | 1 | | | 1 | |

1) External supply must be Exx−proof.

⚠️ **Supply voltage 230 V a.c.**
115 to 230 V a.c. is connected to terminals 1 and 2. The ground wire must be connected to the ground terminal on the terminal plate.

If the ground wire is not connected, personnel can be exposed to 115 V / 230 V.

5.12.7 Remote installation of signal converter

The remote version is installed as shown in the figure. The electronics and the display/keypad unit can be positioned in the same way as those for the compact version.

5.12.8 Electrical connection of separate version

Electrical connections are made in the terminal housing located on the wall fitting. **No connections are made in the front of the signal converter**.

The terminal housing is divided so that all terminals in the "e" increased safety category are located on the left-hand side. This comprises voltage supply and sensor connections. All the output terminals located on the right hand side are intrinsically safe in category "ia".
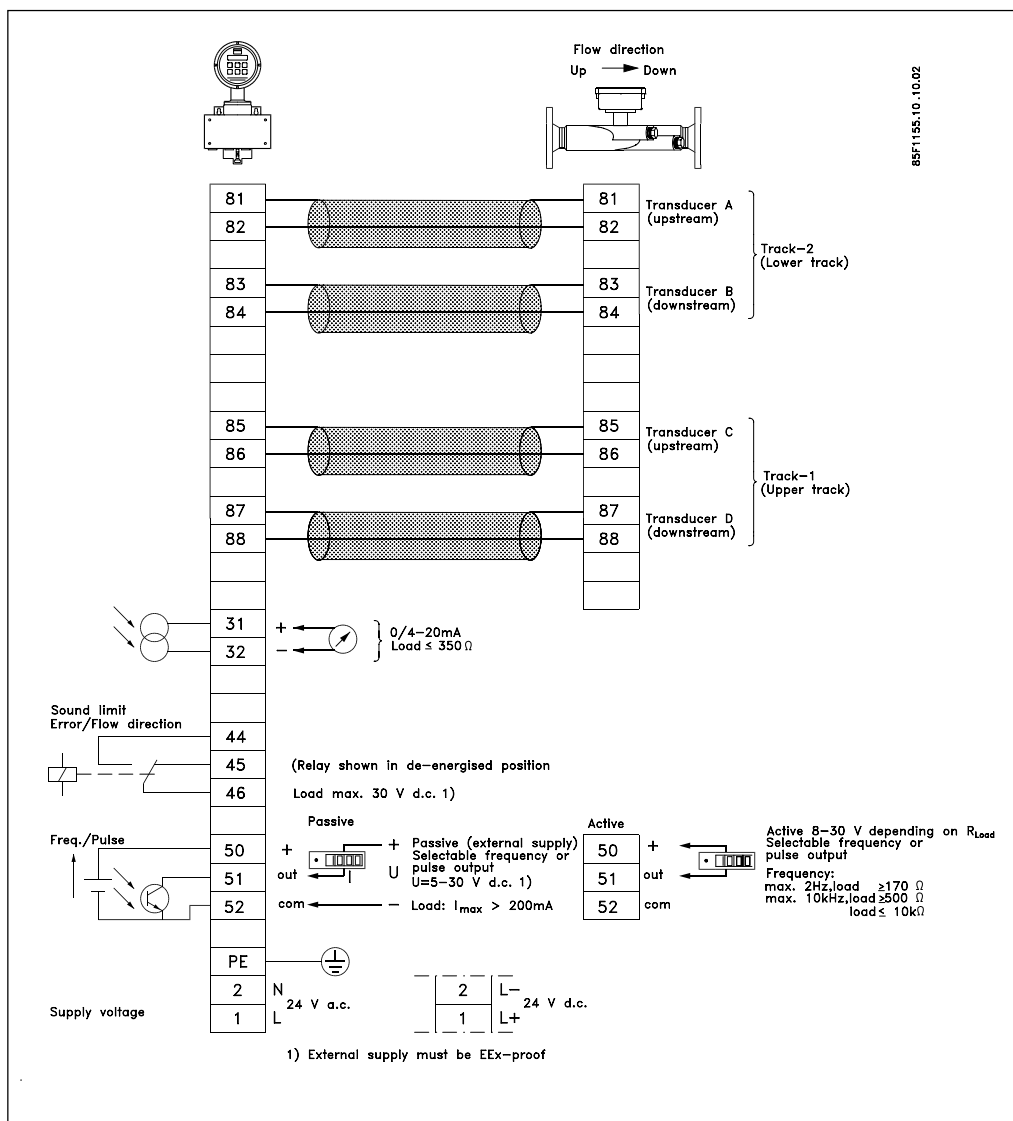
The cap over the power supply terminals must be removed before cable installation
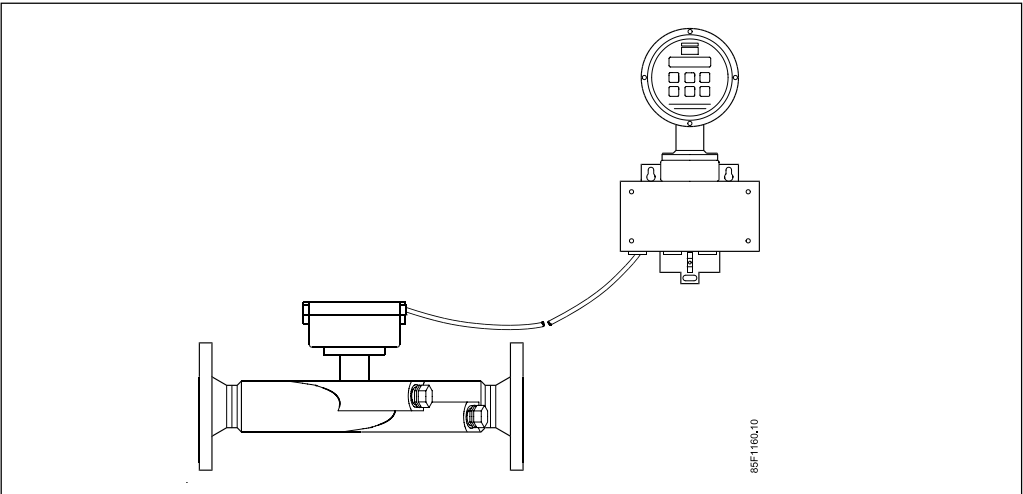
5.12.9 Electrical connection diagram

Supply voltage 230 V a.c.
115 to 230 V a.c. is connected to terminals 1 and 2. The ground wire must be connected to the ground terminal on the terminal plate.

If the ground wire is not connected, personnel can be exposed to 115 V / 230 V.
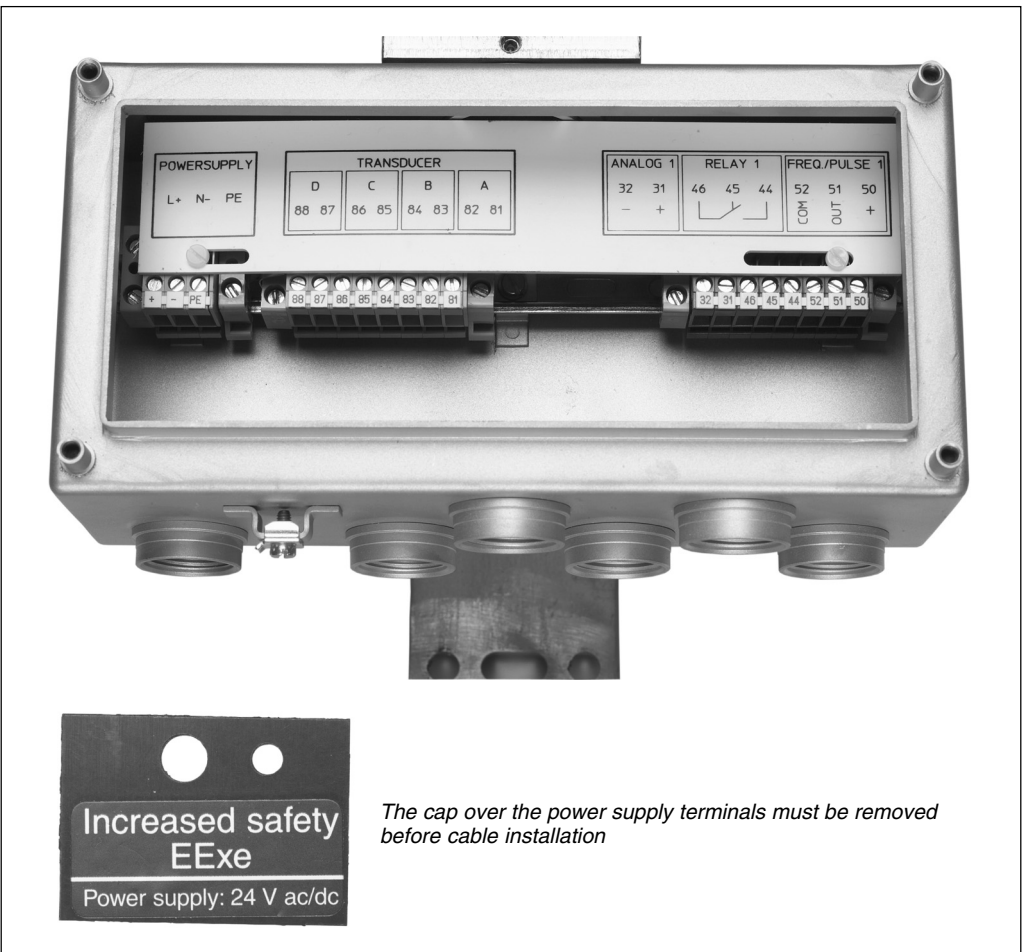
5.12.10 Operation

Operation is identical for both versions, the same menu structure being used for all SITRANS F US SONOFLO® variants. To protect the keypad and display the front is protected with a glass cover which can be screwed off by hand, i.e. without using any special tools.
Since display and keypad are intrinsically safe, the cover does not have to be installed during operation.

5.12.11 Replacement of electronics

If the electronics are to be replaced they are accessed by dismantling the cover located in the back of the enclosure. **The cover must only be opened when the mains supply is disconnected**. The cover is removed by placing e.g. a screwdriver with a diameter of approximately 6 mm in one of the two holes located in the edge of the cover. The cover is removed by turning anti-clockwise. Thereafter the two screws holding the electronic insert are loosened and the entire unit is removed using the curved handle.
Insert the new electronic unit and the enclosure can now be reassembled in the reverse order.
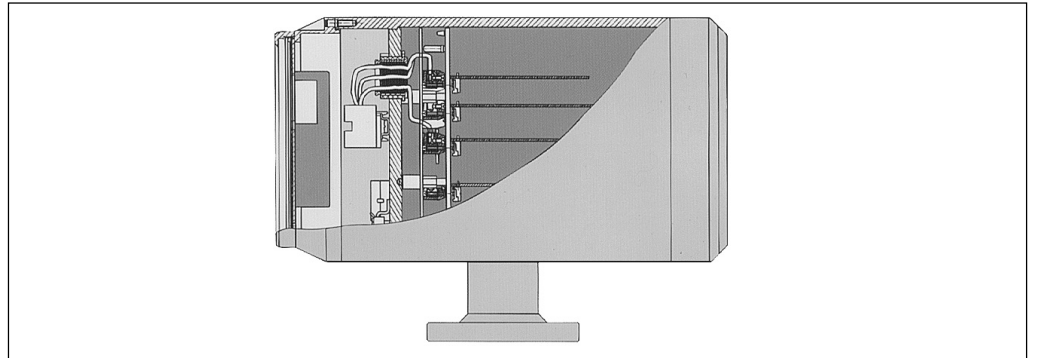
5.12.12 Location of SENSORPROM® flow memory unit

The SENSORPROM® unit is placed in the bottom of the electronics housing and is only accessible when the electronic insert has been removed, i.e. on replacing the SENSORPROM® unit the electronics insert must be removed. After removal of the electronic the two screws retaining the SENSORPROM® unit are loosened, and the new SENSORPROM® unit fitted.

The SENSORPROM® unit is delivered with the sensor in an antistatic bag.

Disconnect the voltage supply. Remove the electronic unit.

1. Loosen the back plate by means of a screwdriver in one of the two holes.
2. Remove the two screws holding the electronic unit.
3. Remove the electronic unit by pulling the handle.
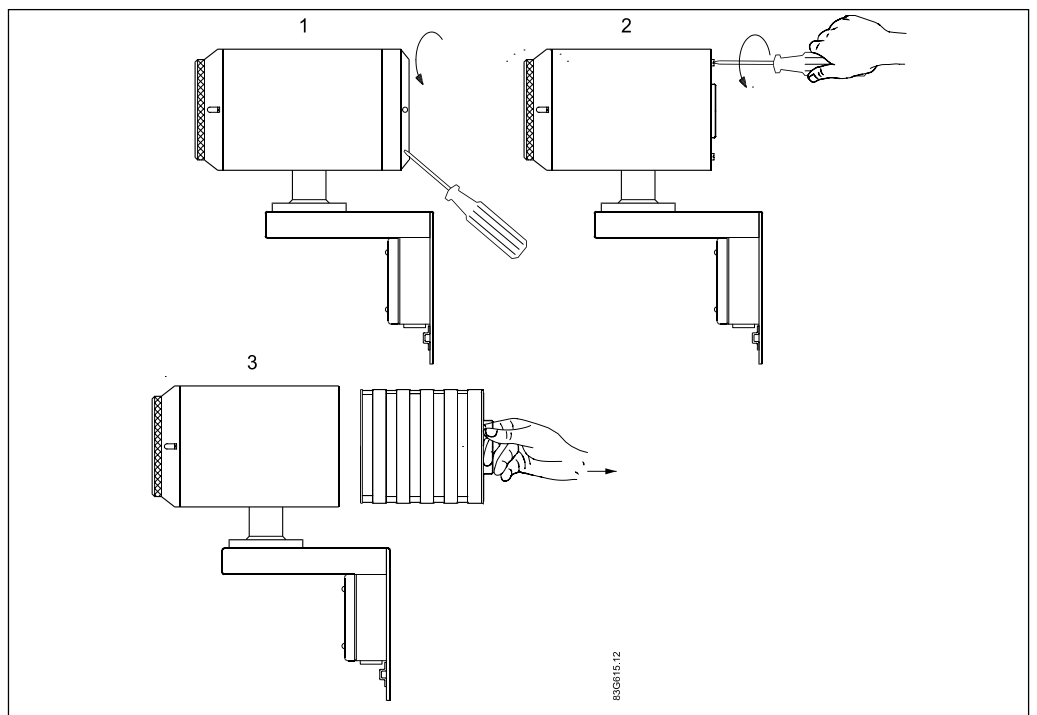
5.12.13 Location of the SENSORPROM® flow memory unit, remote mounting
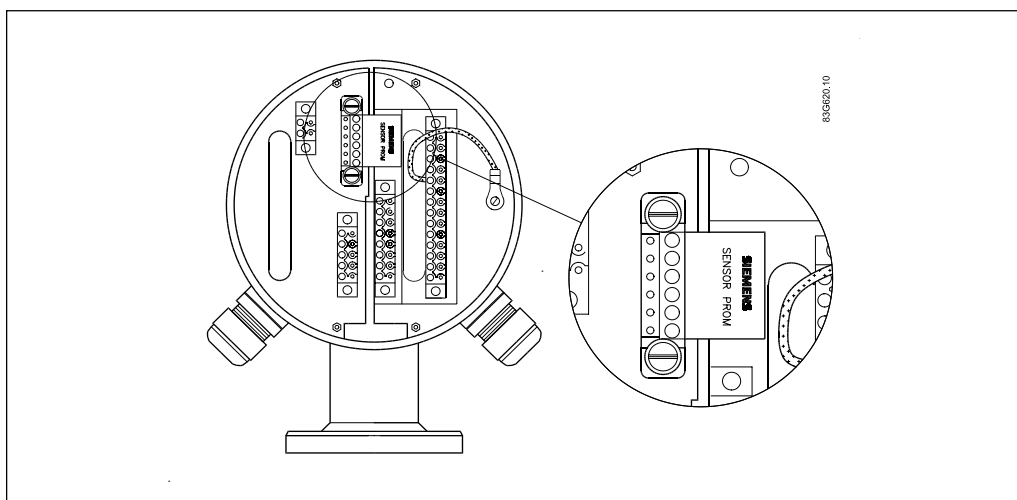
Location of the SENSORPROM® unit.

4. Take the SENSORPROM® unit out of the antistatic bag.
5. Place the SENSORPROM® unit at the bottom of the housing.
6. Replace the electronic unit and make sure that the two screws are tightened firmly.
7. Replace the backplate and make sure that the plate is fixed with a torque of at least 5 Nm.

5.12.14 Signal converter SONO 3000 Ex-d

Ex-d in separate version
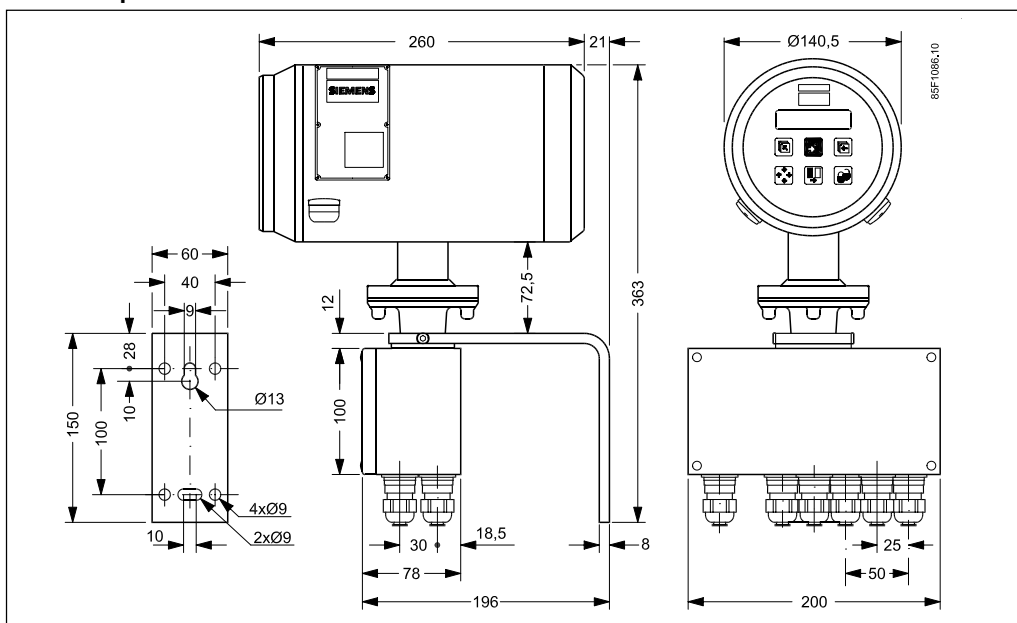
Weight: Ex-d in separate version approx. 11 kg

6.   Electrical connections

6.1   SONO 3000 IP 67 compact mounted
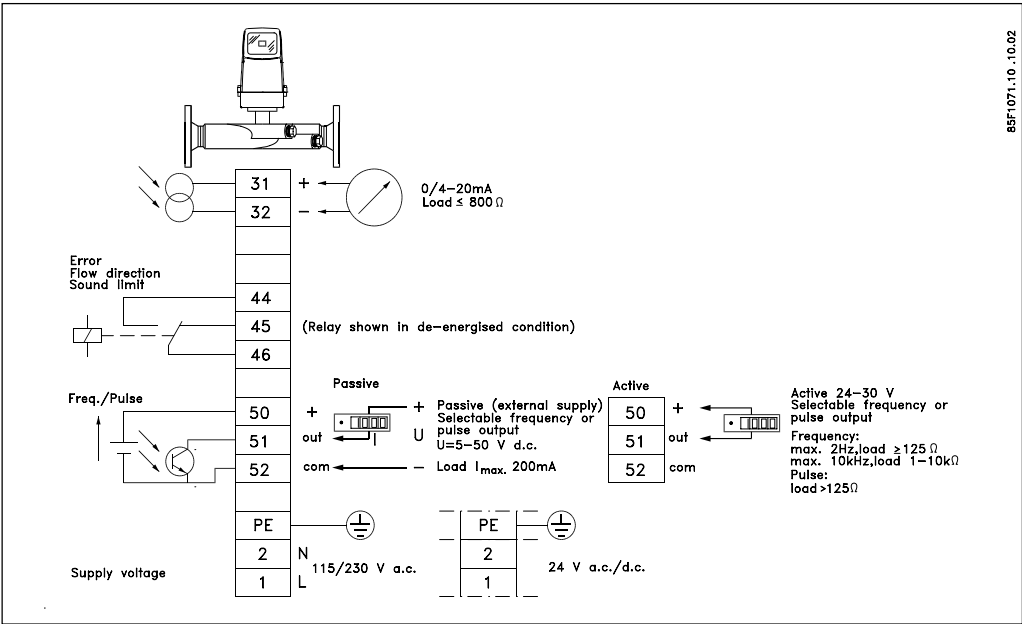
6.2   SONO 3000 IP 67 remote mounted

Connect coax cable to 81, 83, 85 and 87.

Elec. conn.
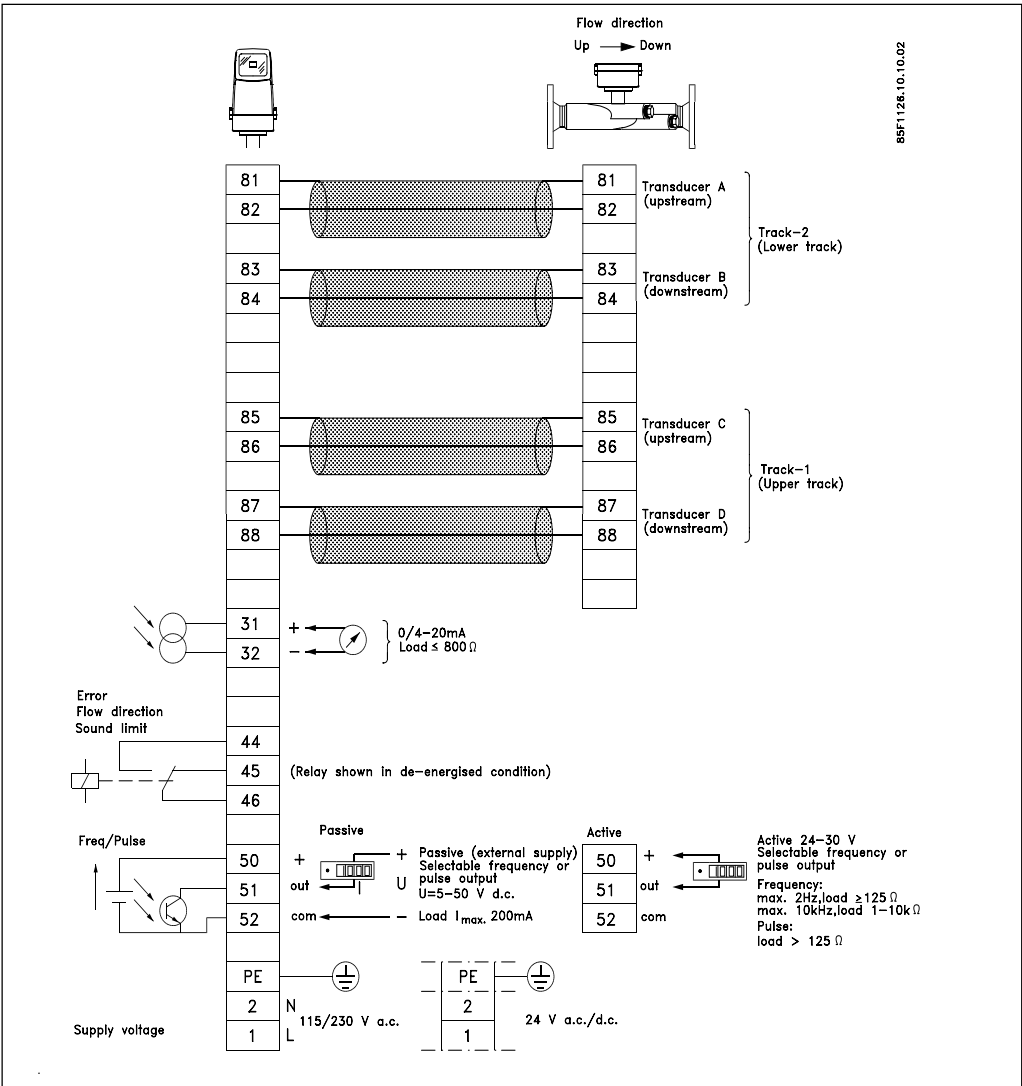
6.3 19" insert with: 3 current outputs, 2 frequency/pulse outputs
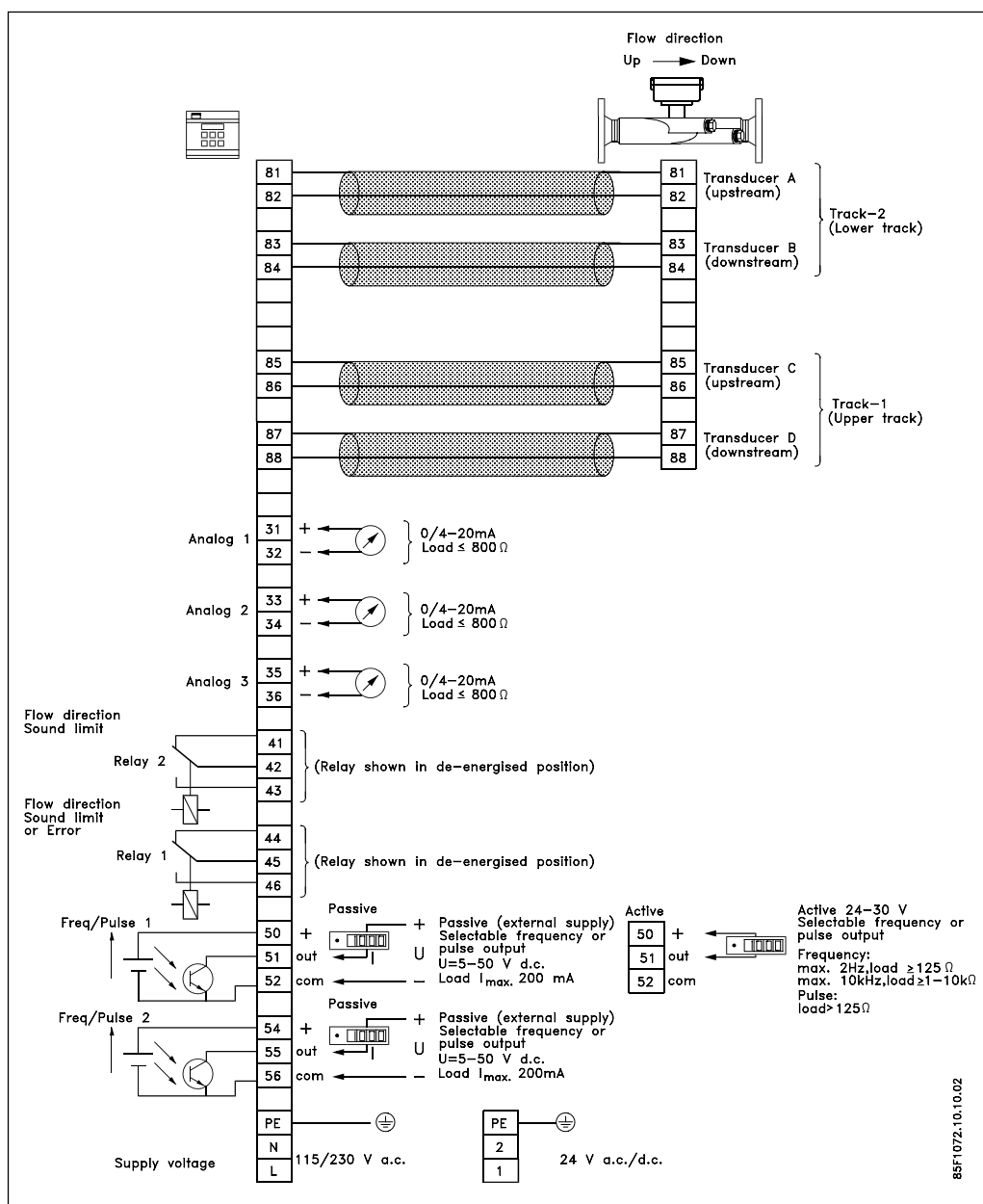
Connect coax cable to 81, 83, 85 and 87.

⚠️ **Supply voltage 230 V a.c.**
115 to 230 V a.c. is connected to terminals 1 and 2. The ground wire must be connected to the ground terminal on the terminal plate.

If the ground wire is not connected, personnel can be exposed to 115 V / 230 V.

6.4 Frequency output with a load > 10kΩ
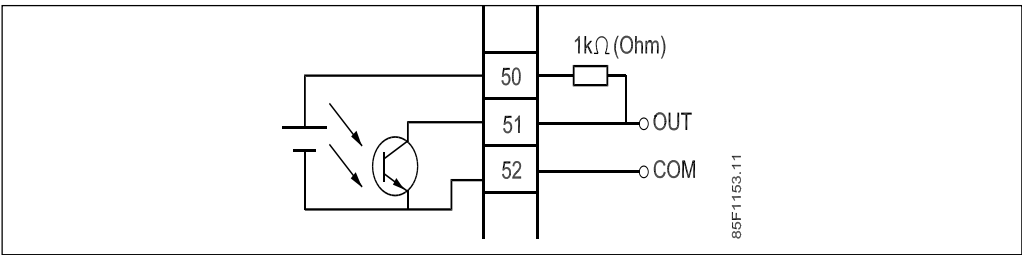
If the load exceeds > 10kΩ it is recommended to connect a resistor to the frequency output as shown on the figure above.

6.5 Relay mode signal converter in compact mode
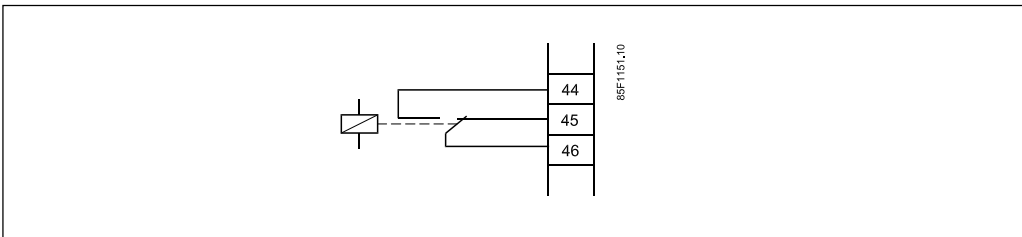
Relay shown in de-energized position.

Relay 1 Connection between Terminal No.	OFF (De-energized) 45-46	ON (Energized) 44-46
Error	"Error"	"Normal"
Direction	"Forward"	"Reverse"
Sound limit	Inside range	Outside range

6.6 Relay mode signal converter 19" insert

Relays shown in de-energized position.

Relay 1 Connection between Terminal No.	OFF (De-energized) 44-45	ON (Energized) 45-46
Error	"Error"	"Normal"
Direction	"Forward"	"Reverse"
Sound limit	Inside range	Outside range

Relay 2 Connection between Terminal No.	OFF (De-energized) 41-42	ON (Energized) 42-43
Direction	"Forward"	"Reverse"
Sound limit	Inside range	Outside range

Elec. conn.

7.   Starting up

7.1 Keypad and display layout
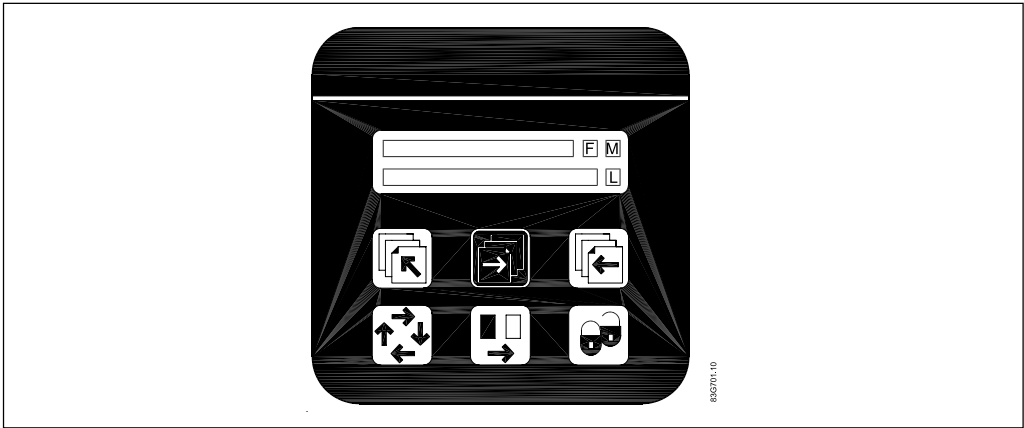
Keypad

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

TOP UP		This key always returns the display to the OPERATOR MENU showing flow.
PAGE FORWARD		This key is used to step forward through the menues.
PAGE BACKWARD		This key is used to step backward through the menues.
CHANGE		This key changes the settings or numerical values.
SELECT		This key selects the figures to be changed.
LOCK/UNLOCK		This key allows the operator to change settings and gives access to submenues.

Settings are stored automatically in the signal converter or the SENSORPROM® flow memory unit. The values remain stored in the event of power failure and when a signal converter is replaced.

Operation of any key illuminates the display. The light is automatically turned off 10 minutes after last key operation.

Display

The display is alphanumerical and indicates flow values and flowmeter settings.
The three fields F, M and L are reserved for the following symbols - see keypad layout:

F: If a fault develops, two flashing triangles appear ◣ .

M: Symbols indicate the following:

⊠	RESET MENU
✕	SERVICE MODE
⊞	LANGUAGE SETUP
⊡	OPERATOR MENU SETUP
┼	CONVERTER SETUP

L: Indicates the function of the lock key by the following symbols:

🔓	Ready for change	⤓	Access to submenu
🔒	Value locked	⚲	RESET MODE: Zero setting of totalizers and initialization of own setting

|	
7.2 Menu build-up	The menu structure of the SONO 3000 signal converter is shown in an overview map and in detail by the build-up of each submenu.
	The menu is built up in two parts. An OPERATOR MENU and a SETUP MENU. Access to the SETUP MENU is, by pressing the TOP-UP key 🔲 for 2 seconds. The SETUP MENU will operate in two modes: VIEW and CHANGE mode. VIEW is a read only mode and CHANGE is both a read and write mode. The preselected flowmeter settings can only be scanned via VIEW MODE. The access to CHANGE MODE is protected with a USER CODE. The user code is factory-set at 1000.
Operator menu	The signal converter always starts in the basic OPERATOR MENU showing flow rate. The PAGE FORWARD and PAGE BACKWARD key ▪ 🔲 is used to step through the OPERATOR MENU.
Setup menu	The SETUP MENU contains the following menues:

- Converter set-up mode
- Reset mode
- Service mode
- Language set-up
- Operator menu set-up
- User code set-up

The PAGE FORWARD ▪ key is used to step through the main menu. Pressing the LOCK key 🔲 opens the submenu below. There is no access from the submenu back to the main menu. To leave the submenu press the TOP-UP key 🔲 , which returns the program to the OPERATOR MENU. To perform further changes in other main menus, press the TOP-UP key 🔲 for 2 seconds, then press the PAGE FORWARD key ▪ to select the CHANGE mode. Enter the USER CODE, press the LOCK key 🔲 and page through the main menu using by the PAGE FORWARD key ▪ until the required menu is reached. Access the submenu by pressing the LOCK key 🔲 .

Converter setup mode	CONVERTER SETUP MODE contains 3 submenus:

- BASIC SETTINGS
- OUTPUT SETUP
- SENSOR CHARACTERISTICS

Basic settings	In BASIC SETTINGS selection of flow direction, measuring range, measuring units, totalizer units and low flow cut-off can be made. Further, overriding of the outputs in an error situation can be established.
Output setup	In OUTPUT SETUP the required output signals can be entered.
Sensor characteristics	SENSOR CHARACTERISTICS gives sensor information. This information is uploaded automatically from the SENSORPROM® unit.
	With remote installation, e.g. when the signal converter is connected to the sensor by means of a signal cable, it is necessary to enter the length of this cable into the meter. The cable length is entered in the SENSOR CHARACTERISTICS menu under APPLICATION PARAMETERS.
Reset mode	In RESET MODE the totalizers can be reset, the flowmeter zero point adjusted and the factory setting re-established.
	NOTE! USER CODE, CORRECTION FACTOR, LANGUAGE and AUTO ZERO do not return to the factory setting via RESET MODE.
Service mode	SERVICE MODE provides the facility to set the outputs to fixed values (forced outputs). On leaving SERVICE MODE, all settings, made in SERVICE MODE, are cancelled.
Language setup	The menu language can be selected.
Operator menu setup	The information accessible to the operator can be selected in this menu.

Starting up

7.3 Menu overview

Starting up

8SF1073.10.10.02
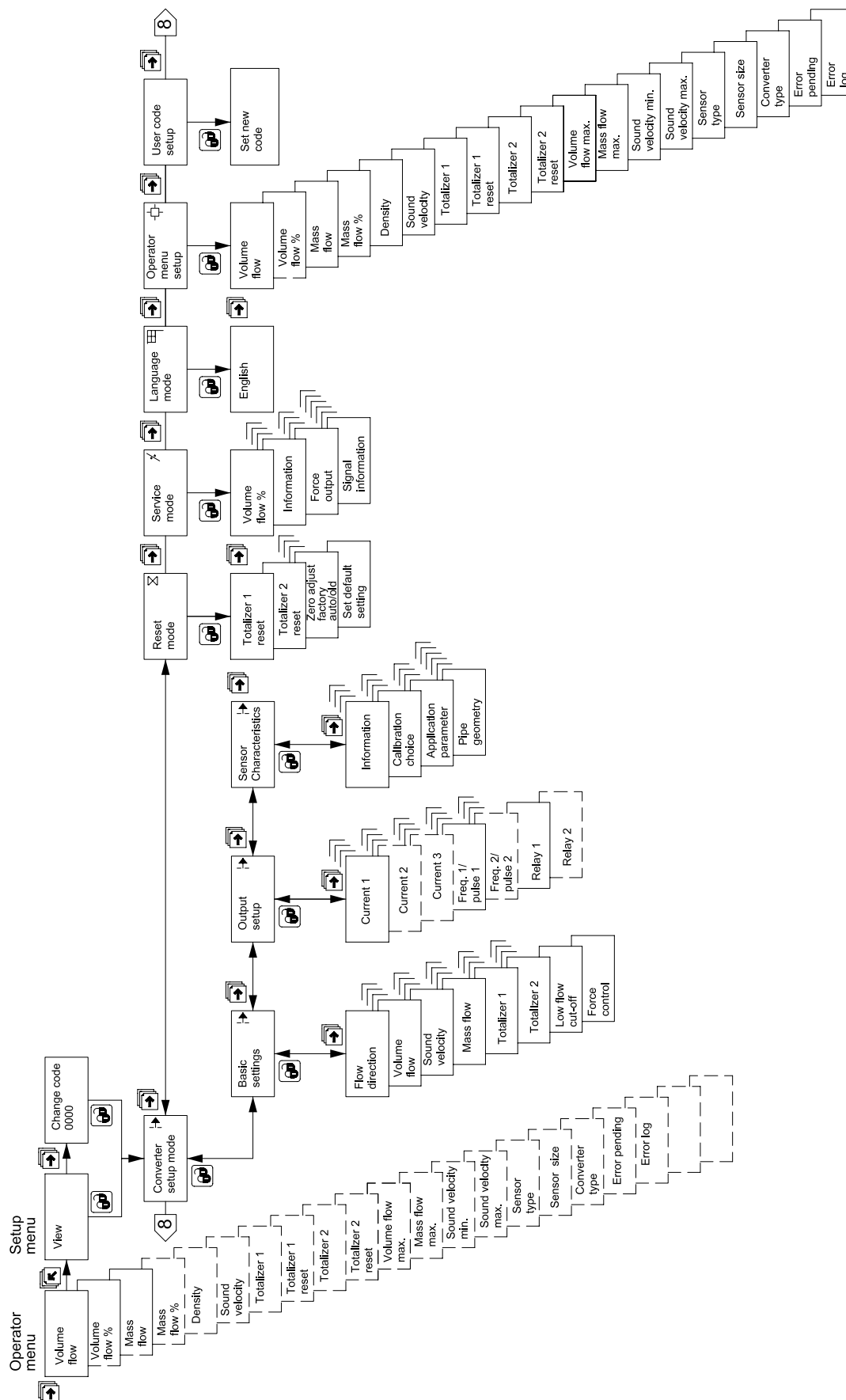
User code setup

The user code can be changed in this menu.

The code is factory-set at 1000. If the user code is lost, the factory setting can be re-established as follows: Switch off supply voltage, press the TOP-UP key [⬚] and switch on the supply voltage. Release the key after ROM and RAM tests are completed. The user code is now reset to 1000.

If the signal converter is left in CONVERTER SETUP for more than 10 minutes, the converter automatically reverts to OPERATOR MENU.

7.4   Sub menus

The figure on previous page gives a view of the menu build up. Below is a more detailed description of the submenus. Use menu block diagram to step through to required sub-menu. (See also detailed diagram blocks).

Information regarding the service menu is placed in the section "Trouble shooting".

Flow direction

The flow direction is defined for volume and mass flow simultaneously.

Volume flow
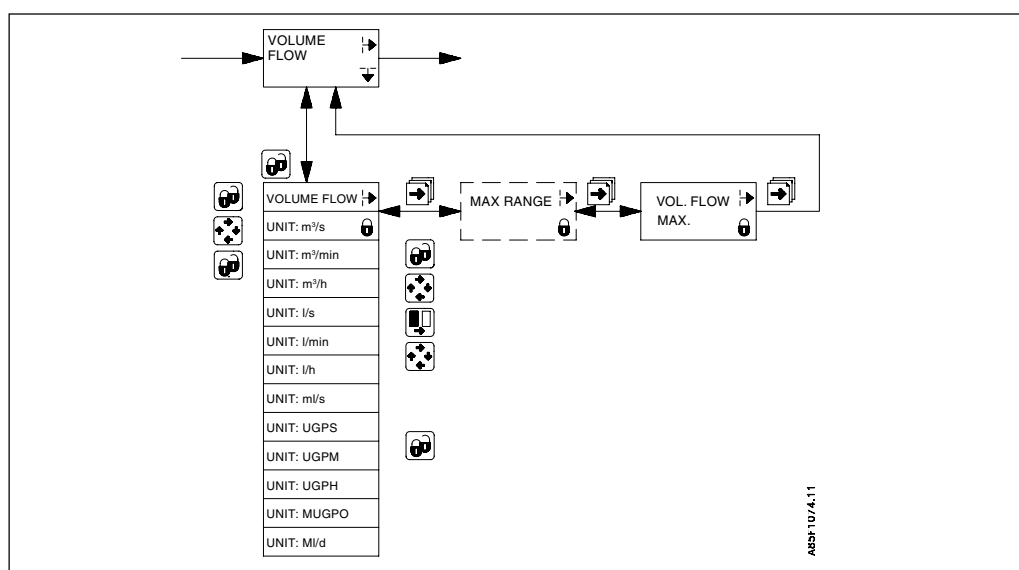
Choose engineering unit and the maximum volume flow range.
For SONO 3000 not fitted with a SENSORPROM® unit the display indication must be formatted. It is done as follows:

a)   Sensor ≤ DN 2000:
In the menu "MAX. RANGE" a value 10 x "VOL. FLOW MAX." should be entered.

b)   Sensor > DN 2000:
In the menu "MAX. RANGE" a value 5 x "VOL. FLOW MAX." should be entered.
(Max. 540,000 m³/h).

Sound velocity
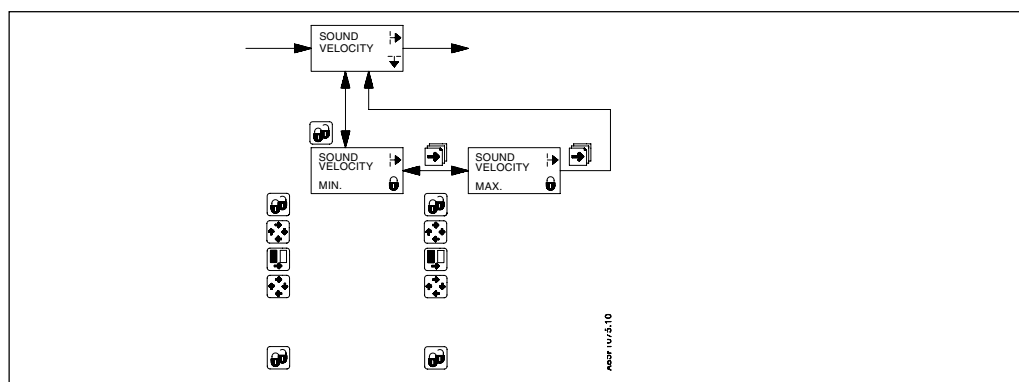
The engineering units for the sound velocity are in meters per second. The measuring range is set by entering the minimum and the maximum sound velocity.
Error relay and error indication are activated, if the sound speed is outside the limits stated.

Mass flow
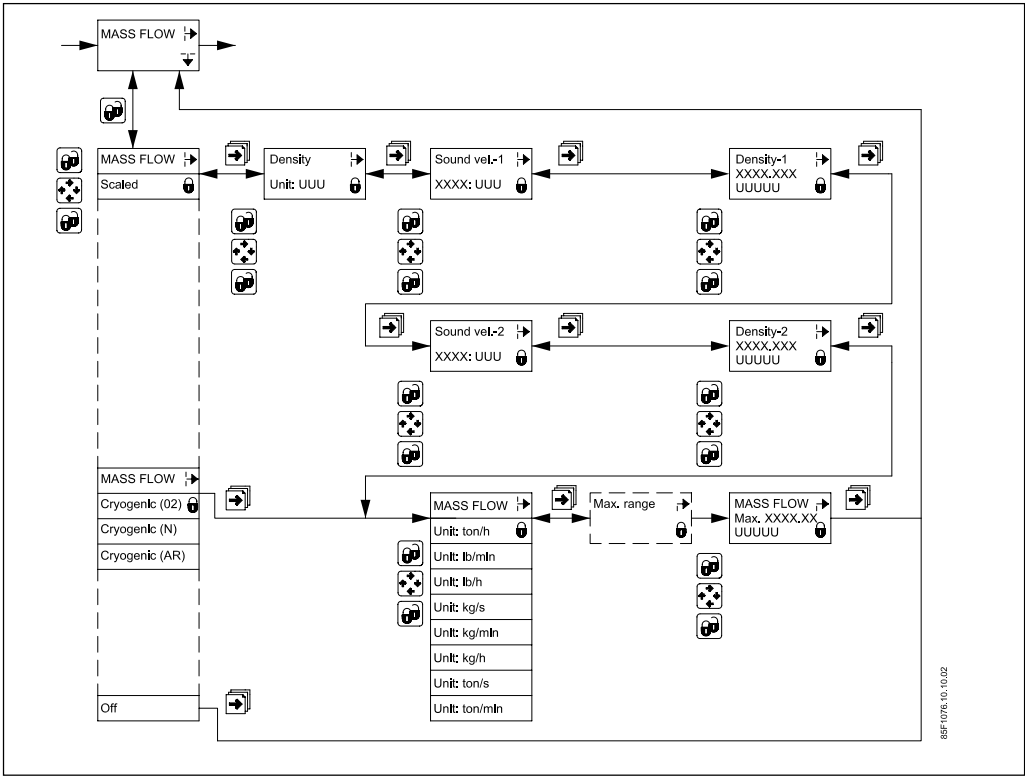
For SONO 3000 not fitted with a SENSORPROM® unit the display indication must be formatted. It is done as follows:

a) Sensor ≤ DN 2000:
   In the menu "MAX. RANGE" a value 10 x "MASS FLOW MAX." should be entered.

b) Sensor > DN 2000:
   In the menu "MAX. RANGE" a value 5 x "MASS FLOW MAX." should be entered.
   (Max. 2 x 540,000 t/h).

User defined relationship between sound velocity and density

Select "scaled mass flow" and density engineering unit, enter the two sets of data for sound velocity and density, mass flow engineering units and the maximum mass flow range. If the relay output is set to indicate sound limit, the relay will make if the actual sound velocity is outside the range given by SOUND VELOCITY 1 and SOUND VELOCITY 2, i.e indicating that the mass flow is calculated with a density outside the defined range.

Cryogenics

Select cryogenic, mass flow engineering unit and the maximum mass flow range.

Calculated mass flow

The SONO 3000 is able to measure compensated mass flow, i.e. mass flow is calculated using volume flow and density derived from sound velocity.
The relation between sound velocity and density is predefined for cryogenics O_2, N_2 and Ar. It is possible to enter a user defined relationship between density and sound velocity. This is achived by entering two sets of data for sound velocity and density. The meter determines the actual density by measuring the sound velocity and interpolation of the relation between density and sound velocity.
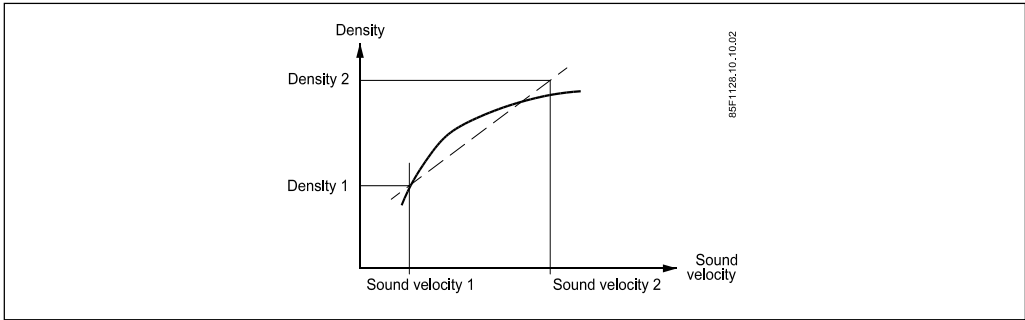
Totalizer
Internal
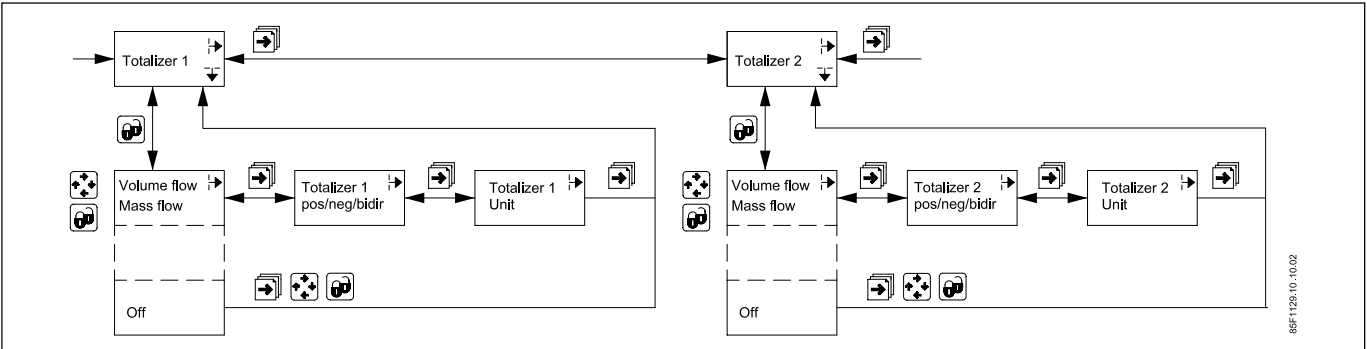
Select flow, direction and engineering units. By selecting bidirectional flow the net flow, i.e. the difference between the positive and the negative flows, will be displayed.

Low flow cut-off

Low flow cut-off can be set over a range from 0 - 9.9% of the measuring range.

Forced control

In forced control it is possible to define the behavior of a current or frequency output in the event of a fatal error. By selecting "off" the output remains on the latest valid reading.
MIN. forces the output to 0% in the event of an error and MAX. forces the outputs to 100%.

Current output
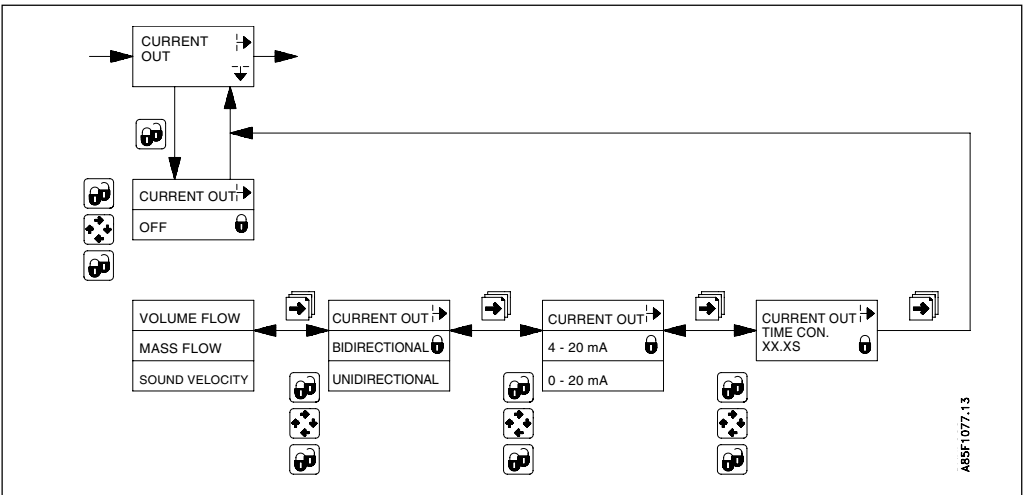
Current output characteristics

Bidirectionel   *Unidirectionel*
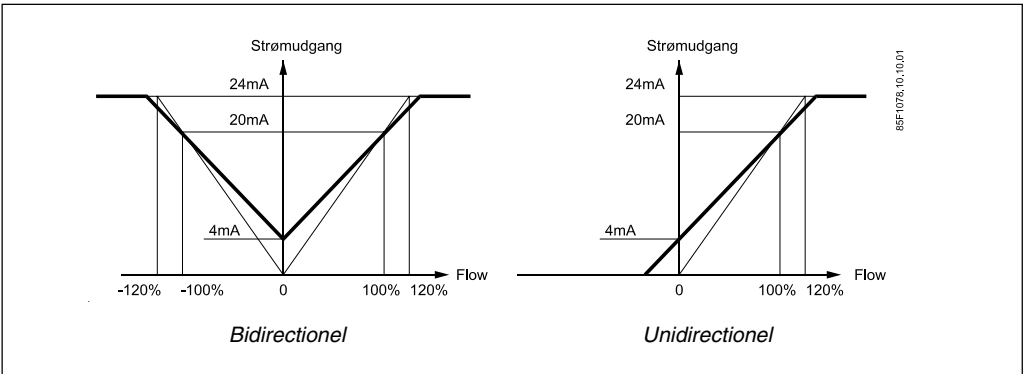
Frequency/pulse output
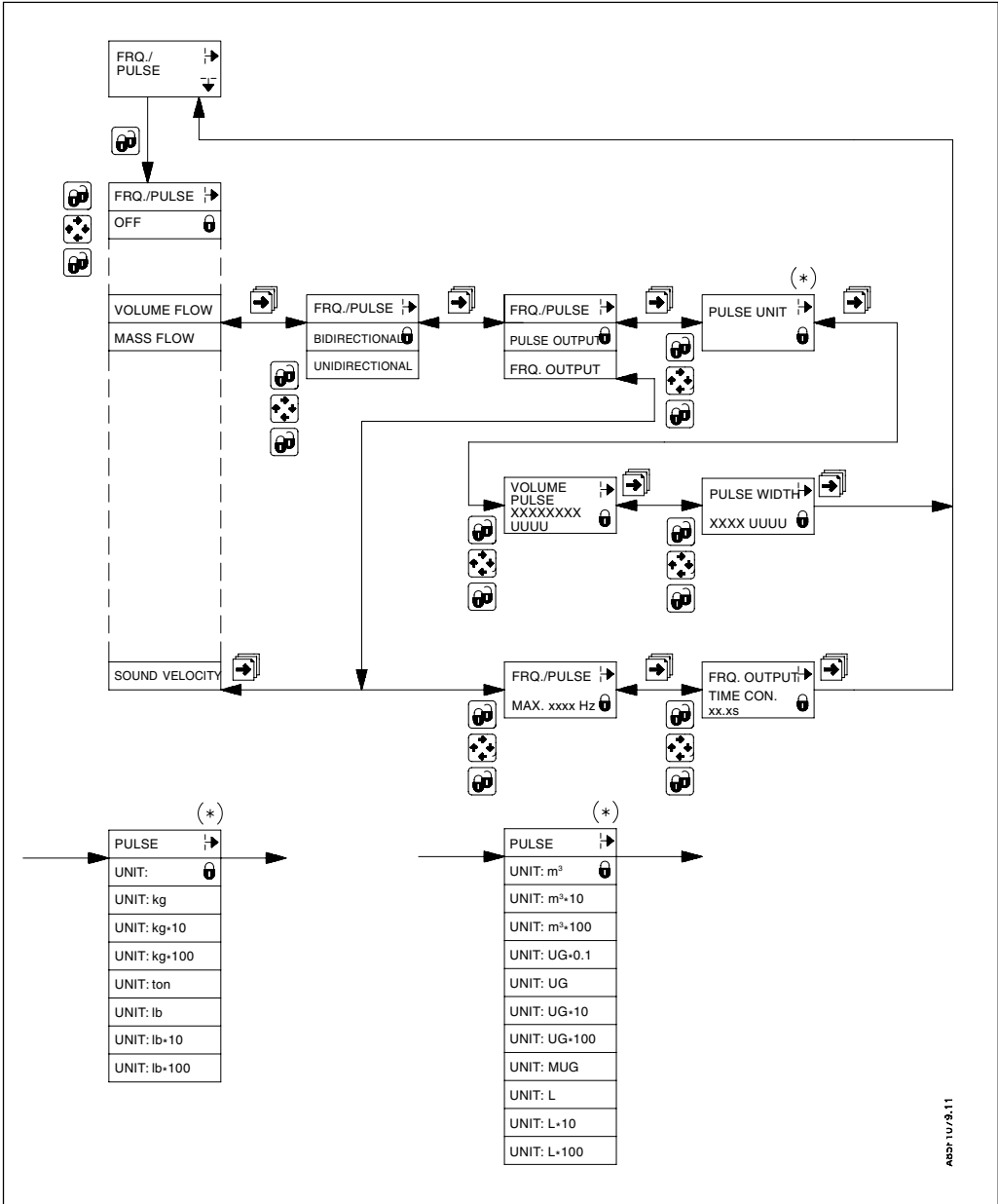
Frequency output characteristics

Bidirectionel   Unidirectionel
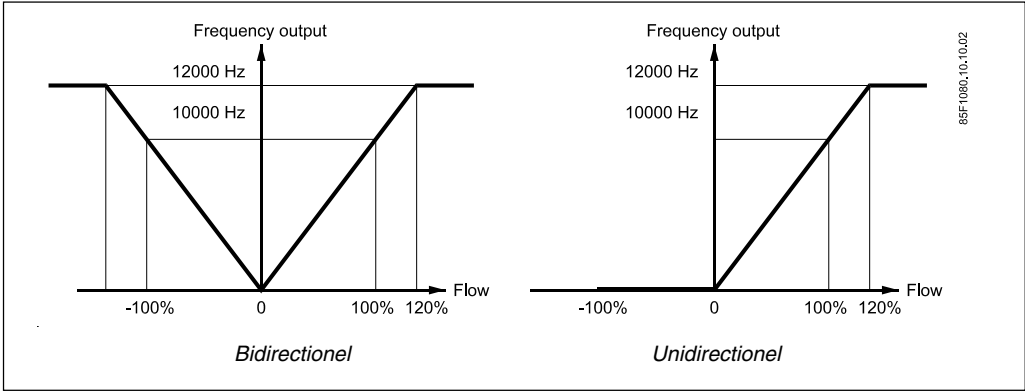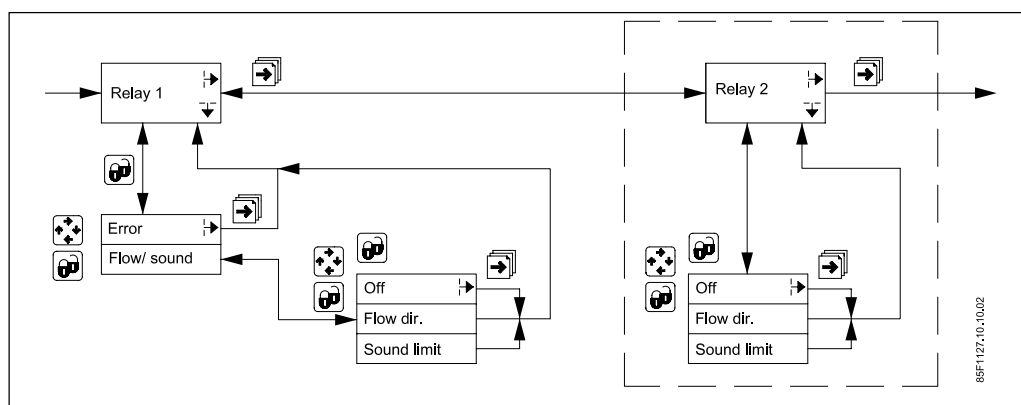
Relay

The relay can be set to indicate flow direction, sound limit or error. The error output is only available on relay no. 1.

The sound limit is defined in the mass flow submenu. Select scaled mass flow and enter SOUND VELOCITY 1 and SOUND VELOCITY 2. The relay will make when the sound velocity exceeds the range defined by SOUND VELOCITY 1 and SOUND VELOCITY 2.

SOUND VELOCITY min. and max. are part of the error message when ERROR is selected.

Calibration options
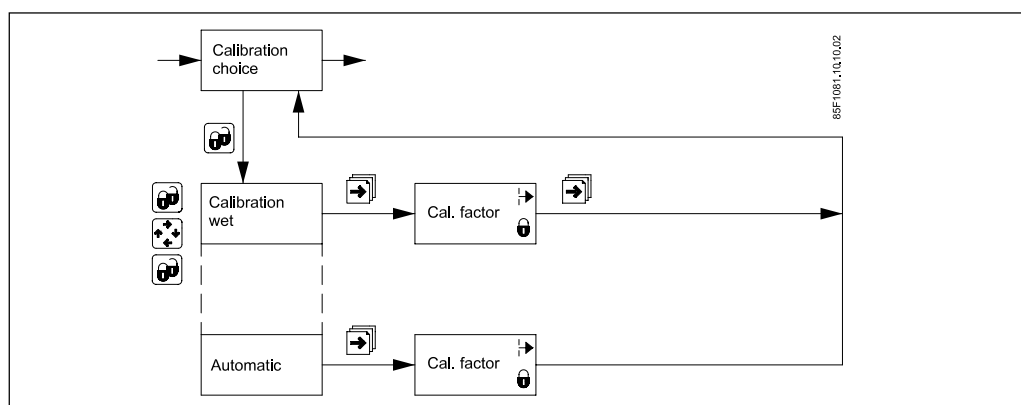
Wet calibration

The calibration factor cannot be changed when the signal converter is connected to a SENSOR-PROM® unit. With no SENSORPROM® unit the cal. factor is manual set.

Auto calibration

Selecting "Auto" will allow the converter to calculate a theoretical calibration factor based on the information entered in the APPLICATION and PIPE GEOMETRY menus.

The theoretical cal.factor is a function of viscosity of the liquid, the internal pipe diameter, the roughness, the number of tracks, the transducer distance, the track angle and the displacement of each track.

Automatic calibration can be used only on straight tube flowmeters.

Application parameters
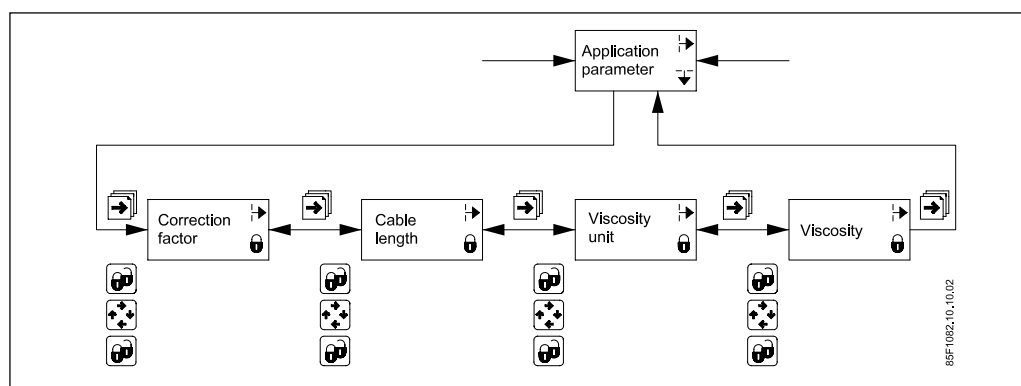
Correction factor

The correction factor allows the user to adjust the calibration factor by up to ±20% by entering a factor between 0.8 and 1.2. The factory setting is 1.

Cable length

If the signal converter is installed in a remote position, entering the length of the sensor cable is necessary to compensate for the time delay occurring in the cables. The cable length is the total length of the signal cable in one sound track. The engineering unit for the cable length is in meters. The tolerance is ±0,5 m.

Viscosity

Only required in case of an auto calibration.

Pipe geometry
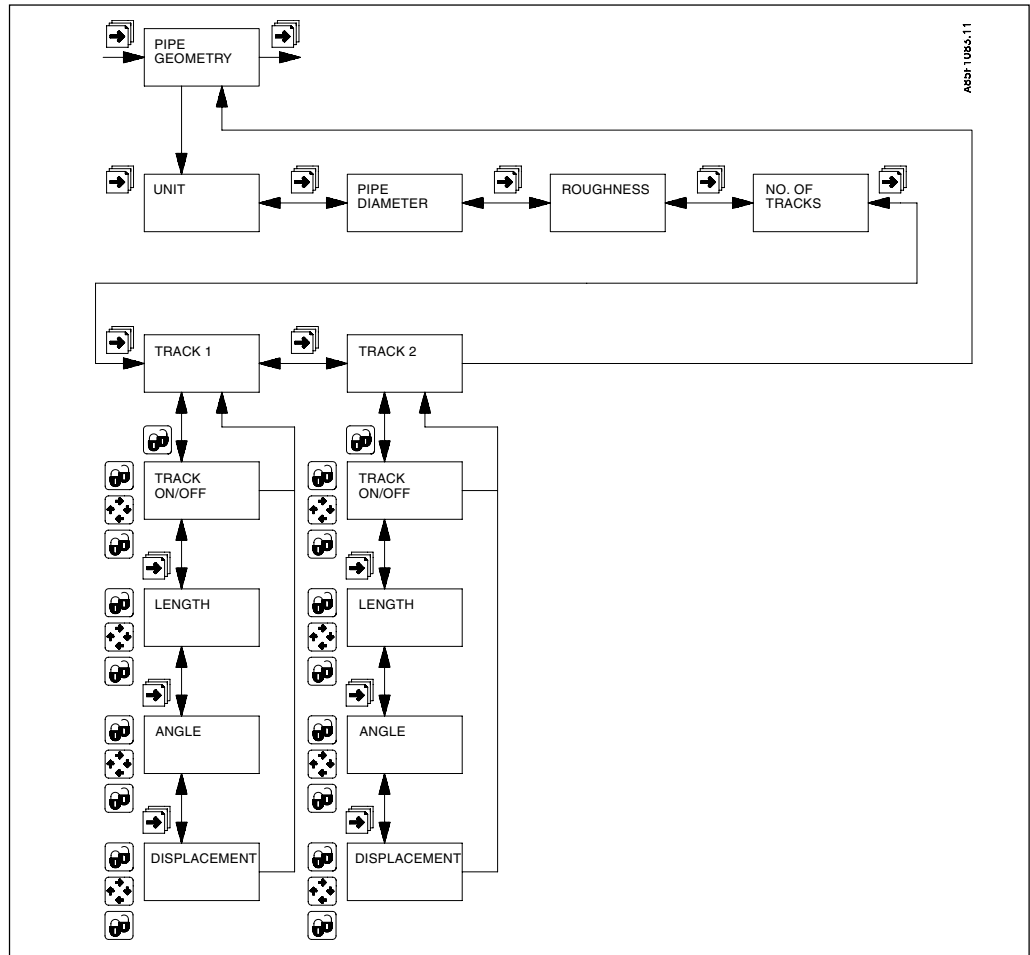
In the PIPE GEOMETRY menu the number of tracks is defined. Here the signal converter can be set to a 1 - 4-track system. If the signal converter is connected to a sensor with a SENSORPROM® unit the data in the PIPE GEOMETRY menu are read only. If the signal converter is used with a sensor without SENSORPROM® unit, e.g. with a retrofitting kit type SONO 3110, the pipe data must be entered here. The standard configuration of a SONO 3000 is a two-track system. It can easily be used as one-track system or in special cases as a three or four-track system.

Using the SONO 3000 as a four-tracks system is beyond the scope of this handbook. Please contact Siemens Flow Instruments for further information.

There is a connection between the number of tracks and which tracks may be set. If installed as a one-track meter, the meter uses only the values set in track 1. Furthermore, it has only electrical connections to transducers C and D. If the meter is installed as a twin-track meter, one of the tracks can be switched off by moving to the required track and changing the setting to "OFF".

Length

The track length (L) is the distance between the two transducer windows in the same track.

Angle of ultrasonic track

The angle (θ) is the track angle, i.e. the angle between the track and centerline of the pipe. Retrofitting kit type SONOKIT will as standard have an angle close to 60°.

Displacement

The track displacement (h) is the distance between the track and the center plane of the pipe. In case of a one-track system where the track is placed in the center plane of the pipe the displacement is 0. In a normal two-track system, where the two-tracks are placed symmetrically in the pipe the displacement is equal to half the track distance (H/2).
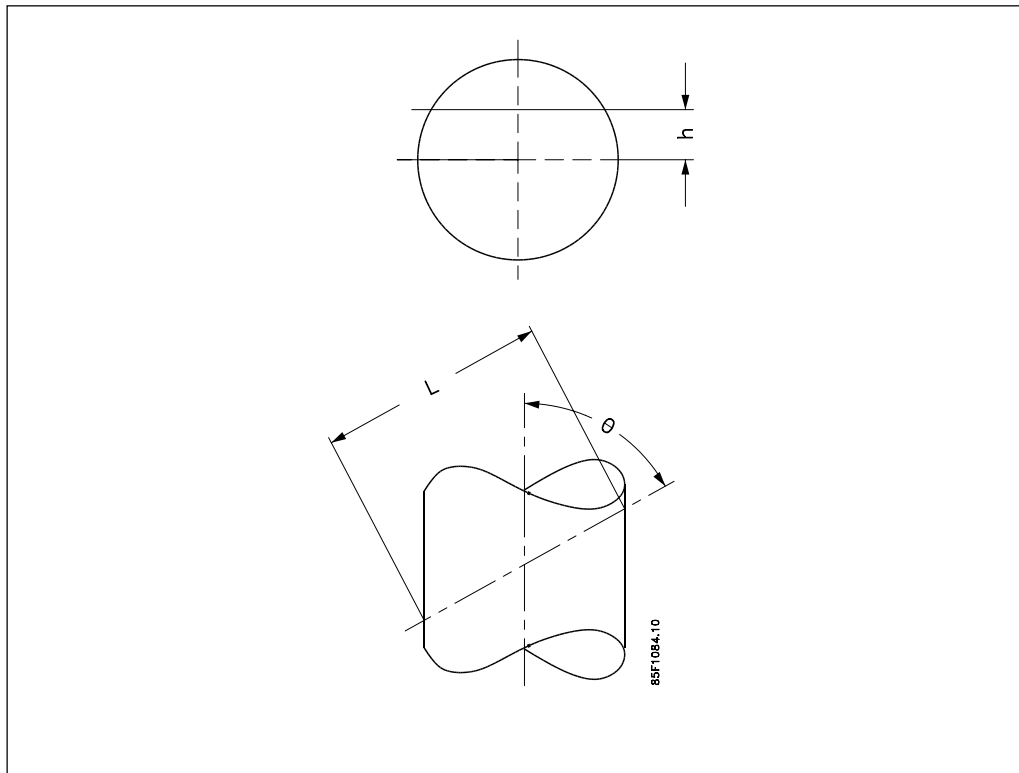
Zero adjustment
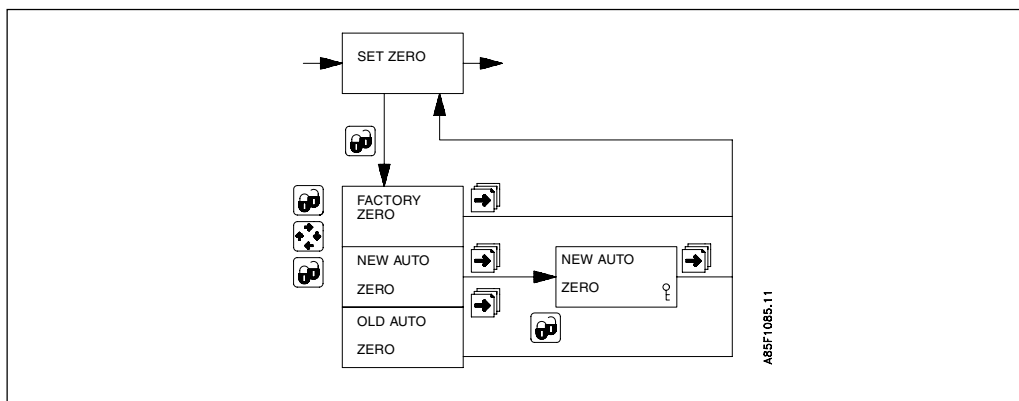
The factory setting is applicable in most cases, but if the user requires a high accuracy at low flow, an APPLICATION dependent zero adjustment, NEW AUTO ZERO is recommended.

The AUTO ZERO adjustment is initiated when the LOCK key is pressed. The zero adjustment will take approx. 60 seconds. During the process the text BUSY and a count down from 300 will be displayed. When the process is finished 0.0000 is displayed.

If the meter detects flow in the pipe during the zero adjustment proces, the zero adjustment proces will be interrupted and an error message displayed.

The signal converter stores the result of the second previous AUTO ZERO adjustment in the register under "OLD".

7.5 Factory settings

On start-up the meter uses the factory default setting in the SENSORPROM® unit. The following tables state the factory-set values. The range for each setting is given.

> **If the respective setting range is exceeded, the cursor moves to the first digit in the display and flashes to indicate the setting is invalid. The selected setting cannot be locked with the LOCK key before a valid figure is selected. If the menu is left with flashing cursor, the original value is maintained.**

Since a number of factory-set values e.g. max. volume flow, max. mass flow etc. are dimension-dependent, these are given separately in the table "Dimension-dependent settings".

Table 1

	Default settings	Settings available
BASIC SETTINGS		
Flow direction definition	Pos	Pos, neg
Volume flow unit	m^3/h	-
Volume flow max.	1300	
Sound velocity, min.	1400	400 - 2000
Sound velocity, max.	1600	400 - 2000
Mass flow	Off	Scaled, O2, N, Ar, Off
Density unit	kg/m^3	g/cm^3, kg/m^3, ton/m^3, lb/ft^3
Sound velocity 1	1447	400 - 2000
Density 1	997.7	
Sound velocity 2	1542	400 - 2000
Density 2	998.0	
Mass flow unit	t/h	-
Mass flow max.	1300	
Totalizer 1	Off	Volume flow, mass flow, off
Totalizer 1 direction	Pos	Pos, neg, bidirectional
Totalizer 1 unit	m^3	-
Totalizer 2	Off	Volume flow, mass flow, off
Totalizer 2 direction	Pos	Pos, neg, bidirectional
Totalizer 2 unit	m^3	-
Low flow cut-off	1.5%	0 - 9.9%
Force control	Off	Off, max., min.
OUTPUT SETUP		
Current 1	Off	Volume flow, mass flow, sound velocity, off
Current 1 direction	Unidirectional	Unidirectional, bidirectional
Current 1 range	4-20 mA	0-20 mA, 4-20 mA
Current 1 time constant	5 s	0.8 - 30 s
Current 2	Off	Volume flow, mass flow, sound velocity, off
Current 2 direction	Unidirectional	Unidirectional, bidirectional
Current 2 range	4-20 mA	0-20 mA, 4-20 mA
Current 2 time constant	5 s	0.8 - 30 s
Current 3	Off	Volume flow, mass flow, sound velocity, off
Current 3 direction	Unidirectional	Unidirectional, bidirectional
Current 3 range	4-20 mA	0-20 mA, 4-20 mA
Current 3 time constant	5 s	0.8 - 30 s
Frq.1/Pulse 1	Off	Volume flow, mass flow, sound velocity, off
Frq. 1/Pulse 1 direction	Unidirectional	Unidirectional, bidirectional
Frq. 1/Pulse 1	Pulse	Frq., pulse
Pulse 1 unit	m^3	L, L × 10, L × 100, m^3, m^3 × 10, m^3 × 100, UG × 0,1, UG, UG × 10, UG × 100, MUG, kg, kg × 10, kg × 100, ton, lb, lb × 10, lb × 100
Pulse 1 Volume/pulse	1	
Pulse 1 Width	50 ms	50 µs, 500 µs, 50 ms E. Mech., 500 ms, 1 s, 5 s
Frq. 1 frequency	10 kHz	500 Hz, 1 kHz, 5 kHz, 10 kHz
Frq. 1 time constant	5 s	0.8 - 30 s

Table 1
(continued)

	Default settings	Settings available
Frq. 2/Pulse 2	Off	Volume flow, mass flow, sound velocity, off
Frq. 2/Pulse 2 direction	Unidirectional	Unidirectional, bidirectional
Frq. 2/Pulse 2	Pulse	Frq., pulse
Pulse 2 unit	m^3	L, L × 10, L × 100, m^3, m^3 × 10, m^3 × 100, UG × 0,1, UG, UG × 10, UG × 100, MUG, kg, kg × 10, kg × 100, ton, lb, lb × 10, lb × 100
Pulse 2 Volume/pulse	1	-
Pulse 2 Width	50 ms	50 μs, 500 μs, 50 ms E. Mech., 500 ms, 1 s, 5 s
Frq. 2 frequency	10 kHz	500 Hz, 1 kHz, 5 kHz, 10 kHz
Frq. 2 time constant	5 s	0,8 - 30 s
Relay 1	Error	Flow dir., sound limit, error, off
Relay 2	Off	Flow dir., sound limit, off
SENSOR CHARACTERISTIC	Default settings without SENSORPROM® unit	
Calibration choice	Wet	Wet, auto
Calibration constant	0.392	
Correction factor	1	0.8000 - 1.2000
Cable length	1	1 - 500
Viscosity unit	mm^2/s	mm^2/s, cSt.
Viscosity	1	-
Pipe diameter	0.398	
Pipe geometry unit	m	m, inch
Pipe surface roughness	0.0004	0.0000 - 0.0100
No. of tracks	2	1, 2, 4
Track 1-track	On	On, off
Track 1-track length	0.46	
Track 1-track angle	60	
Track 1 Displacement	0.179	
Track 2-track	On	On, off
Track 2-track length	0.46	
Track 2-track angle	60	
Track 2 Displacement	0.179	
Track 3-track	Off	On, off
Track 3-track length	0.46	
Track 3-track angle	60	
Track 3 Displacement	0.179	
Track 4-track	Off	On, off
Track 4-track length	0.46	
Track 4-track angle	60	
Track 4 Displacement	0.179	
RESET MODE Zero adjustment	Factory	Factory, new auto, old auto
OPERATOR MENU SETUP	Volume flow Error pending	(Cannot be deselected) Volume flow Volume flow % Mass flow Mass flow % Density Sound velocity Totalizer 1 Totalizer 1 reset Totalizer 2 Totalizer 2 reset Volume flow max. Mass flow max. Sound velocity min. Sound velocity max. Sensor type Sensor size Signal converter type Error log Error pending

Starting up

7.6 Max. ranges and factory settings where applicable

Table 2

DN		Volume flow							Massflow						
		$Q_{max.}$				Volume/ Pulse	Pulse unit	Totalizer unit	$M_{max.}$				Mass/ Pulse	Pulse unit	Totalizer unit
[mm]	[inch]	Factory setting	Min.	Max.	Unit				Factory setting	Min.	Max.	Unit			
		3 m/s	0,5 m/s	10 m/s					998 kg/m³	500 kg/m³	2000 kg/m³				
10		1.600	140	6.000	l/h	1	l	l∗10	1.600	70	13.000	kg/h	1	kg	kg∗10
15	1/2	2.600	220	10.000	l/h	1	l	l∗10	2.600	110	22.000	kg/h	1	kg	kg∗10
20		4.400	360	16.000	l/h	10	l	l∗10	4.400	180	34.000	kg/h	10	kg	kg∗10
25	1	7.000	600	26.000	l/h	10	l	l∗10	7.000	300	60.000	kg/h	10	kg	kg∗10
32		12	1	46	m³/h	10	l	l∗100	12.000	500	95.000	kg/h	10	kg	kg∗100
40	1 1/2	16	1	60	m³/h	100	l	l∗100	16.000	700	130.000	kg/h	100	kg	kg∗100
50	2	26	2	100	m³/h	100	l	l∗100	26	1.10	220	ton/h	100	kg	kg∗100
65	2 1/2	42	4	160	m³/h	100	l	l∗100	42	1.80	340	ton/h	100	kg	kg∗100
80	3	60	5	220	m³/h	100	l	m³	60	2.60	480	ton/h	100	kg	ton
100	4	100	9	380	m³/h	100	l	m³	100	4.20	800	ton/h	100	kg	ton
125	5	150	13	550	m³/h	100	l	m³	150	6.50	1.200	ton/h	1	t	ton
150	6	220	18	850	m³/h	1	m³	m³	220	9.00	1.800	ton/h	1	t	ton
200	8	380	32	1.400	m³/h	1	m³	m³	380	16	3.000	ton/h	1	t	ton
250	10	600	48	2.200	m³/h	1	m³	m³	600	24	4.800	ton/h	1	t	ton
300	12	850	70	3.200	m³/h	1	m³	m³	850	34	7.000	ton/h	1	t	ton
350	14	1.000	85	3.800	m³/h	1	m³	m³	1.000	42	8.000	ton/h	1	t	ton
400	16	1.300	110	5.000	m³/h	1	m³	m³	1.300	55	11.000	ton/h	1	t	ton
500	20	2.200	180	8.000	m³/h	1	m³	m³	2.200	90	17.000	ton/h	1	t	ton
600	24	3.200	260	12.000	m³/h	1	m³	m³	3.200	130	26.000	ton/h	10	t	ton
700	28	4.200	360	16.000	m³/h	10	m³	m³	4.200	180	34.000	ton/h	10	t	ton
800	32	5.500	460	20.000	m³/h	10	m³	m³	5.500	240	44.000	ton/h	10	t	ton
900	36	7.500	600	28.000	m³/h	10	m³	m³	7.500	300	60.000	ton/h	10	t	ton
1000	40	9.000	750	34.000	m³/h	10	m³	m³∗10	9.000	380	70.000	ton/h	10	t	ton
1200	48	220	17	800	m³/min.	10	m³	m³∗10	220	9	1.700	ton/min.	10	t	ton
4000	160	2.400	190	9.000	m³/min.	100	m³	m³∗100	2.400	95	19.000	ton/min.	100	t	ton

7.7 Starting up procedure with SENSORPROM® flow memory unit	1. Switch on the signal converter SONO 3000. The meter will automatically run through a self-test routine. During the self-test the display will show the text ROM TEST, RAM TEST and INITIA-LIZING. The self-test is completed when the display starts showing the volume flow rate.
	2. If the error symbol is displayed, go to section "Trouble shooting".
	3. Refer to the CONVERTER SETUP MODE, OUTPUT SETUP to set the required output signals.

7.8 Starting up procedure without SENSOR-PROM® flow memory unit	1. Switch on the signal converter SONO 3000. The meter will automatically run through a self-test routine. During the self-test the display will show the text ROM TEST, RAM TEST and INITIALIZING. The self-test is completed when the display starts showing the volume flow rate.
	2. When the signal converter detects no SENSORPROM® unit, it will configure itself to a DN 400 mm sensor settings. Error 42 is shown for a short while. The signal converter will display the corresponding flow rate.
	3. For correct flow measurement the following parameters must be set:

<div style="margin-left:2em">

CONVERTER SETUP MODE:

BASIC SETTINGS:
    The dimension-dependent settings are listed in table 2 *(previous page)*.

OUTPUT SETUP:
    Set the required output signals.

SENSOR CHARACTERISTICS:

CALIBRATION CHOICE
    Choice: WET, AUTO

</div>

Wet calibration	If WET:
	    CAL.FACTOR
	
	APPLICATION PARAMETERS
	    Cable length
	
	PIPE GEOMETRY
	    PIPE DIAMETER
	    NO. OF TRACKS
	    TRACK LENGTH

Theoretical calibration	If AUTO:
	    All PIPE GEOMETRY data and APPLICATION PARAMETERS are required
	    UNIT
	    PIPE DIAMETER (Internal)
	    ROUGHNESS (Steel pipes 0.0004 m typically)
	    NO. OF TRACKS
	    TRACK ON/OFF
	    TRACK LENGTH
	    TRACK ANGLE
	    TRACK DISPLACEMENT
	    VISCOSITY UNIT
	    VISCOSITY

4. To set required measuring ranges go to BASIC SETTINGS.

5. If the error symbol is displayed, go to section "Trouble shooting".

6. Zero adjustment is only necessary if the user requires a high accuracy at very low flows.

7. To set the required output signals go to the CONVERTER SETUP and OUTPUT SETUP MODES.

> **The procedure described above is only required when setting up the signal converter for the first time.**
> **The signal converter will retain the settings even in case of power failure.**

Starting up

8. Trouble shooting

The signal converter is self-monitoring and registers the following faults:

1. The ultrasonic signals and the application.

2. Cable fault on sensor cable and current output loop.

3. Operation and setting faults.

4. Internal faults in signal converter.

These faults are displayed immediately in the form of two flashing triangles ◣ .

The individual faults are stored in two registers. Current faults are stored in ERROR PENDING, and current and past faults are stored in ERROR LOG.

The faults are stored in the form of an error code, with indication of elapsed time since error registration. Power off erases the content of the ERROR LOG.
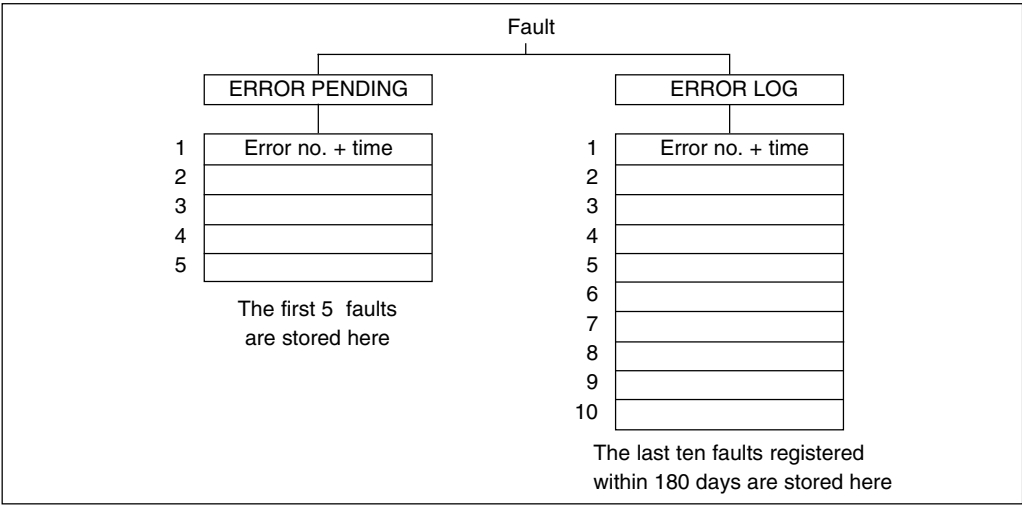
In SONO 3000, errors can also be detected via the relay, but conditional on the relay being set at ERROR under the menu OUTPUT SETUP.

When the converter is being set (user code keyed in), error indication via relay is automatically blocked.

Trouble shooting

8.1 Fault location guide

Symptom	Error code	Error relay	Cause	Remedy
Empty display	None	ON	1. Supply voltage 2. SONO 3000 defective	1. Check supply voltage and voltage selector 2. Replace SONO 3000 [3]
No flow signal	None	OFF	1. Current output deselected 2. Frequency/pulse output deselected	1. Check OUTPUT SETUP 2. Check OUTPUT SETUP
	None	OFF	Reverse flow direction	Select FLOW DIRECTION in BASIC SETTINGS
	1 [1] 2	ON	Signal converter rejects received signals	
	5 [1] 6		Max. amplification exceeded	
	9 10 11 12	ON	1. Sensor cable not connected 2. Mismatch of sensor and liquid	1. Check cable and connections 2. Check sensor manually by means of an oscilloscope. Please contact Siemens Flow Instruments
	13 [1] 14	ON	1. This error code and a high gain[2]. > 60 dB, indicate reception of a week signal 2. Air bubbles in the liquid cause amplitude variations of the flow signal	
	17 18 51 68 84 111 121 125	ON	Internal error Function and communication check	With a typical operation of the signal converter turn the power supply off and on. If the fault occurs again, replace the signal converter[3]
	21	OFF	Error during zero adjustment Unit registers flow in sensor	Ensure optimum zero adjustment in the sensor[3]
	22	ON	Sound velocity value outside the measuring range	Check settings for track length and min./max. sound velocity
	23 24 33 34		Hardware fault	Replace SONO 3000[3]
	25	ON	1. Motherboard defective 2. Supply voltage too low	1. Replace SONO 3000[3] 2. Check supply voltage
	26	ON Forced output redefined in the menu	Fatal measuring error	Remove the cause of additional error(s) and this code will disappear as well
	30 31	ON	SENSORPROM® unit defective	Remove SENSORPROM® unit and enter settings manually[3]
	40		Wrong sensor version	
	41	ON	Error in data exchange with SENSORPROM® unit	
	50	ON	Invalid totalizer value (check sum error)	
	60	ON	1. No load or load exceeds max. setting on current output 2. SONO 3000 defective	1. Check cables and connections 2. Replace SONO 3000[3]
	27	ON	Flow > 2 x $Q_{max.}$	Check max. setting in BASIC SETTINGS
	64	ON	Current output exceeds 24 mA	Check max. setting in BASIC SETTINGS
	80	ON	Frequency/pulse output exceeds 12000 Hz	Check max. setting in BASIC SETTINGS
	82	ON	Pulse width on frequency output exceeds limit by 50%	Select a shorter pulse width
	100	OFF	"Power-on" indication - no error	

[1] Lowest value for track 1.
[2] Alarm if signal level falls below 500 mV (see "Service").
[3] Not permitted with calibrated and sealed flowmeters.
Please contact Siemens Flow Instruments or send the signal converter and sensor to Siemens Flow Instruments for repair and renewed calibration.

Trouble shooting

9.   Service

9.1   Service menu

The SERVICE MENU contains three sub menues. INFORMATION, FORCE OUTPUT and SIGNAL INFORMATION. INFORMATION contains all identification data of the signal converter and sensor. Note that the meter continues to measure and up-dates the output(s) being in the service menu. The only exception is when an output is set in the FORCE OUTPUT MENU.
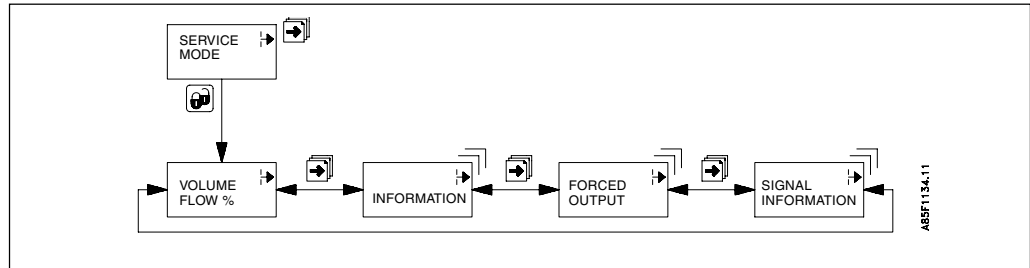
Force output

In FORCE OUTPUT it is possible to set all outputs to fixed values. The current output can be set between 0/4-24 mA, the frequency/pulse output can be set to 1 Hz and the relay output can be set on or off.
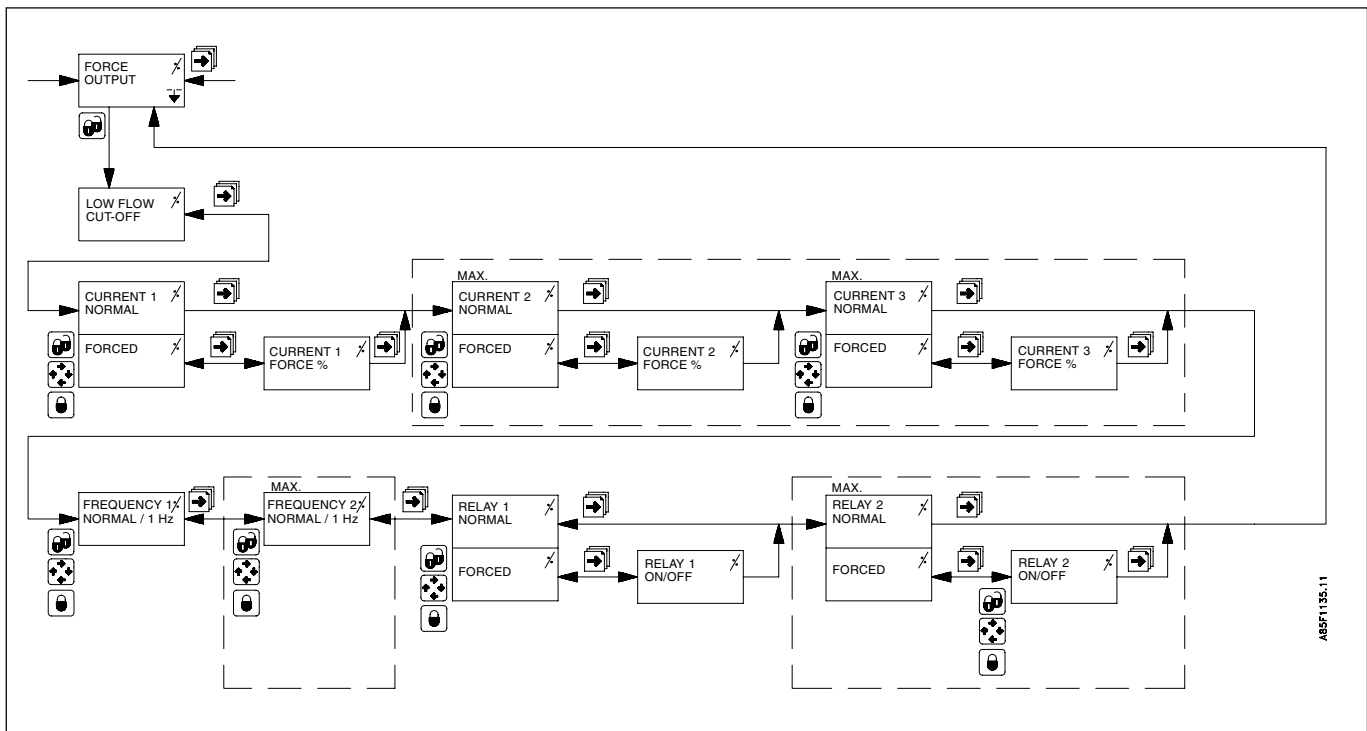
Signal information

In the SIGNAL INFORMATION menu it is possible to read information regarding the ultrasonic signals, the flow signals and the transducers.

9.2   Signal

In the SIGNAL MENU, information relating to amplification of the signal, signal amplitude and signal to noise ratio is given as GAIN, SIGNAL LEVEL and S/N RATIO. GAIN can be between 1 to 60 and depending on sensor type and size, the typical value for water will be between 5 and 30. The SIGNAL LEVEL will be between 375 and 800 mV. A value less than 700 mV indicates variation in the signal amplitude caused by variation in the acoustic damping, e.g. air bubbles. The S/N RATIO will be a number between 1 and 40. A typical value for water is between 20 and 35.

Signal
(continued)


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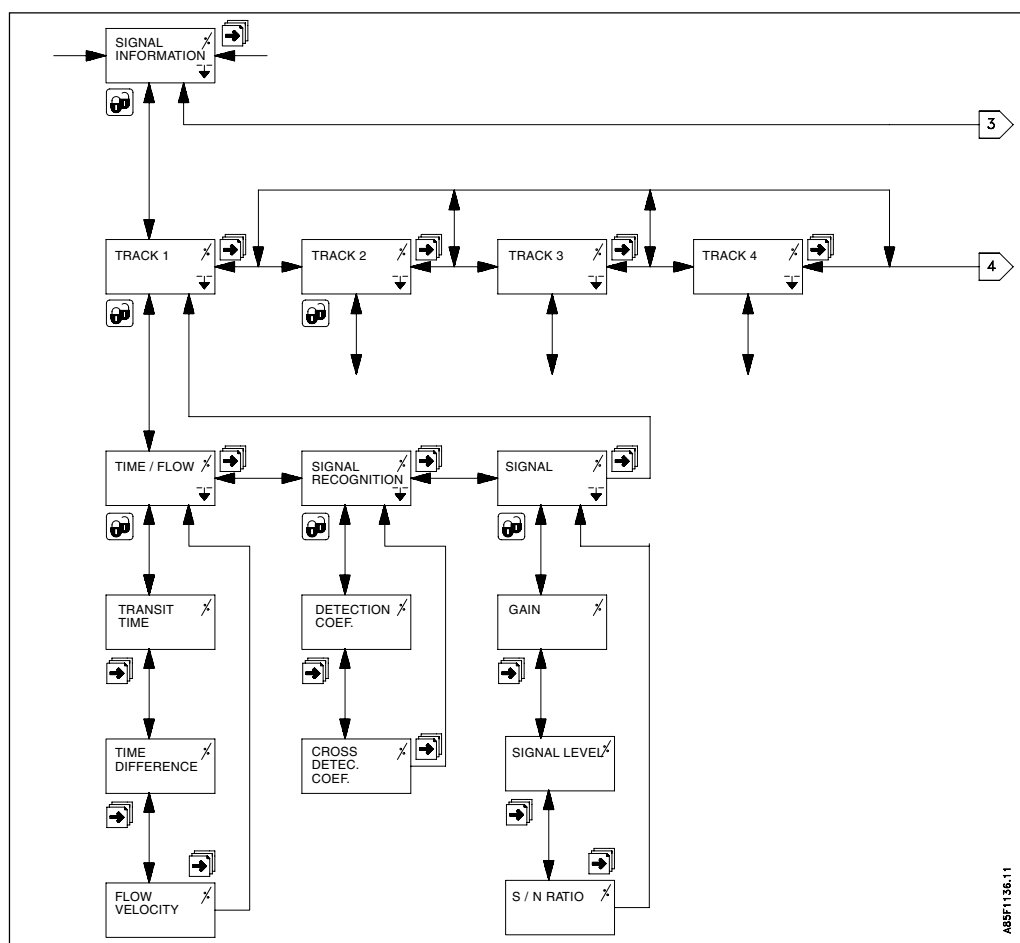
9.3 Signal recognition

In the SIGNAL RECOGNITION menu it is possible to read the correlation coefficient for both the transmission time and the difference time. The correlation coefficient is a number between 0 and ±1. A figure close to 1 denotes a good correlation between the two signals. The DETECTION COEFFICIENT states the quality of the determination of the transmission time. The CROSS DETECTION COEFFICIENT states the quality of the determination of the difference time.

Time/flow

In the TIME/FLOW menu it is possible to read the average transmission time, e.g. the time the sound takes to pass between the two transducers by zero flow in the pipe, the time differential and the average flow velocity in the track.

9.4 Transducer

The quality of the oscillating transducer and liquid is indicated by the RESONANCE LEVEL.
A number higher than 100 indicates satisfactory operation. Less than 100 indicates mismatch between transducer and liquid. A value less than 20 will raise an alarm. If the RESONANCE LEVEL is less than 100 and the meter still operates, this is satisfactory. If the RESONANCE LEVEL is below 20 and the meter is not measuring, (error code 5, 6 and 26), check cable connections and manually check transducers. Please contact Siemens Flow Instruments to establish.
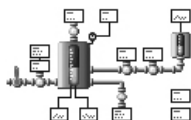

A85F1137.11
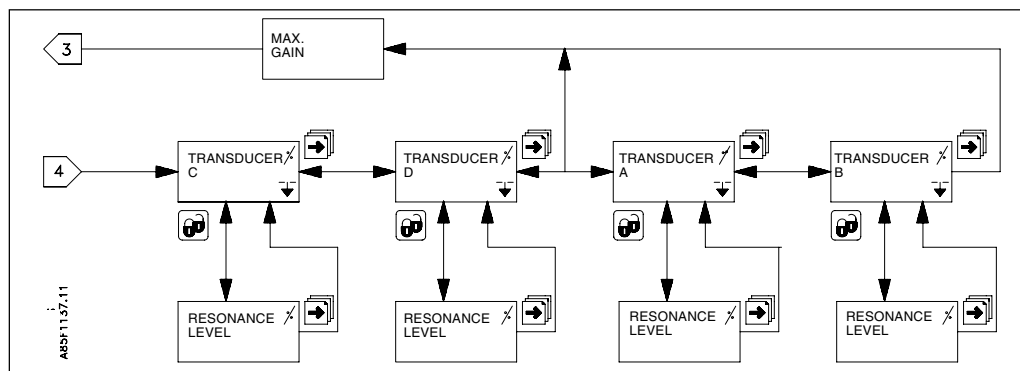
10.   Ordering   Please look on our homepage **http://www.siemens.com/flow** under "Product Selector".

Please use online Product selector to get latest updates.
Product selector link: **http://www.pia-selector.com**

10.1 SENSORPROM® memory unit for SONO 3110

	Code No.
If you order this device, you have to give information regarding the pipe geometry of the sensor. Please contact Siemens Flow Instruments to get a filling in formula.	FDK:085B5329

10.2 Signal converter SONO 3000

Description	Version	Enclosure	Supply	Code No.	Symbol
Signal converter SONO 3000 for compact and wall mounting	1 current output 1 frq./pulse output 1 relay output	IP 67 Fibre glass reinforced polyamid	115/230 V a.c 50/60 Hz	**7ME3150-1AA10-1AA0**	
			24 V a.c./d.c.	**7ME3150-1AA20-1AA0**	
Signal converter SONO 3000 for 19" rack and panel mounting	1 current output 1 frq./pulse output 1 relay output	IP 00	115/230 V a.c. 50/60 Hz	**7ME3150-2CA10-1AA0**	
	3 current outputs 2 frq./pulse outputs 2 relay outputs	IP 00	115/230 V a.c. 50/60 Hz	**7ME3150-2CC10-1AA0**	
			24 V a.c./d.c.	**7ME3150-2CC20-1AA0**	
Signal converter SONO 3000 19" insert assembled complete with wall mounting enclosure	1 current output 1 frq./pulse output 1 relay output	IP 65 ABS plastic	115/230 V a.c. 50/60 Hz	**7ME3150-2EA10-1AA0**	
	3 current outputs 2 frq./pulse outputs 2 relay outputs	IP 65 ABS plastic	115/230 V a.c. 50/60 Hz	**7ME3150-2EC10-1AA0**	
			24 V a.c./d.c.	**7ME3150-2EC20-1AA0**	
Signal converter SONO 3000 Ex-d compact EEx de [ia/ib] IIC T5-T6	1 current output 1 frq./pulse output 1 relay output	IP 67 AISI 316	24 V a.c./d.c.	**Ordered with SONO 3300**	
Signal converter SONO 3000 Ex-d Separate wall mounting EEx de [ia/ib] IIC T5-T6	1 current output 1 frq./pulse output 1 relay output	AISI 316	24 V a.c./d.c.	**7ME3150-2FA22-1AA0**	

10.3 Accessories SONO 3000

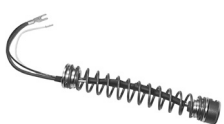| Description	Code No.	Symbol
Wall mounting kit for compact version Using 4 x coaxial sensor cables Wall brackets, PG 13.5 screwed with 4 cable entries	**FDK:085F5027**	
Panel mounting kit for 19" insert (28TE) IP 65 enclosure in ABS plastic for front of panel mounting	**FDK:083F3087**	
Back of panel mounting kit for 19" insert (28TE) IP 00 enclosure in aluminium	**FDK:083F3084**	
Display window for compact version with extra push button for zero setting of internal totalizer **FDK:085F5005** 24 V version only	**FDK:083F3008**	

10.4 Transducers

Transducers SONO 3200 (spare part without terminal housing, including insert)

Transducer type	Material	Gasket	Pressure rating	Temp. range	Length mm	Code No.	Symbol
O-ring	316 SS	O-ring	PN 40	-20/+200	50	**FDK:085B1405**	
O-ring	316 SS	O-ring	PN 40	-20/+200	90	**FDK:085L1101**	
O-ring	316 SS	O-ring	PN 40	-20/+200	160	**FDK:085B1406**	
O-ring	316 SS	O-ring	PN 40	-20/+200	230	**FDK:085B1407**	
Flange	316 SS	DIN 2512	PN 40	-20/+200	88	**FDK:085B1464**	
Flange	316 SS	DIN 2512	PN 160	-20/+200	88	**FDK:085B1706**	

Ordering

Transducers SONO 3200 (complete unit)

Transd. type	Material	Gasket	Pressure rating	Terminal housing	Approval	Temp. range °C	Length mm	Code No.	Symbol
O-ring	316 SS	O-ring	PN 40	Plastic PA 6.6		-20/+100	50	**FDK:085B5306**	
O-ring	316 SS	O-ring	PN 40	316 SS		-20/+200	50	**FDK:085B5300**	
O-ring	316 SS	O-ring	PN 40	316 SS	EEx-d	-20/+200	50	**FDK:085B5312**	
Flange	316 SS	DIN 2512	PN 40	Plastic PA 6.6		-20/+100	88	**FDK:085B5411**	
Flange	316 SS	DIN 2512	PN 40	316 SS		-20/+200	88	**FDK:085B5321**	
Flange	316 SS	DIN 2512	PN 40	316 SS	EEx-d	-20/+200	88	**FDK:085B5425**	
Flange	316 SS	DIN 2512	PN 160	316 SS	EEx-d	-20/+200	88	**FDK:085B5432**	
Flange	UNS S31803 Duplex	DIN 2512	PN 40	316 SS	EEx-d 3.1B NDE	-20/+200	158	**FDK:085X5149**	
Flange	UNS S31803 Duplex	DIN 2512	PN 160	316 SS	EEx-d 3.1B NDE	-20/+200	158	**FDK:085X5150**	
Flange	316 SS	V-groove Aluminium O-ring	PN 40	316 SS		-200/+100	88	**FDK:085B5416**	

Transducers SONO 3200 insert

		Temp. range °C	Length mm	Code No.	Symbol
Insert		-20/+200	50	**FDK:085B1411**	
Insert		-20/+200	88	**FDK:085B1459**	
Insert		-20/+200	90	**FDK:085L1100**	
Insert		-20/+200	160	**FDK:085B1419**	
Insert		-20/+200	230	**FDK:085B1420**	

10.5 Accessories

Type	Pressure rating	Material	Temp. range	Code No.	Symbol
Terminal housing	N/A	PA 6.6	-20/+100	**FDK:085B1403**	
Terminal housing	N/A	ASTM 316	-20/+200	**FDK:085B1402**	
Gaskets for O-ring transducer	PN 40	70 FFKM	-20/+200	**FDK:085B1089**	
Gasket for flange transducer	PN 160	Graphite	-20/+200	**FDK:085B1080**	
Gasket and 12 mm bolts and nuts for flange transducer	PN 40	Graphite 316 SS	-20/+200	**FDK:085B1083**	
Gasket and 16 mm bolts and nuts for flange transducer	PN 160	Graphite 316 SS	-20 /+200	**FDK:085B1084**	
Gasket for cryogenic transducers	PN 40	Aluminium O-ring	-200/+100	**FDK:633L0047**	

Ordering

10.6   Accessories for SITRANS F US SONOFLO® ultrasonic flowmeter

10.6.1 Submersible kit

Type/description	Code No.	Symbol
Submersible kit , IP 68 10 m w.g. rating	**FDK:085L2403**	

10.6.2 Accessories for SONO 3000 converter

Type/description	Code No.	Symbol
SONO 3000 EEx-d insert	**FDK:085F5210**	
SONO 3000 19" back print for IP 65 wall mounting 230 V version	**FDK:085F5327**	
SONO 3000 assembled plate for coax connections	**FDK:085L1023**	
SONO 3000 assembled base plate	**FDK:085L1015**	
SONO 3000 panel mounting kit for 19" inserts IP 65 L = 218 mm/28TE	**FDK:083F3087**	
SONO 3000 panel mounting kit for 19" inserts IP 20 L = 218 mm/28TE	**FDK:083F3084**	
SONO 3000 wall mounting kit	**FDK:085F5027**	
SONO 3000 EEx-d, front glas incl. frame	**FDK:085U2109**	
SONO 3000 EEx-d, gaskets for converter housing	**FDK:085U2002**	
SENSORPROM® memory unit for SITRANS F US SONOFLO® *When ordering:* Inform sensor code No. and calibration factor *For SONOKIT*: Inform sensor data and geometry	**FDK:085B5329**	

Ordering

10.7   Accessories for SONO 3100 and SONOKIT

10.7.1   Tools for SONO 3100 and SONOKIT

Type/description	Length	Code No.	Symbol
Extration tool for replacement of SONO 3200 O-ring transducers under pressure (hot-tap)	50 mm transducers	**FDK:085B5331**	
	160 mm transducers	**FDK:085B5333**	
	230 mm transducers	**FDK:085B5335**	
Angle measurement tool for SONOKIT		**FDK:085B5330**	
Hot-tap drilling tool for SONOKIT		**FDK:085B5392**	
Alignment tool for SONOKIT		**FDK:085B5393**	

10.7.2   Cable and connection boxes for SITRANS F US SONOFLO®

Type/description	Length m	Code No.	Symbol
Standard 75 Ohm coax cable $T_{max.}$ 100º C φ	15	**FDK:085B1373**	
	30	**FDK:085B1374**	
	60	**FDK:085B1375**	
	100	**FDK:085B1376**	
Teflon 75 Ohm coax cable $T_{max.}$ 200º C	5	**FDK:085B1378**	
	15	**FDK:085B1379**	
Multi coax cable $T_{max.}$ 70º C	10	**FDK:085B1392**	
	20	**FDK:085B1393**	
Multi coax cable $T_{max.}$ 200º C	5	**FDK:085B1390**	
	10	**FDK:085B1391**	

10.7.3   Cable connection boxes and cable glands

Type/description	Size	Code No.	Symbol
Junction box for coax cable	IP 68 metal box for 2 coax cables	**FDK:085B1360**	
	IP 68 metal box for 4 coax cables	**FDK:085B1361**	
	IP 68 EEx-e plastic box for 2 coax cables	**FDK:085B1362**	
	IP 68 EEx-e plastic box for 4 coax cables	**FDK:085B1363**	
Cable gland	PG 13 for one 6 mm coax cable Chrome plated brass	**FDK:085B1381**	
Cable gland	PG 13 for two 6 mm coax cables Chrome plated brass	**FDK:614X6068**	
Cable gland EEx	PG 13 for one 6 mm coax cable 316 SS	**FDK:085B1387**	

Ordering