WINCANTON ENGINEERING LTD

The Wincanton Standardising System

Operating Manual

Models TW-200

TW-250

Wincanton Engineering Ltd
South Street
Sherborne
Dorset
DT9 3ND

Section 1
The Wincanton Standardiser Model TW-200/ TW-250

Introduction

Wincanton Standardising System
MODELS TW-200 & 250

100 Introduction

101 What is a Wincanton Standardiser

A standardiser is a piece of equipment to control the production of either cream at a pre-set fat percentage or milk at a pre-set fat percentage or both.

The model number indicates the function of the specific unit
i.e. Model TW-250 indicates the following

TW ----------Two stream (cream and milk)
250 ---------- Relates to the design flow rate (2500 lph)

102 What does the TW 250 do?

The ***TW-250*** is inserted into the system following a self cleaning or solid bowl separator, the controls of the TW-250 render the standard valves on the separator redundant and these should be left fully open.

The ***TW-250*** measures the density and temperature of both cream and skimmed milk and thus calculates the fat percentage of each stream.

The ***TW-250*** controls the density of the cream produced and hence the fat percentage as the two are related.

Once a known density cream is produced the correction of milk can take place, by measuring the flow of the skimmed milk, the density and the temperature the TW-250 undertakes a complex formula is calculated within the plc which calculates the amount of cream to be added to the skimmed milk to produce a milk of the correct density and hence fat percentage. The basis of the formula is a calculation by Philps.

Section 2

The Wincanton Standardiser Model TW-200/ TW-250

Measurement

Wincanton Standardising System
MODEL TW-200 & 250

200 Measurement

201 Determination of fat content from density

The density of milk products is determined by several elements, principally: the fat content, the solids non fat (fat free dry substance) and the temperature. By means of recently developed massflow meters the flow, density and temperature of the skimmed milk and cream can be measured to a high degree of accuracy.

The use of the Danfoss Massflo meter with the above attributes and the plc software calculations give automatic temperature compensation. The fat contents are established from the density of fat free and fat rich streams.

202 Density measurement

The Massflow meters measure density by use of the Coriolis principle where the product flows through a tube which oscillates a predetermined frequency the damping effect of this oscillation is a result of the product density.
All units are supplied calibrated and unique calibration data is held on a SensorProm located within the signal converter. This data is then transmitted to the plc via an analogue 4020ma signal.

203 Measurement of flows

a. ***Cream and skimmed milk***

The flow of the two streams from the separator are measured by the Massflow meters however the skimmed milk is the important value for calculation purposes.

b. ***Reblend flow***

Following the calculation the required flow of controlled cream is metered by a Magflo meter into the skimmed milk flow.

Section 3
The Wincanton Standardiser Model TW-200/ TW-250

Factors Affecting Performance

300 Factors affecting smooth operation

301 The influence of air

The ***TW-250*** system measures the density of the two streams from the separator hence the inclusion of air will have a drastic effect on the system accuracy and stability. The following points have to be considered when including a ***TW-250*** into a new existing system:-

301a The level in the milk balance tank should be such as to prevent the inclusion of air into the system.

301b The separator itself should be maintained effectively and the seals replaced at regular intervals.

WINCANTON ENGINEERING OFFER A RANGE OF SERVICE CONTRACTS TO ENSURE MAXIMISED OPERATIONAL EFFICIENCY.

301c Particular care must be exercised when related to pump seals a defective seal can induce air entrainment into the system.

301d Milk should not flow directly from reception to the system as the unloading of tankers will promote the inclusion of air.

301e Milk should be unloaded into a silo then transferred to the system.

301f Under no circumstance should air agitation be used also the use of "jet" mixing should be avoided as this increases the likelihood of air being introduced.

301g The ***TW-250*** system employs a constant back pressure valve to maintain the skim back pressure on the separator. It is important to run this system at a minimum of 4 bar.

301h The combination of top filling whilst bottom emptying of tanks feeding the facility should be avoided.

302 The effect of pressure

The effect of pressure may not display itself in the production of inaccurate results however pressure fluctuations are to be avoided. Especially counter pressure to the system. In some installations it may be necessary to install a boost pump on the milk side to overcome the effect of system back pressure. On the milk side it is more important that the back pressure is constant rather than eliminated and it is therefore recommended that a constant pressure valve is used in conjunction with the pump.

It is most important that the surplus cream line flows directly to atmosphere.

303 The effect of temperature

The effect of temperature is compensated for however rapid fluctuations in product temperatures may influence the readings and compromise the process.

304 The effect of system siting

The system should be installed as close to the separator as possible to minimise the process lag.

305 The effect of flow

The flow to the separator should be controlled at the design throughput.

306 The effect of the production run

The system goes through a start-up phase before measuring and controlling values during this time the unit uses default values from the last time the particular product combination was selected. Once measuring and controlling commence the unit requires time to "settle" down therefore short production runs are to be avoided.

307 The effect of a separator discharge

The process of a separator discharge results in a falling flow and the introduction of air hence the indicated measured variable should be disregarded. The ***TW-250*** predicts the effect of the discharge by freezing the valves and the calculations for the duration of the disturbance. In order for this to take place a signal from the separator discharge valve is fed to a relay to generate a volt free contact for the plc this is then coded through a series of time filters to accommodate the process lag.

Section 4
The Wincanton Standardiser Model TW-200/ TW-250

The Operator Interface

400 The operator interface

Please refer to screen images for guidance

401 The power up screen

Defaulted to on power up, this screen contains copyright information.
Exit by pressing

F10

402 The logo screen

Defaulted to on exit of the previous screen, this displays the

W

logo of **WINCANTON ENGINEERING LTD.**

Exit by pressing

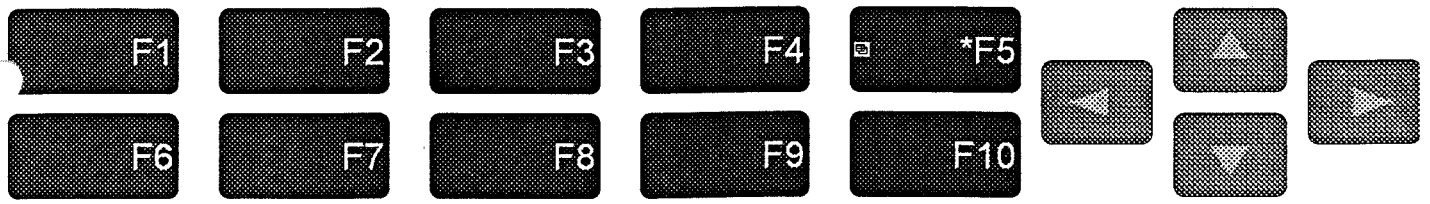
F10

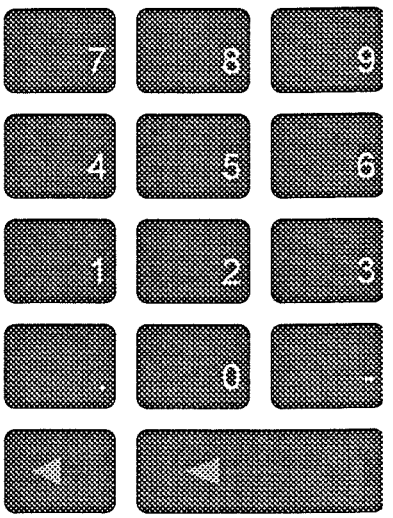
403 The main menu screen

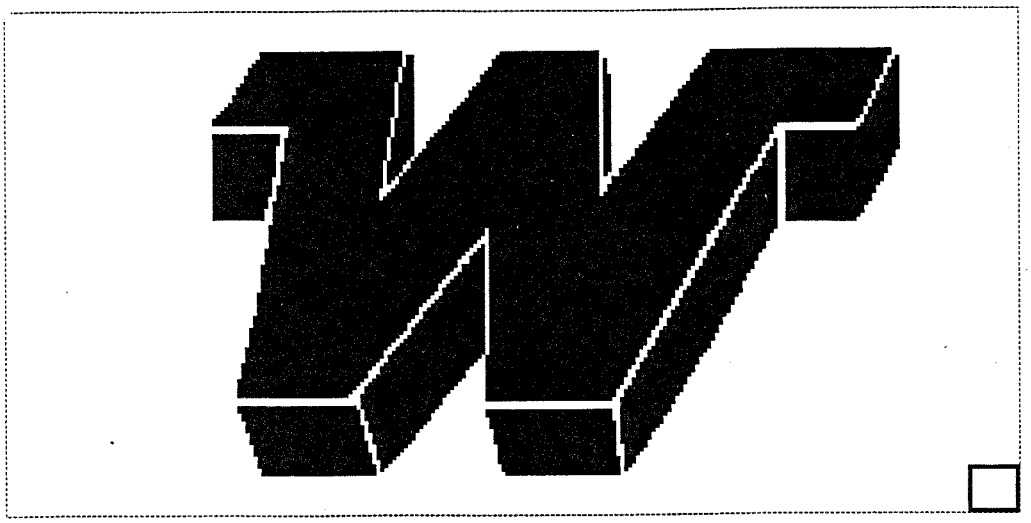
The main menu screen is defaulted to on exit of the logo screen. It is scrolling list selector with a highlighted bar, to select an option move the highlighted bar over the option using the **UP** and **DOWN** keys. Then press the **ENTER** key.

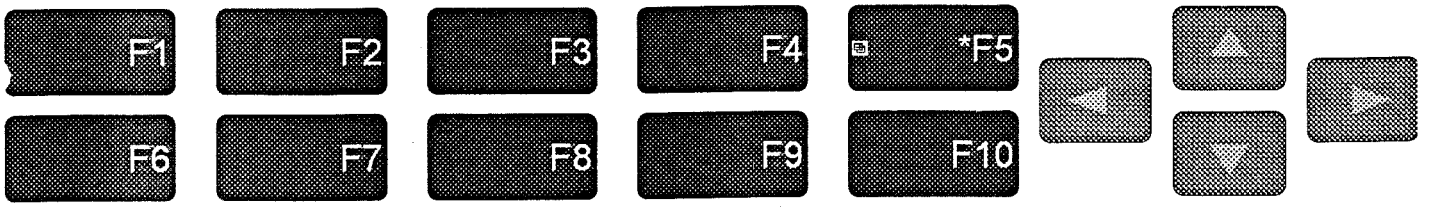
H15

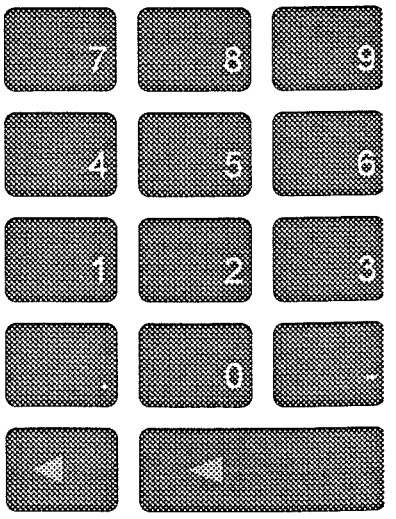
Prepared by: JBT Ltd.








F1
F2
F3
F4
*F5
F6
F7
F8
F9
F10


7
8
9
4
5
6
1
2
3
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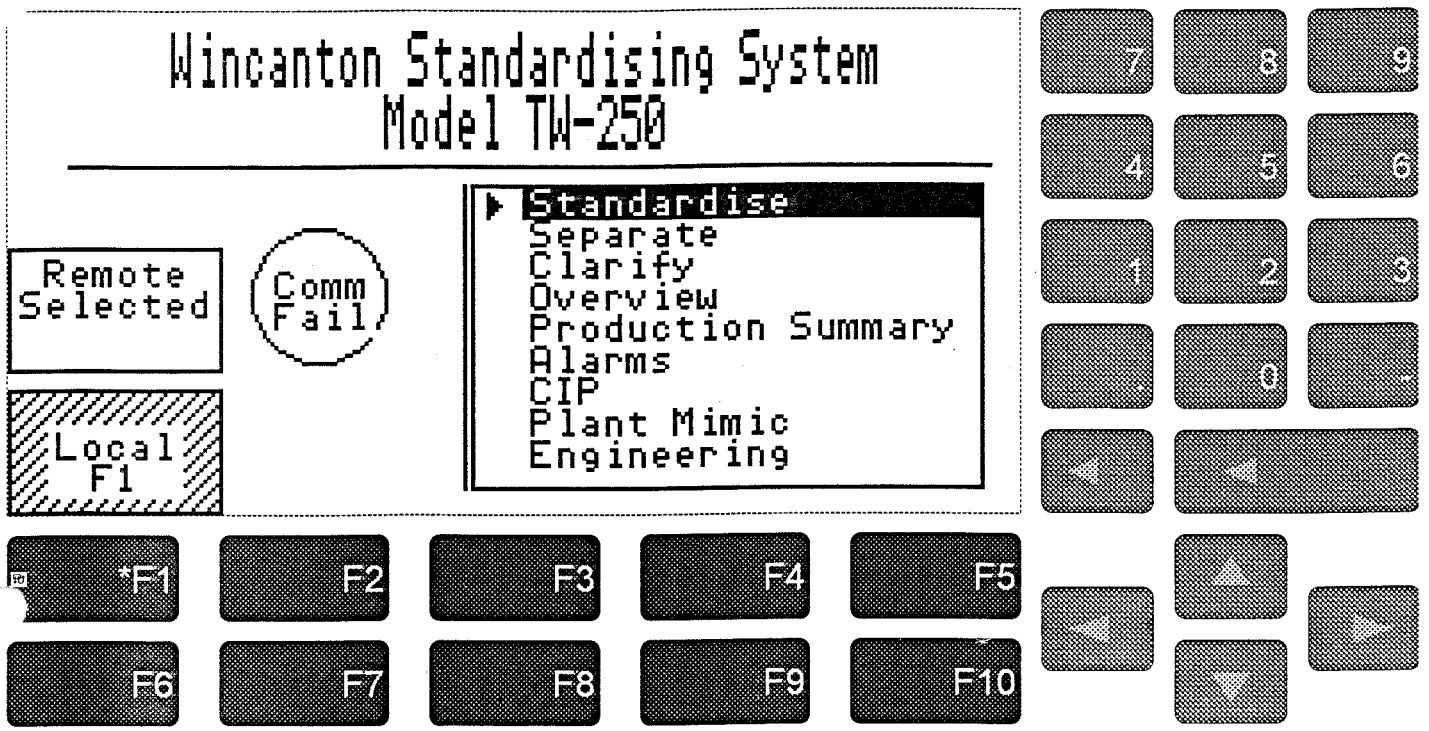
0
-


Wincanton Standardising System
Model TW-250
Remote Selected
Comm Fail
Local F1
Standardise
Separate
Clarify
Overview
Production Summary
Alarms
CIP
Plant Mimic
Engineering
7
8
9
4
5
6
1
2
3
.
0
-
*F1
F2
F3
F4
F5
F6
F7
F8
F9
F10

404 Process screen STANDARDISE

The screen is entitled Standardiser set-up and the message should read Standardiser ready. Data entry is required on this screen. Note the cream fat value is surrounded by a box as is the standard milk fat value, the box can be highlighted for data entry using the **UP** and **DOWN** keys, a highlighted box includes a vertical line to the left most edge. Once a box is highlighted a value can be entered, the value is a 3 digit value i.e.

376=37.6
16 = 1.6

After entering the numeric value press the **ENTER** key to accept.

Having selected the values required the standardiser is started by pressing **F6** which commences the start up sequence. The plant should be on milk when this is executed.

F7 executes a controlled closedown i.e. when flushing out with water use of this key before water is introduced will lock the valves in their current position for a controlled shutdown.

F8 executes an emergency stop

F4 changes the screen to the process overview

F5 changes the screen to the main menu

405 Process screen SEPARATE

This screen is entitled Separator set-up and the message should read Standardiser ready. Data entry is required on this screen. Note the cream fat value is surrounded by a box, the box can be highlighted for data entry using the **UP** and **DOWN** keys, a highlighted box includes a vertical line to the left most edge. Once a box is highlighted a value can be entered, the value is a 3 digit value i.e.

376 = 37.6

After entering the numeric value press the **ENTER** key to accept.

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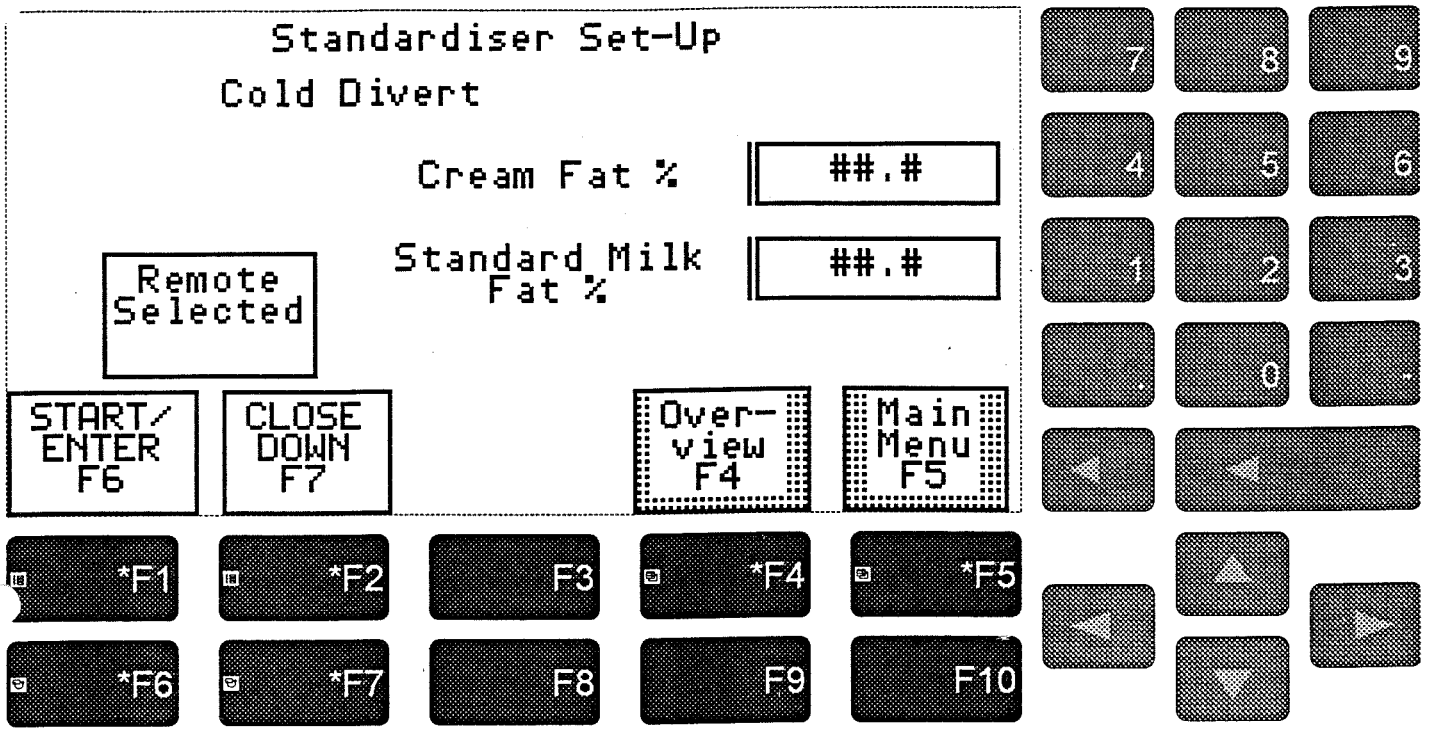
Standardiser Set-Up
Cold Divert
Cream Fat %
##.#
Standard Milk Fat %
##.#
Remote Selected
START/ ENTER F6
CLOSE DOWN F7
Over- view F4
Main Menu F5
*F1
*F2
F3
*F4
*F5
*F6
*F7
F8
F9
F10
7
8
9
4
5
6
1
2
3
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0
-

405 **Process screen SEPARATE continued**

F8 executes an emergeny stop

F4 changes the screen to the process overview

F5 changes the screen to the main menu

406 **Process screen CLARIFIER**

This screen is entitled Clarifier set-up and the message should read Standardiser ready. Data entyr is required on this screen. Note the cream fat value is surrounded by a box, thebox can be highlighted for data entry using the **UP** and **DOWN** keys, a highlighted box includes a vertical line to the left most edge. Once a box is highlighted a value can be entered, the value is a 3 digit value i.e.

376 = 37.6

The fat value selected has no meaning as all cream is re blended selection of 40% is recommended.
After entering the numeric value press the **ENTER** key to accept.

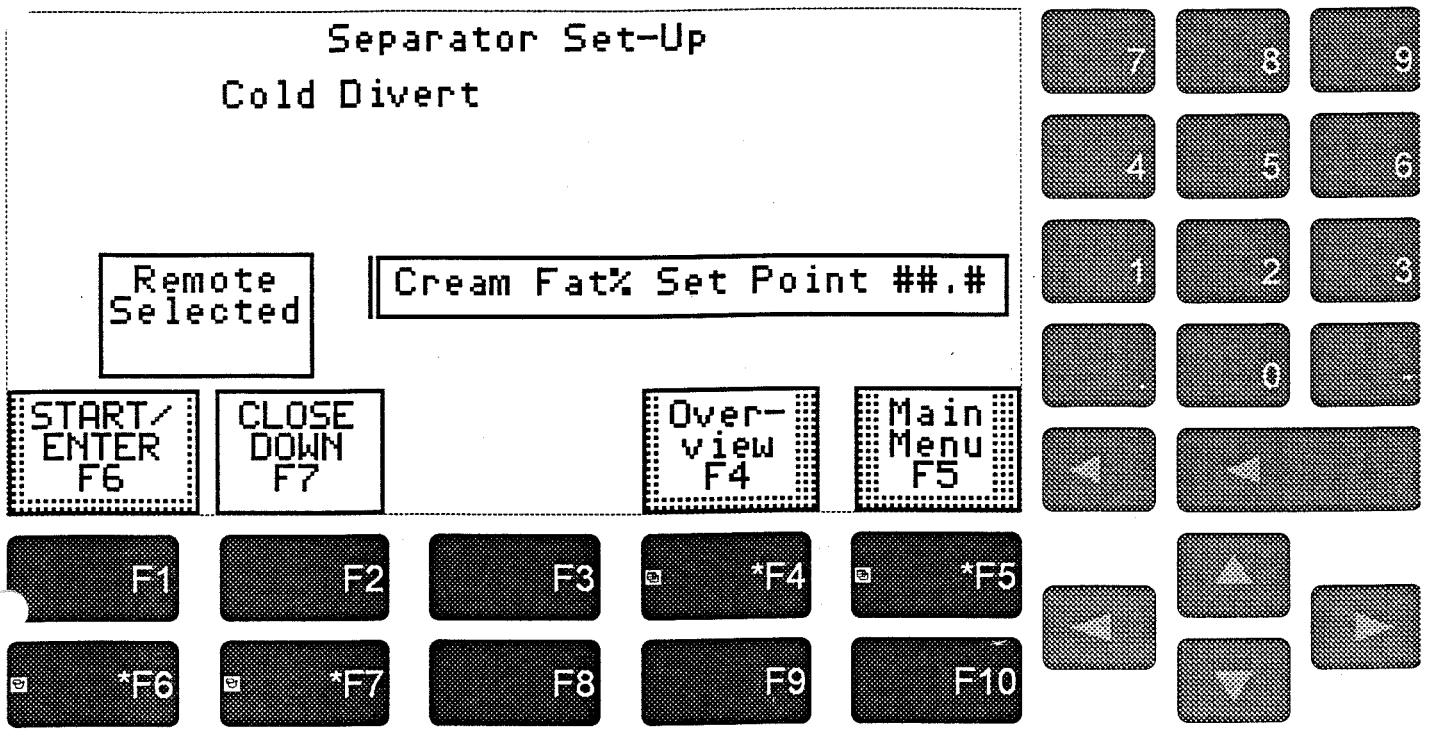
Having selected the values required the standardiser is started by press **F6** which commences the start up sequence. The plant should be on milk when this is executed.

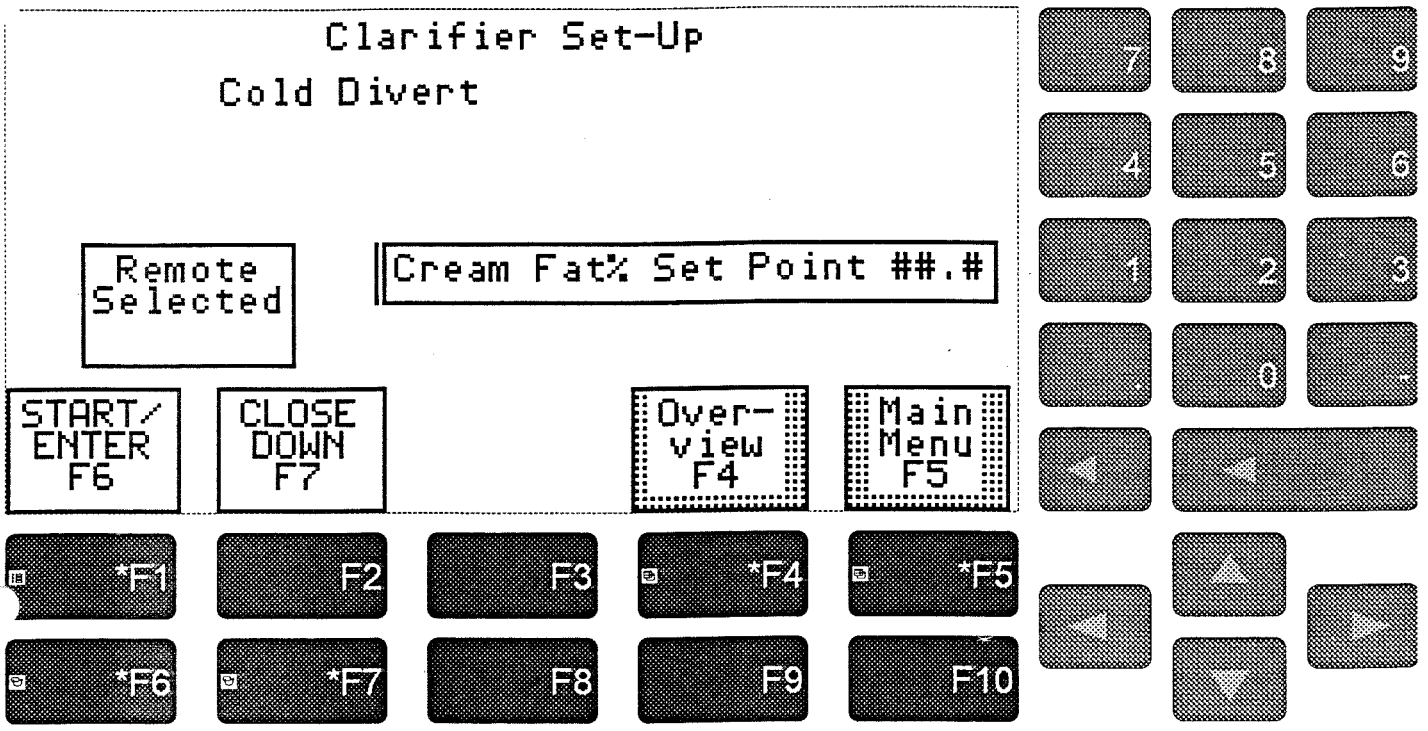
F7 executes a controlled closedown i.e. when flushing out with water use of this key before water is introduced will lock valves in their current position for a controlled shutdown.

F8 executes an emergency stop

F4 changes the screen to the process overview

F5 changes the screen to the main menu


Separator Set-Up
Cold Divert
Remote Selected
Cream Fat% Set Point ##.#
START/ ENTER F6
CLOSE DOWN F7
Over- view F4
Main Menu F5
F1
F2
F3
*F4
*F5
*F6
*F7
F8
F9
F10
7
8
9
4
5
6
1
2
3
0

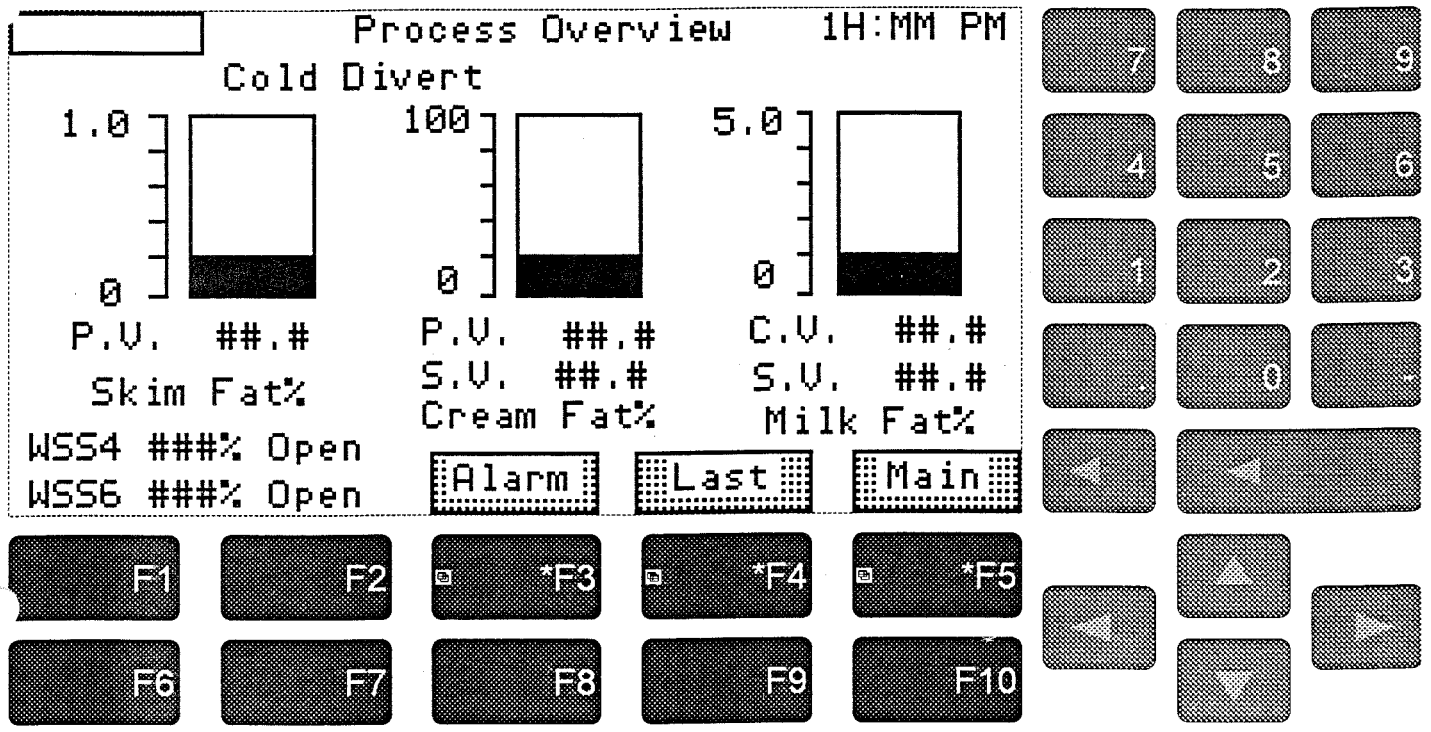

Clarifier Set-Up
Cold Divert
Remote Selected
Cream Fat% Set Point ##.#
START/ ENTER F6
CLOSE DOWN F7
Over- view F4
Main Menu F5
*F1
F2
F3
*F4
*F5
*F6
*F7
F8
F9
F10
7
8
9
4
5
6
1
2
3
0

Wincanton Standardising System
MODEL TW-200 & 250

407 Process Overview

As the name suggests this screen allows the operator to have an overview of the complete plant, along the title bar is the time. Following is a description of the screen content.

	Left screen	Centre	Right
Product	Skimmed milk	Cream	Standardised
Display	Bar chart 0-1%	Bar chart 0-100%	Barchart 0-5%
Values	Process variable	Process variable	Calculated var
		Set point	Set point
Valve	Cream valve % open		
posn	Re blend valve % open		


Process Overview
1H:MM PM
Cold Divert
1.0
0
P.V. ##.#
Skim Fat%
100
0
P.V. ##.#
S.V. ##.#
Cream Fat%
5.0
0
C.V. ##.#
S.V. ##.#
Milk Fat%
WSS4 ###% Open
WSS6 ###% Open
Alarm
Last
Main
7
8
9
4
5
6
1
2
3
.
0
-
F1
F2
*F3
*F4
*F5
F6
F7
F8
F9
F10

408 Changing Valves Whilst in Production

Values of cream fat percentage and milk fat percentage can be changed whilst "on the run". This is done as follows:-

1. Select the appropriate screen ie. Separate when separting etc.
2. Enter the new required fat percentage as described in 404 and 405 and
3. Press the Enter key to enter the values.
4. Press **F6** to restart the process.

409 Machines with Remote operation ie. from SCADA SYSTEMS

When machines are controlled by SCADA systems the fat values and run commands can be downloaded automatically providing the TW-250 is placed in remote mode.

The TW-250 machine No. P8755 is controlled in this way with live data being transmitted along the DH485 data highway from live "PLC B".

Data is transferred in words relating to the run state and the live PLC receives data words for fat percentages.

Section 5

The Wincanton Standardiser Model TW-200/ TW-250

Product Matrix

WINCANTON ENGINEERING Ltd

The Wincanton Standardising System

Operating Manual

Model Tw 200

Product Matrix

Wincanton Engineering Ltd
South St.
Sherborne
Dorset
Tel 01935 813741

WINCANTON ENGINEERING LIMITED

STANDARDISER OPERATION MATRIX

The following table is intended as a guide to possible combinations of milks / creams.

	MILK TYPE		
CREAM TYPE	SKIM	SEMI	STANDARDISED
SINGLE 20%	Yes	No	No
WHIPPING 38%	Yes	Yes	Yes
BUTTER 42%	Yes	Yes	Yes
DOUBLE 48%	Yes	Yes	Yes
CLOTTED 63%	Yes	No	No

Section 6

The Wincanton Standardiser Model TW-200/ TW-250

Diagnostics

THE WINCANTON STANDARDISING SYSTEM

DIAGNOSTICS PREFACE

Wincanton Standardising System
MODEL TW-200 & 250

Diagnostics Preface

Note

The unit is a sensitive piece of equipment. Care and attention to detail must be exercised at all times.

1. Adjustments should only be made by suitably familiar and competent personnel.

2. Prior to making any alterations to system set up log and record system settings before your start.

3. Make minimal progressive adjustments allowing time for the process to respond to each change.

WINCANTON ENGINEERING Ltd

The Wincanton Standardising System

Operating Manual

Model Tw 200

Problem Solving

Diagnostics

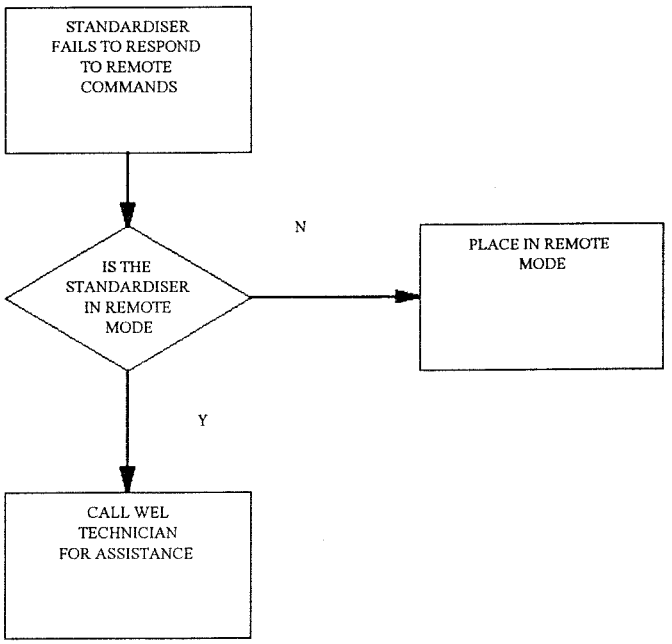
Wincanton Engineering Ltd
South St.
Sherborne
Dorset
Tel 01935 813741

WINCANTON ENGINEERING Ltd.

MILK STANDARDISER DIAGNOSTICS

MODEL TW - 200

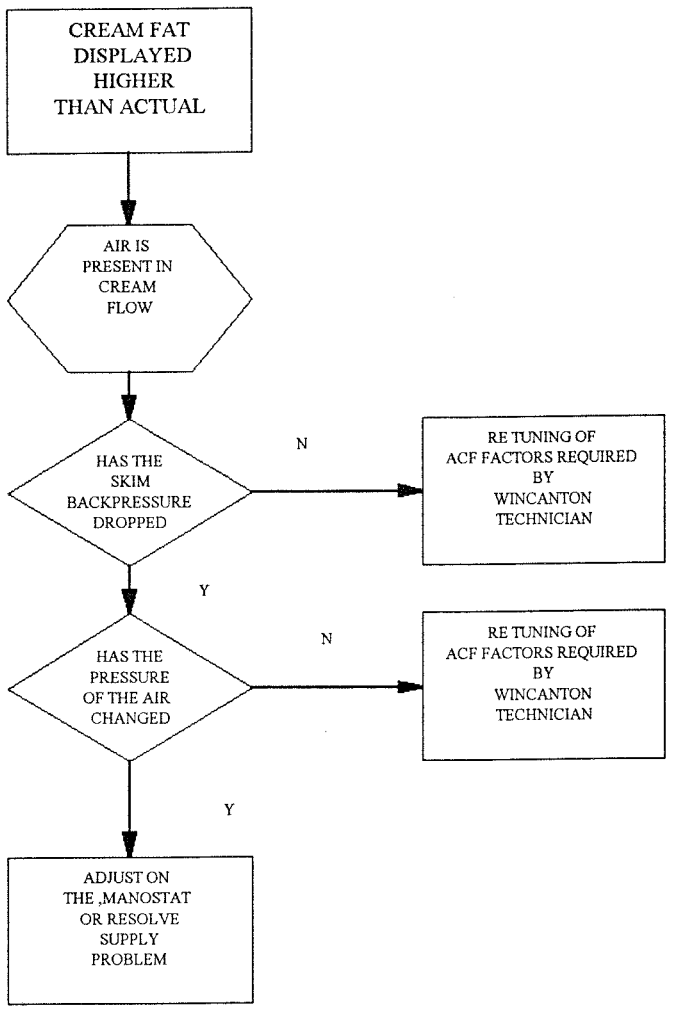
REMOTE
CONTROL
SYSTEMS
ONLY!



WINCANTON ENGINEERING Ltd.

MILK STANDARDISER DIAGNOSTICS

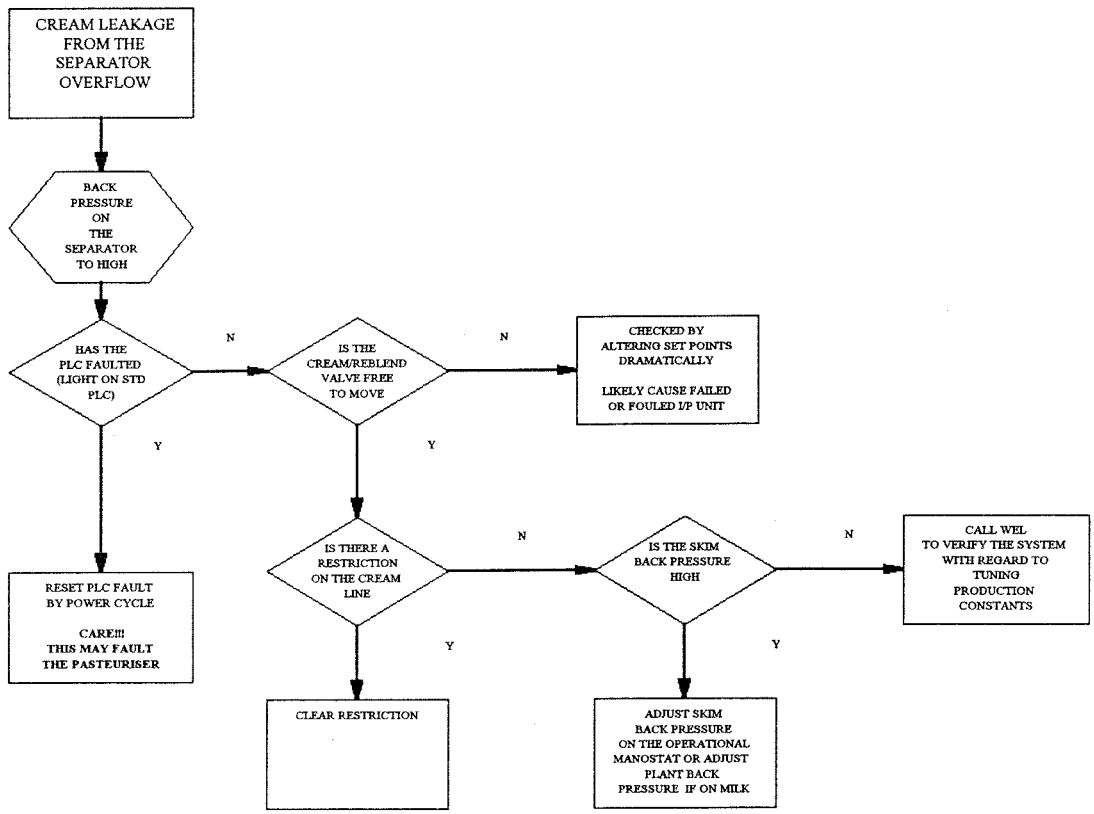
MODEL TW - 200



WINCANTON ENGINEERING Ltd.

MILK STANDARDISER DIAGNOSTICS

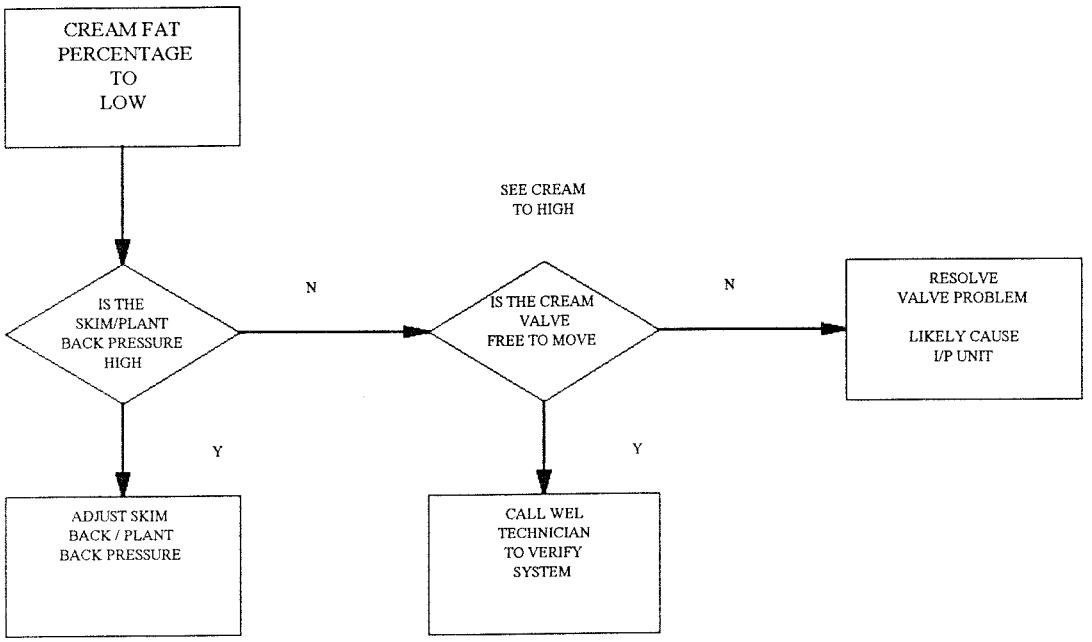
MODEL TW - 200



WINCANTON ENGINEERING Ltd.

MILK STANDARDISER DIAGNOSTICS

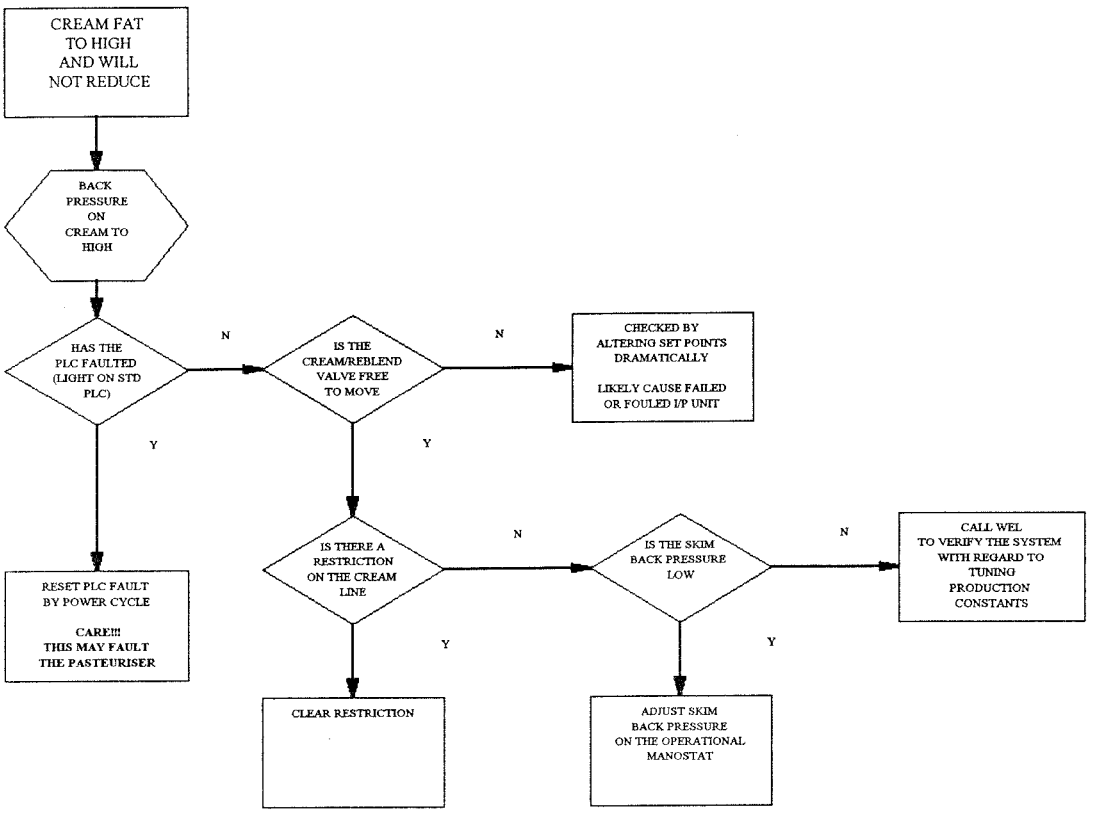
MODEL TW - 200



WINCANTON ENGINEERING Ltd.

MILK STANDARDISER DIAGNOSTICS

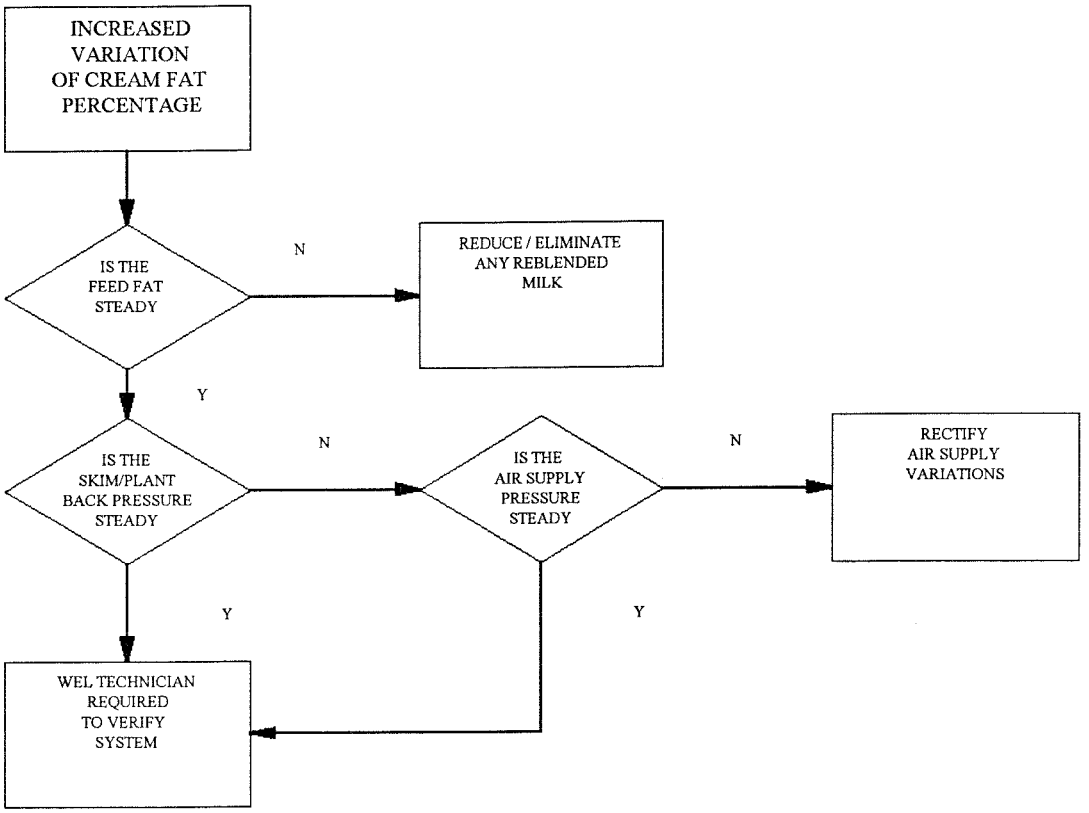
MODEL TW - 200



WINCANTON ENGINEERING Ltd.

MILK STANDARDISER DIAGNOSTICS

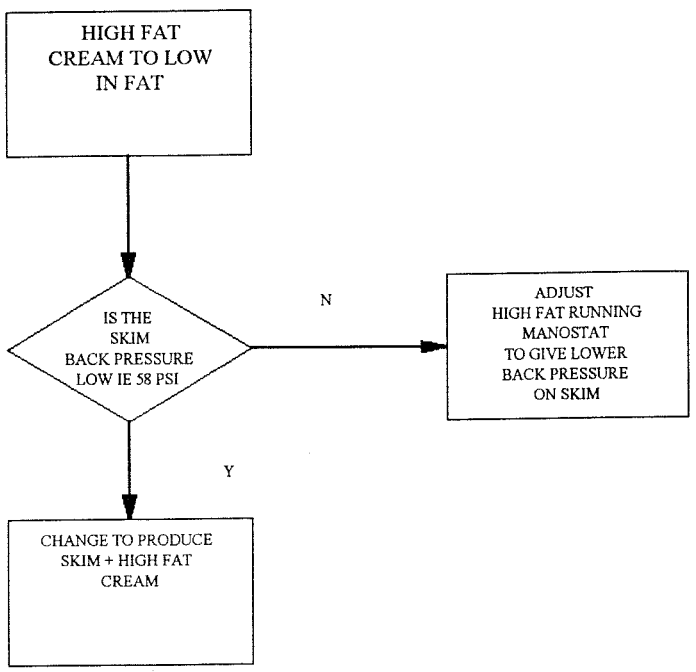
MODEL TW - 200



WINCANTON ENGINEERING Ltd.

MILK STANDARDISER DIAGNOSTICS

MODEL TW - 200

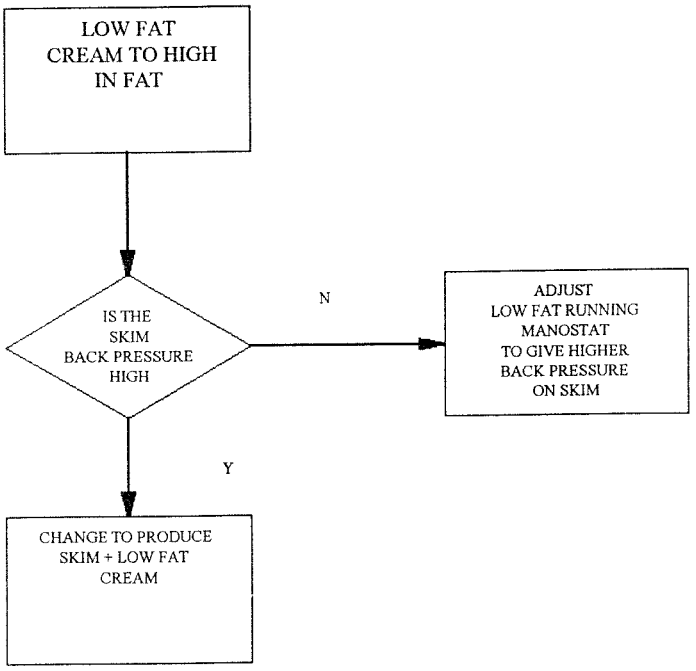


WINCANTON ENGINEERING Ltd.

MILK STANDARDISER DIAGNOSTICS

MODEL TW - 200

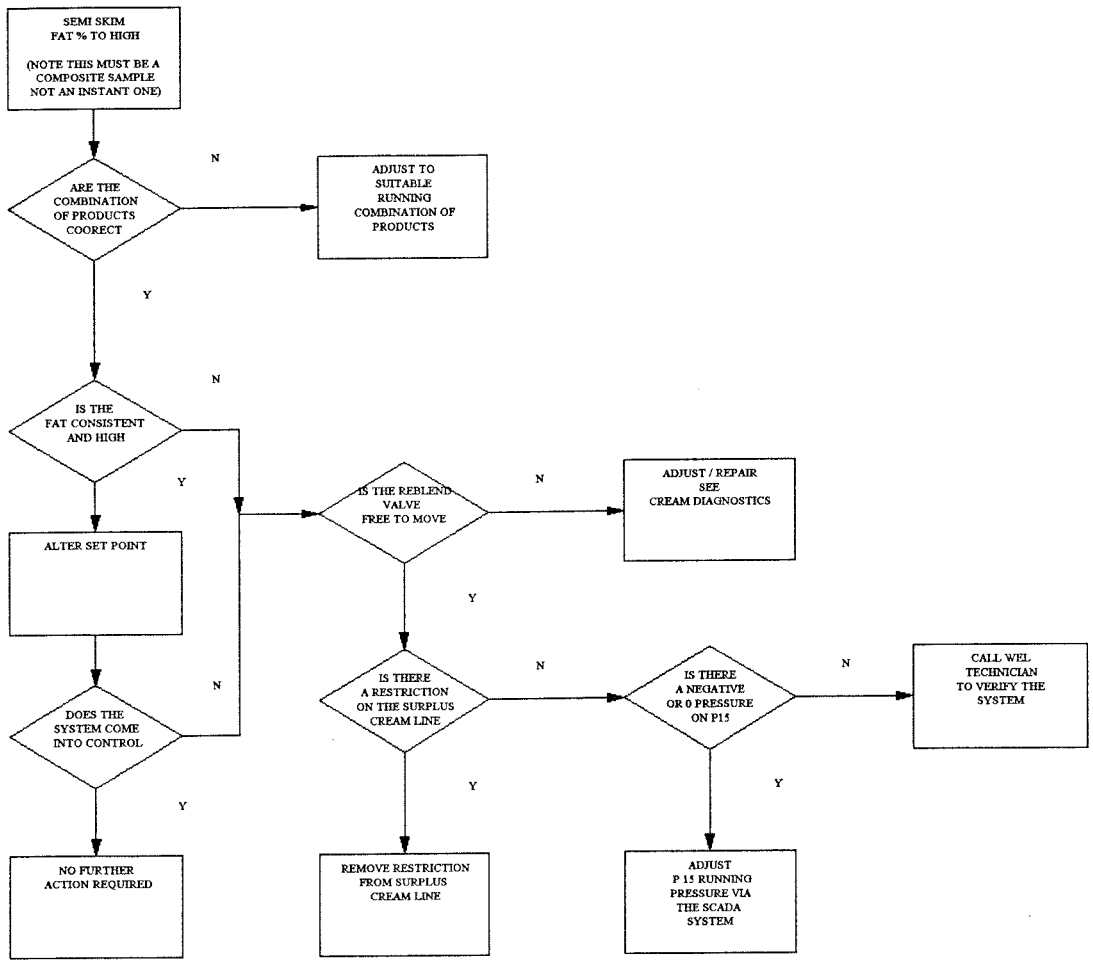
PRODUCTION OF LOW FAT CREAM IE SINGLE MAY REQUIRE ADJUSTMENTS OF THE LOW FAT RUNNING MANOSTAT TO ACHIEVE DESIRED CREAM FAT AND ACHIEVE CONTROL



WINCANTON ENGINEERING Ltd.

MILK STANDARDISER DIAGNOSTICS

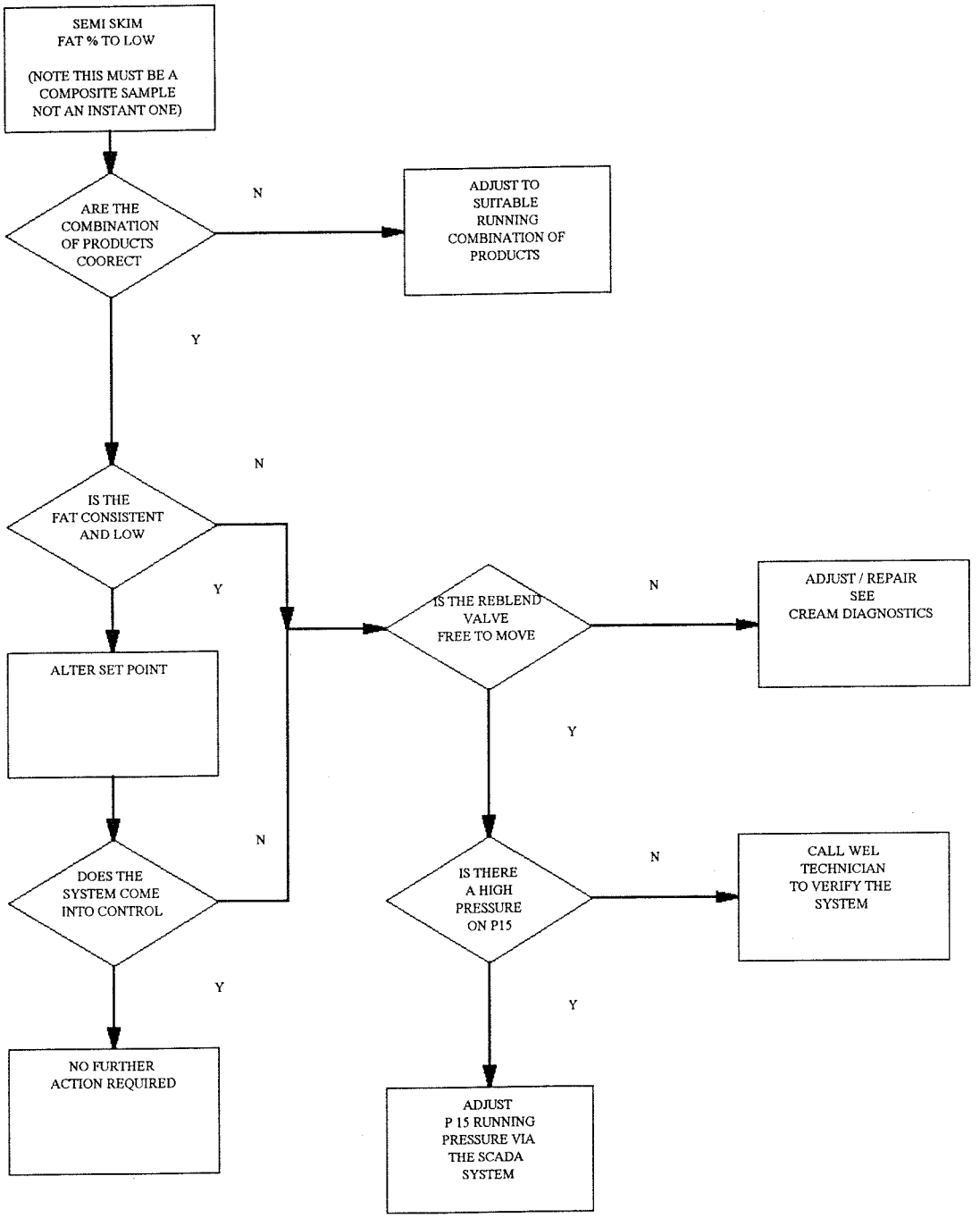
MODEL TW - 200



WINCANTON ENGINEERING Ltd.

MILK STANDARDISER DIAGNOSTICS

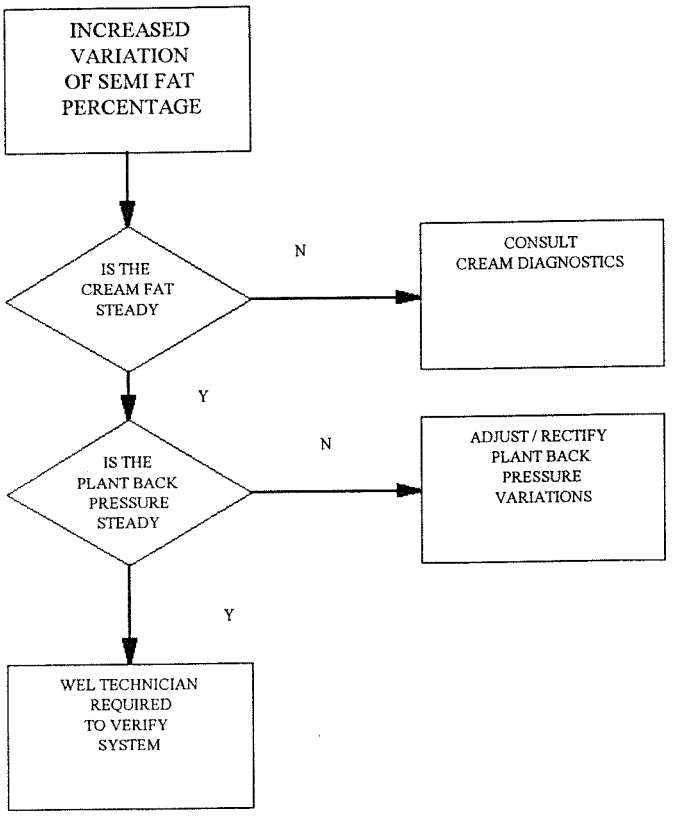
MODEL TW - 200



WINCANTON ENGINEERING Ltd.

MILK STANDARDISER DIAGNOSTICS

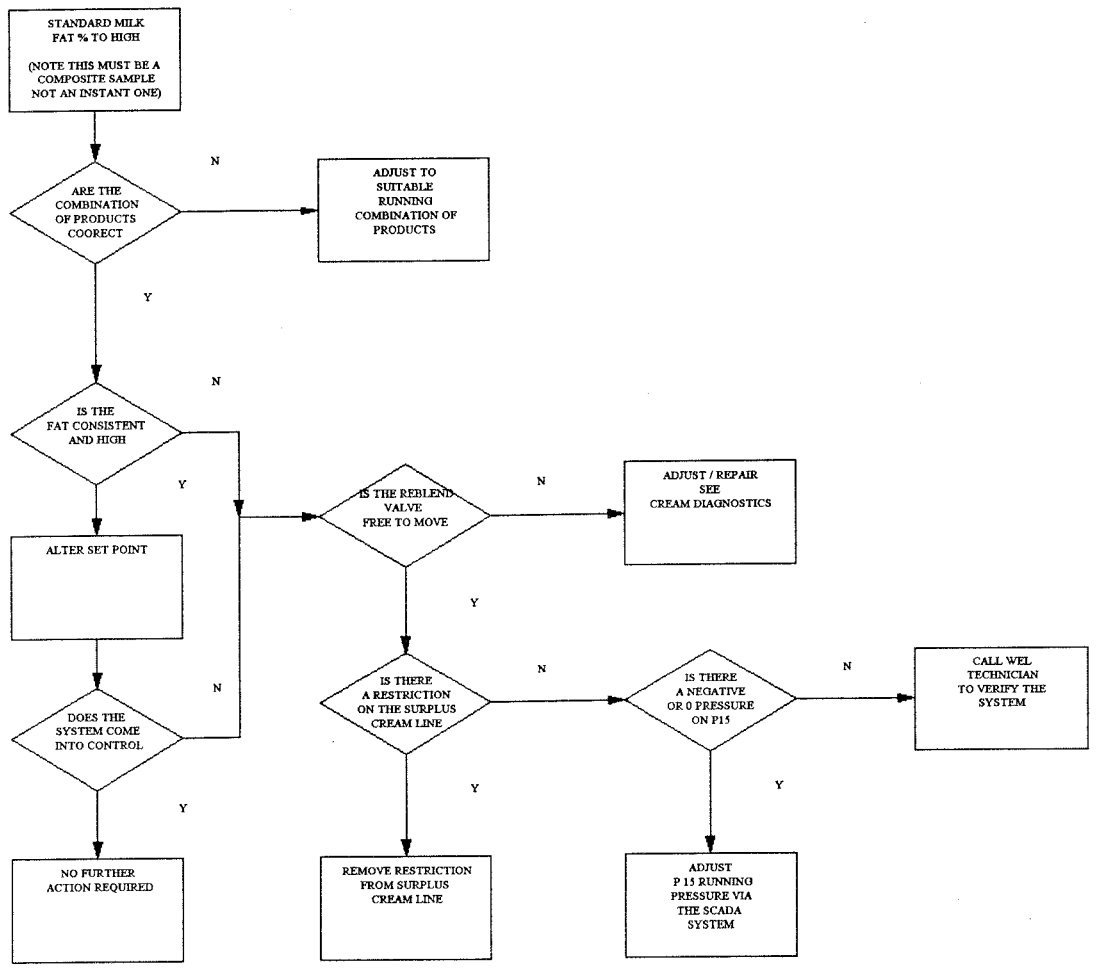
MODEL TW - 200



WINCANTON ENGINEERING Ltd.

MILK STANDARDISER DIAGNOSTICS

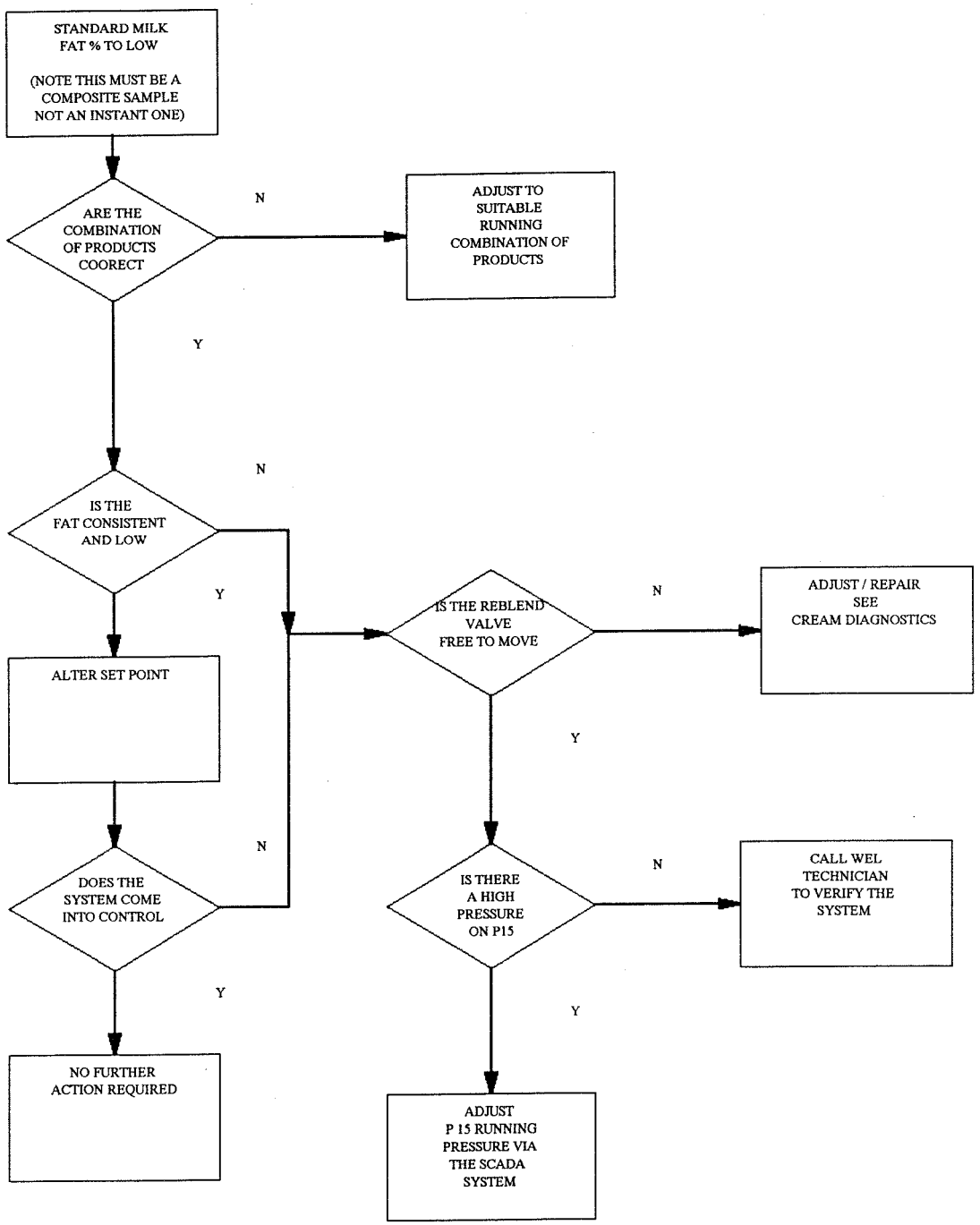
MODEL TW - 200



WINCANTON ENGINEERING Ltd.

MILK STANDARDISER DIAGNOSTICS

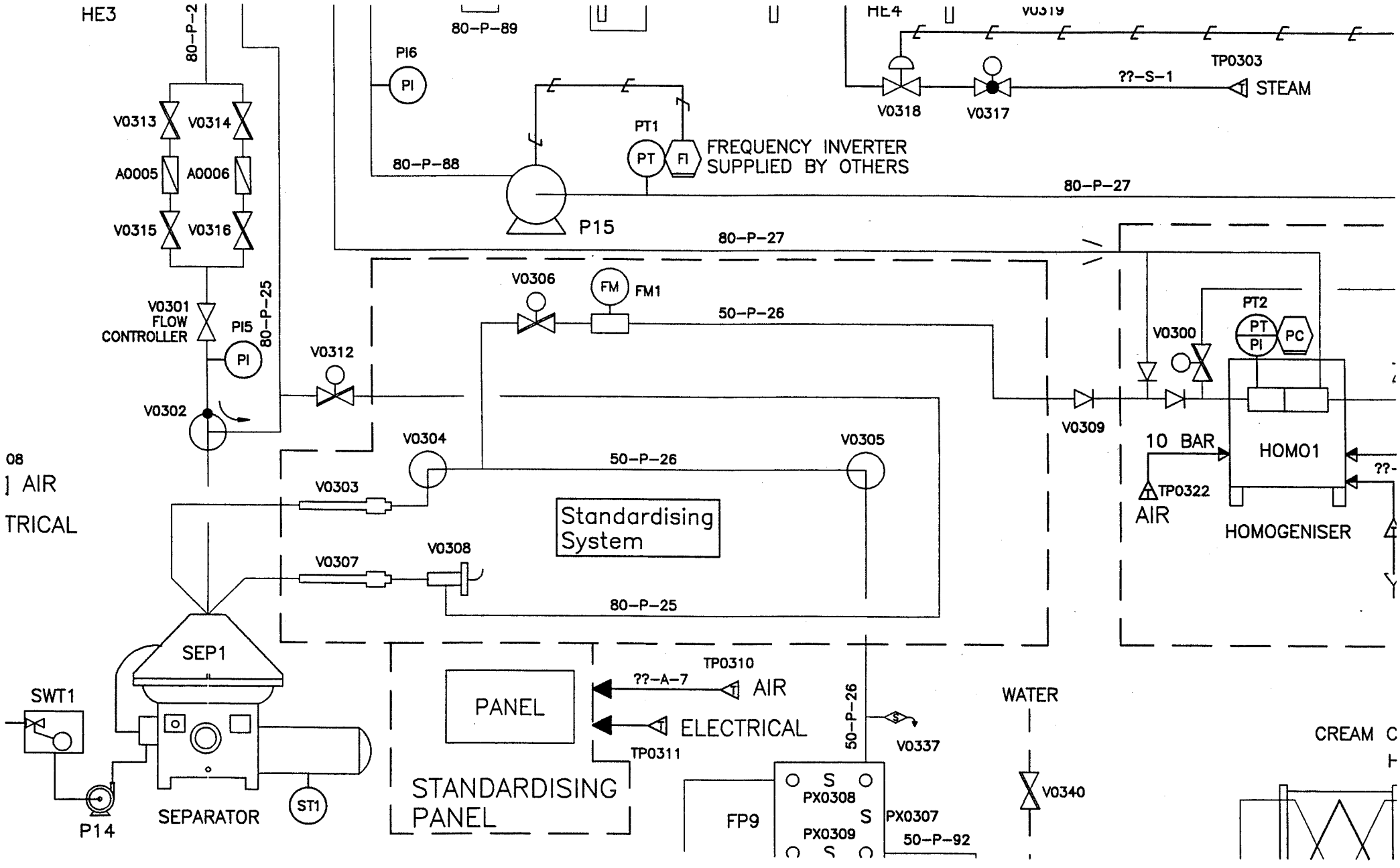
MODEL TW - 200



Section 7

The Wincanton Standardiser Model TW-200/ TW-250

Line Diagram


HE3
80-P-2
80-P-89
PI6
PI
V0313
V0314
A0005
A0006
V0315
V0316
V0301
FLOW
CONTROLLER
PI5
80-P-25
V0302
80-P-88
PT1
PT
FI
FREQUENCY INVERTER
SUPPLIED BY OTHERS
P15
HE4
V0319
TP0303
??-S-1
STEAM
V0318
V0317
80-P-27
V0306
FM
FM1
50-P-26
V0312
V0300
PT2
PT
PI
PC
V0309
10 BAR
HOMO1
TP0322
AIR
HOMOGENISER
V0304
V0305
50-P-26
V0303
Standardising
System
V0307
V0308
80-P-25
08
AIR
TRICAL
SEP1
SWT1
P14
SEPARATOR
ST1
PANEL
TP0310
??-A-7
AIR
ELECTRICAL
TP0311
STANDARDISING
PANEL
50-P-26
V0337
WATER
V0340
FP9
PX0308
PX0309
PX0307
50-P-92
CREAM C

Section 8

The Wincanton Standardiser Model TW-200/ TW-250

Calibration Reports

CALIBRATION REPORT

Danfoss Industrial Instrumentation

Identity

Customer	:		
Converter type	: MASS3000	Serial no. :	Reference converter
Sensor type	: MASS2100 DI40	Serial no. :	128703N335
Cal. factor MASS1000	: 35142-26		
Cal. factor MASS3000	: 3.610 uS/kg*s	Sensor TC. :	-0.0443 %/°C

Calibration Data

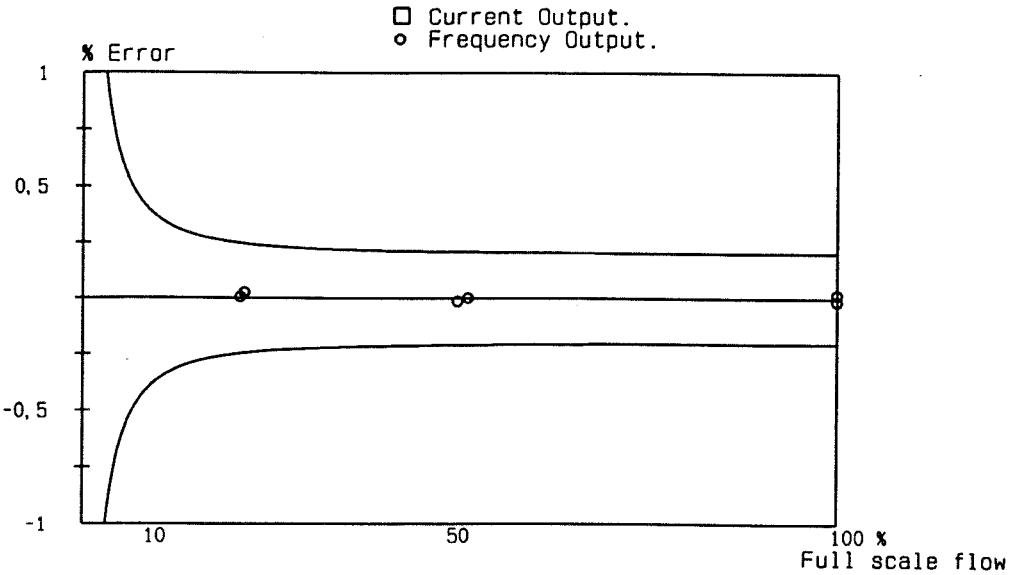
Full scale flow	: 19866 Kg/h.	Calibration liquid	: Water
Calibration mass	: 253 Kg.	Calibration rig	: 8636

Settings

Frequency output	: 0-10000 Hz	Current output	: Not Recorded

Calibration Results

Test No.	Full scale Flow	Water Temp	True Mass	Flowmeter Current Output			Flowmeter Frequency Output		
				Output	Mass	Error	Output	Mass	Error
	%	°C	kg	mA	kg	%	Hz	kg	%
1	103	24.7	252.009				10253.3	251.976	-0.01
2	102	24.6	250.235				10186.1	250.279	0.02
3	51	24.5	253.040				5099.1	253.045	0.00
4	50	24.4	252.260				4963.5	252.226	-0.01
5	21	24.4	253.652				2086.7	253.665	0.01
6	21	24.3	253.204				2142.2	253.270	0.03
7									
8									
9									
10									



Calibrated by : KM

Date : 95.08.16 Time : 13.42

Approved by :

Date : 95-08-18

CALIBRATION REPORT

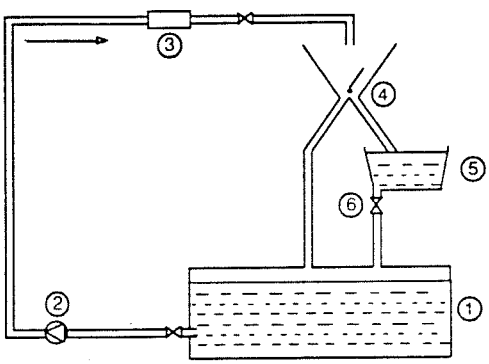
Danfoss Industrial Instrumentation

Reference Conditions

Calibration Rig

The test rigs work according to the static weighing method, of the ISO 4185 "Measurement of fluid flow in closed conduits". See diagram below.

During calibration the meter under test (3) is compared with a weighing-out from a weighing tank (5). The diverter (4) controls start/stop of the required weighing-out. This quantity is compared with the totalized flowrate. Hence, the meter sensitivity can be derived from this.



1. Sump
2. Pump
3. Meter under calibration
4. Diverter
5. Weighing tank
6. Drain valve

Specification

Calibration Rig	DN 10, Rig No: 8634	DN 25, Rig No.: 8635	DN 50, Rig No: 8636
Liquid	Water	Water	Water
Meter capacity	DN 3 - DN 15	DN 15 - DN 25	DN 40 - DN 50
Max. Flowrate	2100 Kg/h	11000 Kg/h	22000 Kg/h
Min. Flowrate	30 Kg/h	350 Kg/h	500 Kg/h
Max. Mass	18 Kg	118 Kg	380 Kg
Uncertainty *)	E < 0,02%	E < 0,02%	E < 0,02%

*) The uncertainty has been set according to ISO 9368-1.

Traceability.

All readings which enter into the uncertainty calculations from the calibration rigs come from measuring instruments which in an uninterrupted row are traceable to international standards.

Measurement	Type	Manufacture	Traceable to
Temperature	Pt 1000	Danfoss	Jydsk Teknologisk Lab.
Mass	HBM27A	HBM	Dantest via Reference Weights
Time	3852.A	HP	DCF77 Braunschweig (freq.normal)

DENSITY CALIBRATION REPORT

Instrumentation

Identity

Customer	:		
Converter type	: MASS1000/3000	Serial no. :	Reference Converter
Sensor type	: 083L0176 DI40	Serial no. :	128703N335

Measurements:

Test No.	Calibration Liquid/air	True Density	Sensor Freq.
		kg/m3	Hz
1	Air	1.20	139.9660
2	Water	998.08	116.6918
3	Water	980.33	115.8216

Calibration Constant Density:

MASS3000	
A	-2.2545692100E+03
B	4.4694647800E+07
Density TC	-0.000444

Calibrations Constants Density:

MASS1000	
A	-2.2545692100E+03
B	4.4694647800E+07
Density TC	-0.000444
Addr.41	0
Addr.42	40
Addr.43	0
Addr.44	1826
Addr.52	39878
Addr.53	61483
Addr.54	10828
Addr.55	7807
Addr.56	3269
Addr.57	7145

Settings:

Current output : 0-20mA Density Scale : 800-1200kg/m3 RigNo : 1334

Density Verification:

Test No.	Liquid	True Temp.	True Density	Flowmeter Current Output		
				Output	Density	Error
		°C	kg/m3	mA	kg/m3	kg/m3
1	Water	21.2	997.89	9.883	997.65	-0.2
2	Water	64.5	980.83	9.038	980.75	-0.1

Temperature Verification:

Test No.	Calibration Liquid/air	True Temp.	Sensor Temp.	Temp. Error
		°C	°C	°C
1	Water	19.84	20.25	0.4
2	Water	65.22	65.37	0.2

Calibrated by :

Date : 95-08-18 Time : 12:18

Approved by :

Date : 95-08-18

Ver. 1.1 P

DENSITY CALIBRATION REPORT

Danfoss Industrial Instrumentation

Reference Conditions

Density measurement :
Density outputs on MASSFLO® massflow meter are calculated on the basis of fluid temperature and period of the sensor.

$$\text{Density} = A + B(1 + \alpha t)T^2$$

A,B = Calibration constants, α = Density TC, t = Fluid temperature, T = period time of sensor

Method of calibration:
Measurement :
For a density calibration of the sensor, measurements are taken at 3 different combinations of density and temperature :

1) Air - app. 25°C
2) Cold water - app. 20°C
3) Hot water - app. 65°C

Before each measurement the temperature is allowed to stabilize for 30 minutes.

Reference density for water is calculated from temperature measurement.

$$\text{Density} = C0 + C1 * t + C2 * t^2 + C3 * t^3 + C4 * t^4$$

C0 = 999.95046416
C1 = 0.0409832410
C2 = -0.0070894300
C3 = 0.0000353980
C4 = -0.0000001010
t = Water temperature

Reference density of air is 1.2 kg/m3

Calibration verification:
After completion of the measurements, the calibration factors are calculated and implemented in the reference converters of the testrig. The sensor is now operated with water, applying temperature steps in the sequence of app. 65 - 20 - 65 °C

Deviations of density and temperature are measured for 14 minutes after temperature step, results in report are the measurement after 14 minutes.
Deviations reported are the combined deviation from sensor and testrig.

Traceability:

Measurement	Secondary measurement	Type of equipment	Testrig Uncertainty	Traceable to
Density	Frequency	Phillips PM6671	< 0.3 kg/m3	DCF77 Braunschweig
Temperature	-	Pt 1000 kl. A	< 0.5 °C	DTI, Denmark

CALIBRATION REPORT

Danfoss Industrial Instrumentation

Identity

Customer	:			
Converter type	: MASS3000		Serial no. :	Reference converter
Sensor type	: MASS2100	DI25	Serial no. :	139704N335
Cal. factor MASS1000	: 23555-15			
Cal. factor MASS3000	: 8.305	uS/kg*s	Sensor TC. :	-0.0448 %/°C

Calibration Data

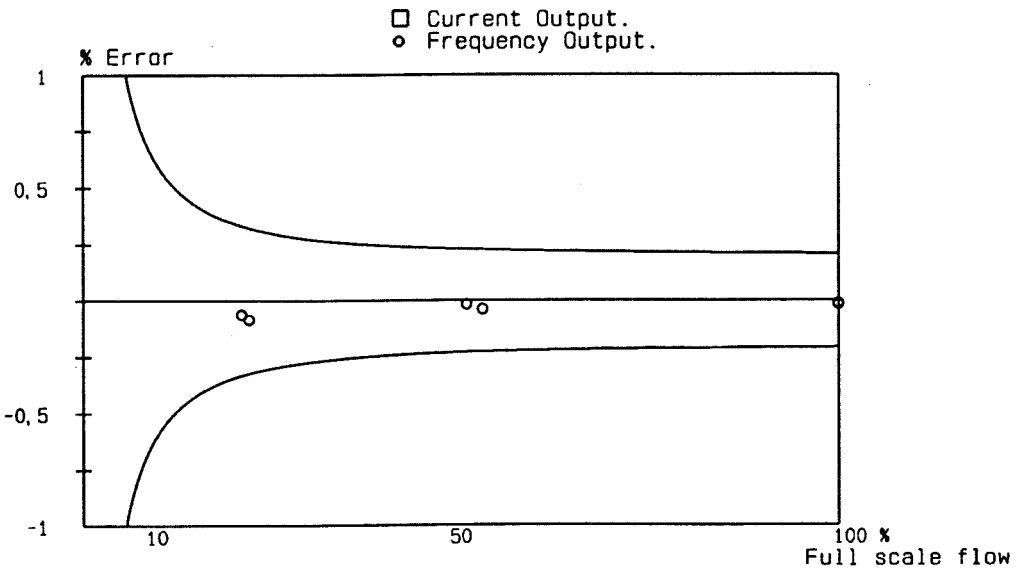
Full scale flow	: 11401 Kg/h.	Calibration liquid	: Water
Calibration mass	: 118 Kg.	Calibration rig	: 8635

Settings

Frequency output	: 0-10000 Hz	Current output	: Not Recorded

Calibration Results

Test No.	Full scale Flow	Water Temp	True Mass	Flowmeter Current Output			Flowmeter Frequency Output		
				Output	Mass	Error	Output	Mass	Error
	%	°C	kg	mA	kg	%	Hz	kg	%
1	103	25.4	117.742				10259.2	117.722	-0.02
2	102	25.4	116.586				10156.6	116.571	-0.01
3	53	25.3	118.695				5280.0	118.649	-0.04
4	51	25.3	117.914				5065.8	117.893	-0.02
5	22	25.3	118.134				2190.4	118.036	-0.08
6	21	25.3	118.062				2091.3	117.990	-0.06
7									
8									
9									
10									



Calibrated by : PD

Date : 95.08.15 Time : 15.12

Approved by :

Date : 95-08-18

CALIBRATION REPORT

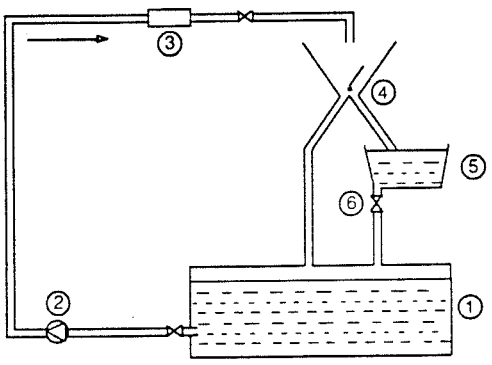
Danfoss Industrial Instrumentation

Reference Conditions

Calibration Rig

The test rigs work according to the static weighing method, of the ISO 4185 "Measurement of fluid flow in closed conduits". See diagram below.

During calibration the meter under test (3) is compared with a weighing-out from a weighing tank (5). The diverter (4) controls start/stop of the required weighing-out. This quantity is compared with the totalized flowrate. Hence, the meter sensitivity can be derived from this.



1. Sump
2. Pump
3. Meter under calibration
4. Diverter
5. Weighing tank
6. Drain valve

Specification

Calibration Rig	DN 10, Rig No: 8634	DN 25, Rig No.: 8635	DN 50, Rig No: 8636
Liquid	Water	Water	Water
Meter capacity	DN 3 - DN 15	DN 15 - DN 25	DN 40 - DN 50
Max. Flowrate	2100 Kg/h	11000 Kg/h	22000 Kg/h
Min. Flowrate	30 Kg/h	350 Kg/h	500 Kg/h
Max. Mass	18 Kg	118 Kg	380 Kg
Uncertainty *)	E < 0,02%	E < 0,02%	E < 0,02%

*) The uncertainty has been set according to ISO 9368-1.

Traceability.

All readings which enter into the uncertainty calculations from the calibration rigs come from measuring instruments which in an uninterrupted row are traceable to international standards.

Measurement	Type	Manufacture	Traceable to
Temperature	Pt 1000	Danfoss	Jydsk Teknologisk Lab.
Mass	HBM27A	HBM	Dantest via Reference Weights
Time	3852.A	HP	DCF77 Braunschweig (freq.normal)

DENSITY CALIBRATION REPORT

Identity

Customer	:		
Converter type	: MASS1000/3000	Serial no. :	Reference Converter
Sensor type	: 083L0280 DI25	Serial no. :	139704N335

Measurements:

Test No.	Calibration Liquid/air	True Density	Sensor Freq.
		kg/m3	Hz
1	Air	1.20	146.4494
2	Water	998.14	128.1225
3	Water	980.63	127.1008

Calibration Constant Density:

MASS3000	
A	-3.2228692200E+03
B	6.9907512200E+07
Density TC	-0.000443

Calibrations Constants Density:

MASS1000	
A	-3.2228692200E+03
B	6.9907512200E+07
Density TC	-0.000443
Addr.41	0
Addr.42	35
Addr.43	0
Addr.44	1826
Addr.52	61894
Addr.53	59568
Addr.54	34124
Addr.55	34646
Addr.56	18885
Addr.57	59501

Settings:

Current output : 0-20mA Density Scale : 800-1200kg/m3 RigNo : 1334

Density Verification:

Test No.	Liquid	True Temp.	True Density	Flowmeter Current Output		
				Output	Density	Error
		°C	kg/m3	mA	kg/m3	kg/m3
1	Water	20.8	997.97	9.898	997.95	0.0
2	Water	60.6	982.89	9.135	982.70	-0.2

Temperature Verification:

Test No.	Calibration Liquid/air	True Temp.	Sensor Temp.	Temp. Error
		°C	°C	°C
1	Water	19.86	19.97	0.1
2	Water	65.27	64.83	-0.4

Calibrated by :

Date : 95-08-17 Time : 10:23

Approved by :

Date : 95-08-18

DENSITY CALIBRATION REPORT

Danfoss Industrial Instrumentation

Reference Conditions

Density measurement :
Density outputs on MASSFLO® massflow meter are calculated on the basis of fluid temperature and period of the sensor.

$$\text{Density} = A + B(1 + \alpha t)T^2$$

A,B = Calibration constants, α = Density TC, t = Fluid temperature, T = period time of sensor

Method of calibration:
Measurement :
For a density calibration of the sensor, measurements are taken at 3 different combinations of density and temperature :

1) Air - app. 25°C
2) Cold water - app. 20°C
3) Hot water - app. 65°C

Before each measurement the temperature is allowed to stabilize for 30 minutes.

Reference density for water is calculated from temperature measurement.

$$\text{Density} = C0 + C1 * t + C2 * t^2 + C3 * t^3 + C4 * t^4$$

C0 = 999.95046416
C1 = 0.0409832410
C2 = -0.0070894300
C3 = 0.0000353980
C4 = -0.0000001010
t = Water temperature

Reference density of air is 1.2 kg/m3

Calibration verification:
After completion of the measurements, the calibration factors are calculated and implemented in the reference converters of the testrig. The sensor is now operated with water, applying temperature steps in the sequence of app. 65 - 20 - 65 °C

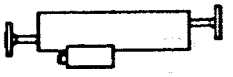
Deviations of density and temperature are measured for 14 minutes after temperature step, results in report are the measurement after 14 minutes.
Deviations reported are the combined deviation from sensor and testrig.

Traceability:

Measurement	Secondary measurement	Type of equipment	Testrig Uncertainty	Traceable to
Density	Frequency	Phillips PM6671	< 0.3 kg/m3	DCF77 Braunschweig
Temperature	-	Pt 1000 kl. A	< 0.5 °C	DTI, Denmark

INSTRUCTIONS

MASSFLO® mass flowmeter type MASS 2100



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Introduktion
Introduction

DANSK

Danfoss MASSFLO® masse flowmåler er en flowmåler til direkte måling af:

- Masseflow
- Total masse
- Massefylde
- Temperatur
- Volumenflow
- Total volumen
- Fraktionsflow
- % fraktionsflow
- Total fraktion

MASSFLO® masse flowmåler måler den gennemstrømmende masse direkte i kilogram uden omregning, og målingen er uafhængig af ændringer i væsketemperatur, massefylde, tryk, viskositet, ledningsevne og flowprofil.

Med masse flowmåleren kan man også måle masseflowet af væsker med homogent fordelte luft- og faststofandele. Større luftansamlinger derimod forstyrrer målingen.

Denne instruktion beskriver den mekaniske montage af målehoved type MASS 2100.

Beskrivelse af den korrekte placering af målehoved type MASS 2100 i systemet er givet i manualen, som leveres med signalomsætteren. Elektrisk tilslutning er ligeledes angivet i manualen.

Målenøjagtighed
Monteres MASSFLO® masse flowmåleren i henhold til montageanvisningen, er den upåvirkelig af ydre forstyrrelser og kan måle med en stor nøjagtighed. Måleunøjagtigheden er mindre end ±0,15% af målt værdi i et stort måleområde.

Præcisionsmålesystem
Masse flowmåleren er et præcisionsmålesystem. Trods sin robuste opbygning er det vigtigt, at MASSFLO® masse flowmåler behandles og installeres efter anvisning, givet i denne instruktion.

Håndtering
Flowmåleren bør behandles forsigtigt.
Slag og stød kan i værste fald give anledning til ubalance i målehovedet MASS 2100 med forringet målenøjagtighed til følge.

Montering
Ved montering af masse flowmåleren er det ikke nødvendigt at tage hensyn til turbulensgenererende komponenter, såsom rørbøjninger, T-stykker, ventiler m.m., idet måleren ikke påvirkes af, hvordan indløbsforholdene er. Dog skal man undgå kavitation i anlægget, da det kan forstyrre målingen.

Det anbefales at montere måleren vandret. Derved hindres medførte faststofandele i at aflejres i måleren, og målehovedet kan lettere tømmes for væske.

Man bør **altid** sikre, at målehovedet **ikke** tømmes for væske under normal drift, da det medfører fejlmålinger.

Ønsker man målehovedet monteret lodret, anbefales, at flowet er nedefra og op for lettere at kunne fjerne evt. luftbobler.
For at opnå en optimal funktion af måleudstyret er det vigtigt at følge montageanvisningen punkt for punkt.

ENGLISH

Danfoss MASSFLO® mass flowmeters are units for the direct measurement of:

- Mass flow rate
- Total mass
- Density
- Temperature
- Volumetric flowrate
- Total volume
- Fraction flow
- % fraction
- Total fraction

MASSFLO® mass flowmeters measure the flow direct in kilogrammes, without conversion. Measurements are independent of changes in liquid temperature, pressure, viscosity, conductivity, and flow profile.

With the mass flowmeter it is also possible to measure the mass flow of liquids containing homogeneous mixtures of air and solids.
However, large collections of air can disturb measurement.

This instruction covers the mechanical installation of the sensor type MASS 2100. For guidance in selecting the correct place in the system to install the sensor type MASS 2100 please see the manual which is packed with the signal converter. Data on the wiring up of the system is also given in the manual.

Measuring accuracy
Provided the MASSFLO® mass flowmeter is installed in accordance with the instructions it will be unaffected by external disturbances and will measure with high accuracy. Measuring inaccuracy is less than ±0.15% of the measured value, throughout a wide measuring range.

Precision measuring system
The mass flowmeter is a precision measuring system. It is very robust, but must be handled and installed in accordance with the instructions given.

Einführung
Introduction

Handling
The flowmeter should be handled carefully.
In the worst case impact and shock can produce imbalance in the MASS 2100 sensor, with consequent measuring inaccuracy.

Sensor mounting
When installing a mass flowmeter it is not necessary to take account of components that generate turbulence, such as pipe bends, T-pieces, valves, etc. because the meter is not affected by inlet conditions. However, cavitation in the system can disturb measurements and must be avoided.

Horizontal installation is recommended. This avoids solid particles being deposited in the meter and the sensor can be easier emptied.

Ensure that the sensor is **not** emptied during normal operation otherwise error measurement will occur.

If vertical installation is desired, upward flow in order to facilitate the removal of air bubbles is recommended.

To ensure the optimum function of measuring equipment it is important that the installation instructions be followed closely, point by point.

DEUTSCH

Der Danfoss MASSFLO® Masse Durchfluß–messer ist ein System für die direkte Messung von:
- Massedurchfluß
- Totaler Masse
- Dichte
- Temperatur
- Volumetrischem Durchfluß
- Totalem Volumen
- Fraktionsdurchfluß
- % Fraktion
- Totale Fraktion

MASSFLO® Masse Durchflußmesser messen die durchfließende Masse ohne jegliche Umrechnung direkt in Kilogramm, unabhängig von Änderungen der Flüssigkeitstemperatur, der Dichte, des Druckes, der Viskosität, der Leitfähigkeit oder des Durchflußprofils.

Der Masse Durchflußmesser ermöglicht auch die Messung von Flüssigkeiten mit homogen verteilten Gas- und Feststoffanteilen. Inhomogen verteilte Gaseinschlüsse (Gaspropfen) sind hingegen zu vermeiden.

In dieser Instruktion ist die Montage des Meßaufnehmers Typ MASS 2100 beschrieben.

Die Beschreibung der korrekten Anbringung des Meßaufnehmers Typ MASS 2100 im System ist aus dem Manual zu entnehmen, das dem Meßumformer beigefügt ist. Der elektrische Anschluß ist ebenfalls im Manual angegeben.

Meßgenauigkeit
Wird der MASSFLO® Masse Durchflußmesser entsprechend den Montageanweisungen installiert, können äussere Störquellen die hohe Meßgenauigkeit nicht beeinflussen. Die Meßgenauigkeit ist dann über einen grossen Meßbereich besser als ±0,15% des aktuellen Meßwertes.

Präzionsmeßsystem
Masse Durchflußmesser sind Präzisionssysteme. Trotz des robusten Aufbaus ist es wichtig, daß MASSFLO® Masse Durchflußmesser entsprechend den Ausführungen dieser Instruktion behandelt und installiert werden.

Handhabung
Der Durchflußmesser muß, wie jedes andere Meßgerät auch, vorsichtig behandelt werden.
Schläge bzw. Stöße gegen den Meßaufnehmer können Instabilitäten und damit verbundene Ungenauigkeiten hervorrufen.

Montage
Bei der Montage des Meßaufnehmers müssen keine Ein- und Auslaufstrecken vorgesehen werden. Turbulenzerzeugende Komponenten wie Rohrbögen, Ventile usw. beeinflussen die Massedurchflußmessung nicht. Kavitation in der Anlage muß jedoch vermieden werden, da diese die Messung stören kann.

Die waagerechte Montage des Durchfluß–messers wird empfohlen. Dadurch werden Ablagerungen von mitgeführten Feststoffen im Meßaufnehmer vermieden, und gleichzeitig ist es leichter, den Meßaufnehmer von Flüssigkeit zu entleeren.

Es muß sichergestellt werden, daß der Meß–aufnehmer bei normalem Betrieb **nicht** von Flüssigkeit entleert wird, da das zu falschen Messungen führt.

Bei senkrechter Montage des Meßaufnehmers empfehlen wir die Fließrichtung von unten nach oben zu wählen, damit evtl. Luftblasen leichter zu entfernen sind.

Um eine sichere Funktion der Messung zu gewährleisten, sollte die Montageanweisung Punkt für Punkt beachtet werden.

FRANÇAIS

Le débitmètre massique MASSFLO® de Danfoss est conçu pour la mesure directe de:

- Débit massique
- Totalisation massique
- Masse volumique
- Température
- Débit volumétrique
- Totalisation volumétrique
- Débit fractionné
- Fractionnement en %
- Totalisation fractionnement

Le débitmètre massique MASSFLO® mesure directement en kilogramme la quantité massique qui s'écoule. La mesure est indépendante de toute variation de température, de masse volumique, de pression, de viscosité, de conductibilité et du profil d'écoulement.

Le débitmètre massique permet également de mesurer le débit de fluides contenant en suspension des particules de corps solides et de l'air répartis de façon homogène. Par contre, de fortes concentrations d'air perturbent la mesure.

Cette feuille d'instructions concerne seulement le montage mécanique de la tête de mesure type MASS 2100.
L'emplacement correct de la tête de mesure type MASS 2100 du système ressort du manual qui accompagne le convertisseur de signaux à la livraison. Il en est de même pour le raccordement électrique.

Précision de mesure
Lorsque le débitmètre massique MASSFLO® est installé conformément aux instructions de montage, il est insensible aux perturbations extérieures et mesure avec grande précision, les écarts de mesure étant inférieurs à ±0,15% de la valeur mesurée, sur une large plage de mesure.

Système de mesure précis
Le débitmètre massique MASSFLO® constitue un système de mesure tres précis. Malgré sa conception robuste, il est donc important qu'il soit manipulé et installé conformément aux indications données.

Maniement
Le débitmètre doit être manié avec précaution
Des coups ou des heurts pourraient engendrer un déséquilibre dans la tête de mesure MASS 2100 et compromettre de ce fait la précision de la mesure.

Montage
Ce débitmètre massique étant insensible aux effets des conditions d'écoulement menant à l'entrée, il est inutile de tenir compte des composants pouvant provoquer des turbulences tels que coudes, raccords en T, vannes, etc. Par contre, il faut éviter toute cavitation dans la tuyauterie puisque celles-ci risquent de perturber la messure.

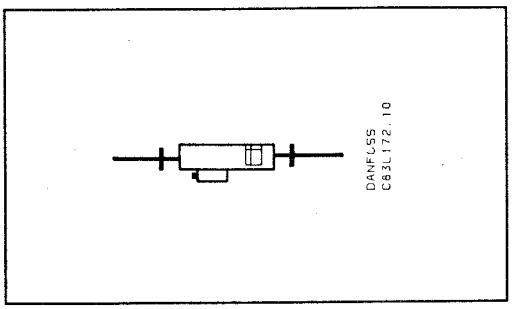
Toutefois, pour éviter tout dépôt de particules, il est recommandé de monter le débitmètre horizontalement. Il est ainsi facile de vidanger la tête de mesure.

La tête de mesure **ne doit pas se vider** en fonctionnement normal (erreur de mesure).

Si le montage vertical s'impose, il est recommandé d'établir le débit de bas en haut pour faciliter l'élimination des bulles d'air éventuelles.

Pour obtenir le fonctionnement optimal du matériel de mesure, il est important de suivre point par point les instructions de montage.

Befæstigelse
Mounting
Befestigung
Montage



MASS 2100 målehoved kræver ingen montagebeslag, men kan frit monteres mellem to flanger i et eksisterende rørsystem. Kraftige vibrationer bør dog afkobles.

Sensor MASS 2100 requires no mounting bracket, but can be mounted between two flanges in existing piping. However, the unit should not be subject to severe vibration.

Der Meßaufnehmer MASS 2100 benötigt keine Montagebeschläge. Eine freie Montage zwischen zwei Flanschen im vorhandenen Rohrnetz ist möglich. Größere Vibrationen sollten vermieden werden.

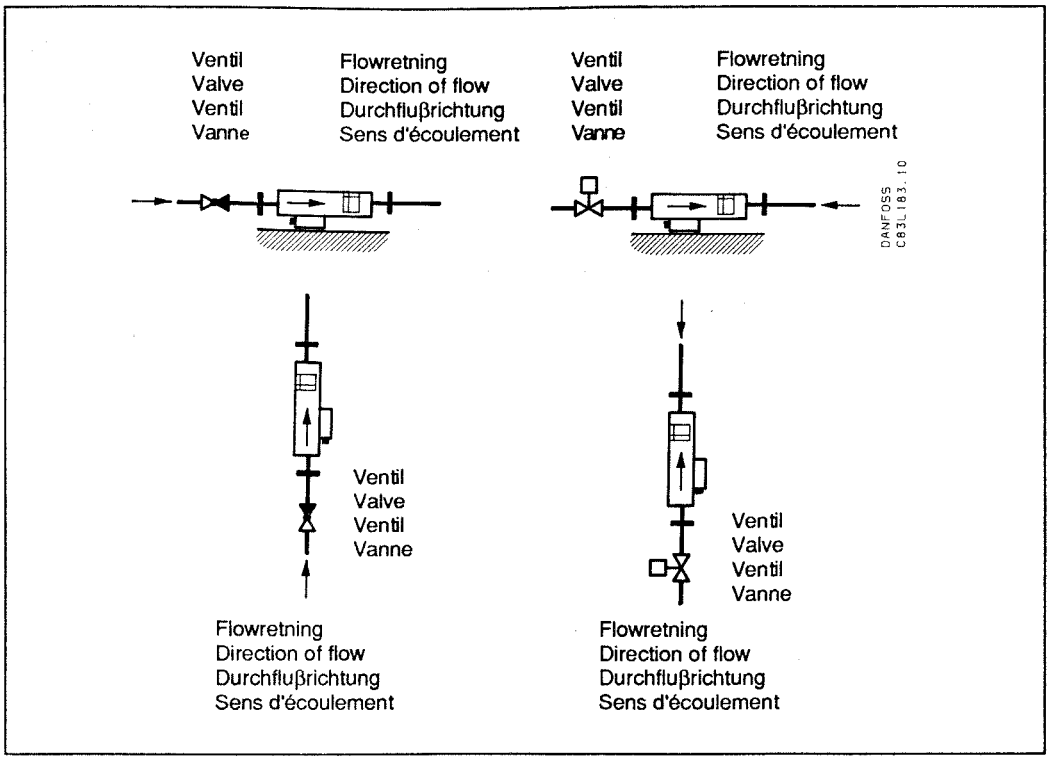
La tête de mesure type MASS 2100 ne demande pas de fers de montage: il suffit de la monter entre deux brides dans la tuyauterie existante. Toutefois, en cas de fortes vibrations, les amortir convenablement.

Ventil 0-punktsjustering

Valve 0-point adjustment

Nullpunktkalibrierung

Utilisation de vannes pour l'étalonnage du point zéro



Der bør altid anbringes en tætsluttende ventil i forbindelse med målehovedet til 0-punktsjustering.

Vor der Einstellung des Nullpunktes ist darauf zu achten, daß
- der Meßaufnehmer völlig gefüllt ist
- vorhandene Absperrventile geschlossen sind bzw.
- der Massedurchfluß Null beträgt.

To facilitate 0-point adjustment, a valve with good shut-off should always be mounted in connection with the sensor.

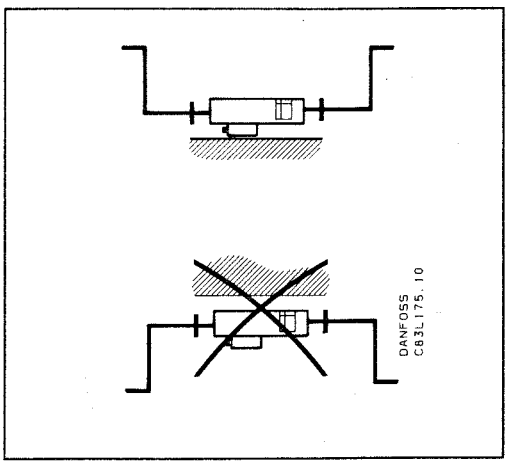
Pour l'étalonnage du point zéro, il faut toujours monter près de la tête de mesure une vanne fermant hermétiquement.

Vandret placering i rørsystemet

Horizontal mounting in pipe

Waagerechter Einbau

Montage horizontal dans la tuyauterie



Monter målehovedet lavt i rørsystemet for at undgå undertryk i målehovedet og dermed udskillelse af luft fra væsken. Monteres målehovedet vandret, er målehovedet selvtømmende.
Ved små flow anbefales det at montere målehovedet vandret, idet evt. luftbobler da lettere vil kunne fjernes.

Locate the sensor low in the pipe system in order to avoid under-pressure in the sensor and consequent air separation in the liquid. If the sensor is mounted horizontally it is self-emptying.
With low flow, horizontal mounting is recommended, in that air bubbles are easier to remove.

Der Meßaufnehmer sollte möglichst tief im Rohrsystem angebracht werden, um eine vollständige Befüllung sicherzustellen. Bei waagerechtem Einbau ist der Meßaufnehmer selbstentleerend. Bei kleinem Durchfluß wird der waagerechte Einbau empfohlen.
Dadurch werden evtl. vorhandene Luftblasen leichter mitgerissen.

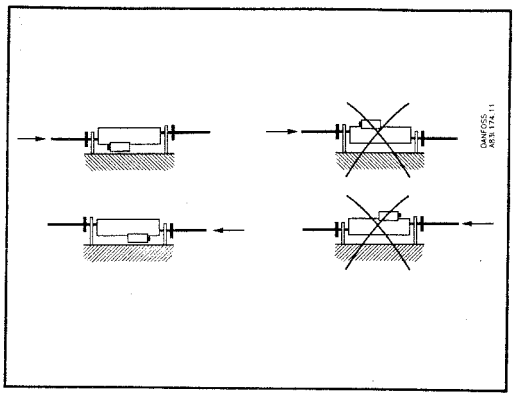
Monter la tête de mesure en position basse dans la tuyauterie afin d'éviter une dépression dans la tête de mesure et la séparation de l'air qui en résulterait. La tête de mesure se vide automatiquement si elle est montée horizontalement. Pour les faibles débits, il est recommandé de monter la tête de mesure horizontalement pour faciliter l'élimination des bulles d'air éventuelles.

Klemkasse-orientering

Terminal box orientation

Lage des Klemmenkastens

Orientation de la boîte à bornes



The terminal box can be orientated as shown. The measuring pipes will then be lower than the outlet pipe, i.e. collections of air can be more easily removed from the measuring pipes. For the sensor to be self-emptying the terminal box must be face downwards.

Bei einer Einbaulage des Klemmenkastens entsprechend der Abbildung befindet sich das Auslaufrohr im höchsten Punkt, d.h. evtl. Lufteinschlüsse können besser entweichen. Nur in den gezeigten Einbaulagen kann sich der Meßaufnehmer selbst entleeren.

Tilslutningsklemkassen kan vende som vist, målerøret vil da være placeret lavere end afgangsrøret, dvs. eventuelle luftansamlinger vil da lettere kunne fjernes fra målerørene. Men for at være selvtømmende skal klemkassen vende nedad.

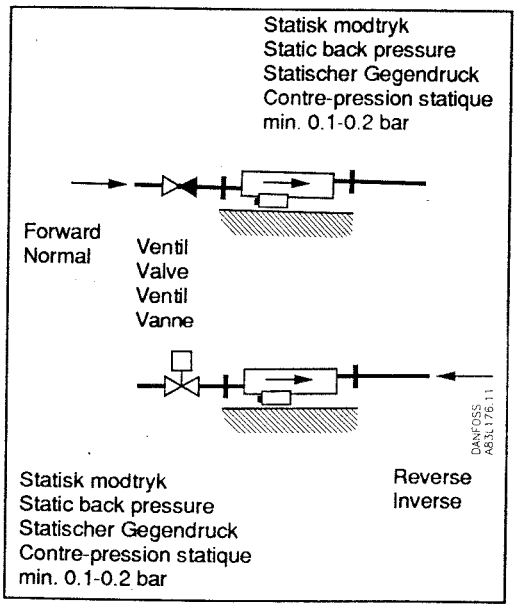
Orienter la boîte à bornes comme montré pour que le tube de mesure soit plus bas que la conduite de départ; d'éventuelles accumulations d'air dans les tubes de mesure pourront ainsi être éliminées plus facilement. Pour obtenir le vidange automatique du tube de mesure, orienter la boîte à bornes vers le bas.

Flowretning

Direction of flow

Durchflußrichtung

Sens d'écoulement



The arrow on the sensor indicates the direction of flow defined as "positive" (the meter is able to measure flow in both directions).
As far as possible, the liquid should flow in the direction of the arrow (on the sensor) to avoid partial emptying of the sensor, especially with low flow.
In addition there should be a valve (check/solenoid) that closes when the flow is 0 so that the liquid does not flow back to produce partial emptying of the sensor.

Pilen på målehovedet angiver den gennemstrømningsretning, der er defineret som positiv (måleren kan måle flow i begge retninger).
Væsken bør så vidt muligt strømme i pilens retning (angivet på målehovedet) for at undgå delvis tømning af målehovedet, specielt ved små flow. Der bør anbringes en ventil (kontra-/magnetventil), som lukker, når flowet er 0, således at væsken ikke strømmer tilbage med delvis tømning af målehovedet til følge.

Der Pfeil auf dem Meßaufnehmer gibt die positive (forward) Fließrichtung an (der Durchflußmesser kann Durchfluß in beiden Richtungen messen).
Die Flüssigkeit sollte möglichst in Pfeilrichtung fließen (am Meßaufnehmer angegeben), damit eine teilweise Entleerung des Meßaufnehmers besonders bei kleinen Durchflußmengen vermieden wird. Es sollte außerdem ein Ventil (Rückschlag-/Magnetventil) eingebaut werden.
Beträgt der Durchfluß Null, verhindert dies das Zurückströmen der Flüssigkeit und somit eine teilweise oder völlige Entleerung des Meßaufnehmers.

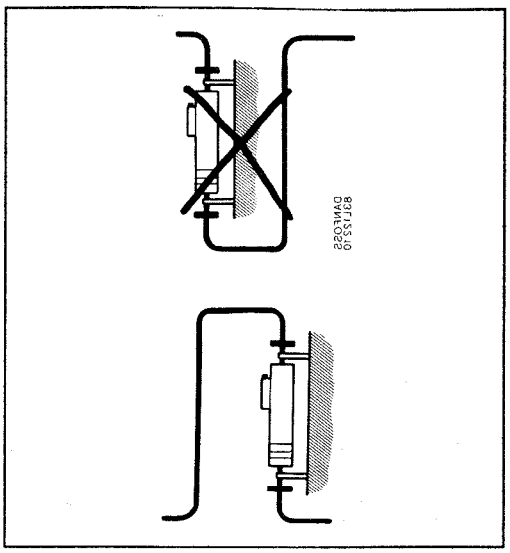
La flèche sur la tête de mesure indique le sens d'écoulement défini comme positif (le débitmètre peut mesurer dans les deux sens). Dans la mesure du possible, le fluide doit s'écouler dans le sens indiqué par la flèche: on évite ainsi le remplissage partiel du tube de mesure en cas de faible débit. Il faut également monter une vanne (électrovanne ou clapet antiretour) qui se ferme lorsque de débit est nul; on évite ainsi le vidange partiel du tube de mesure causé par le retour du fluide.

Lodret placering i rør-
stemet

Vertical mounting in pipe

Senkrechter Einbau

Montage vertical dans la tuyauterie



Monter målehovedet lavt i rørsystemet for at undgå undertryk i målehovedet og dermed udskillelse af luft fra væsken.

Locate the sensor low in pipe system in order to avoid under-pressure in the sensor and consequent air separation in the liquid.

Der Meßaufnehmer sollte möglichst tief im Rohrsystem angebracht werden, um eine vollständige Befüllung sicherzustellen.

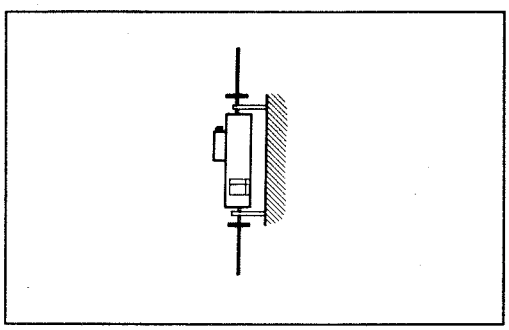
Monter la tête de mesure en position basse dans la tuyauterie afin d'éviter une dépression dans la tête de mesure et la séparation de l'air qui en résulterait.

Klemkasse-orientering

rminal box orientation

Lage des Klemmenkastens

Orientation de la boîte à bornes



Ved lodret montering kan tilslutningsklemkassen vende vilkårligt.

With vertical mounting the orientation of the terminal box is not important.

Die Lage des Klemmenkastens kann bei senkrechtem Einbau beliebig gewählt werden.

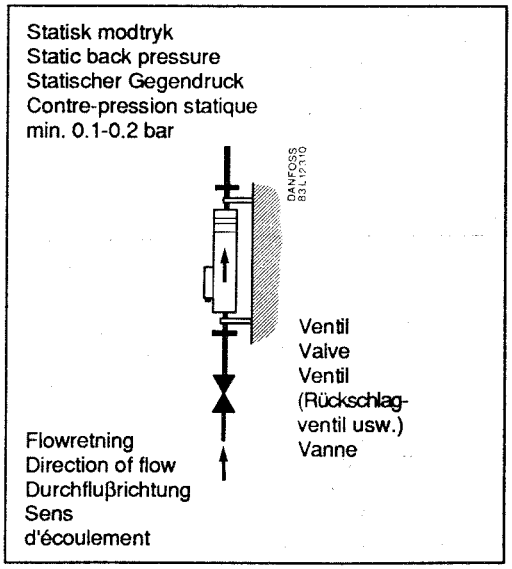
En cas de montage vertical l'orientation de la boîte à bornes est arbitraire.

Flowretning

Direction of flow

Durchflußrichtung

Sens d'écoulement



Væsken bør så vidt muligt strømme nedefra og opefter for lettere at fjerne evt. luftbobler. Ved lodret montage skal der altid være anbragt en ventil (kontraventil), som lukker, når flowet er 0, således at mediet ikke strømmer tilbage med delvis tømning af målehovedet til følge. Pilen på målehovedet angiver positiv (forward) flowretning.

As far as possible, the liquid should flow upwards to make bubble removal easier.
With vertical mounting, a check valve, which closes on zero flow, must always be installed so that the liquid cannot flow back and partially empty the sensor.
The arrow on the sensor indicates positive (forward) flow direction.

Der Durchfluß sollte von unten nach oben erfolgen. Dadurch werden eventuell vorhandene Luftblasen im Meßaufnehmer leichter mitgerissen.
Bei senkrechter Montage muß darauf geachtet werden, dass z.B. bei Dosier-Ende keine Flüssigkeit zurückfließt und damit Teilfüllung im Meßaufnehmer entsteht.
Der Pfeil auf dem Meßaufnehmer gibt die positive (forward) Durchflußrichtung an.

Si possible, le fluide doit s'écouler de bas en haut afin d'éliminer les bulles d'air éventuelles.
En cas de montage vertical, il faut toujours monter une vanne (clapet antiretour) qui se ferme à débit nul pour empêcher le fluide de refluer, ce qui viderait partiellement la tête de mesure.
La flèche sur la tête de mesure indique le sens positif (normal) d'écoulement du fluide.

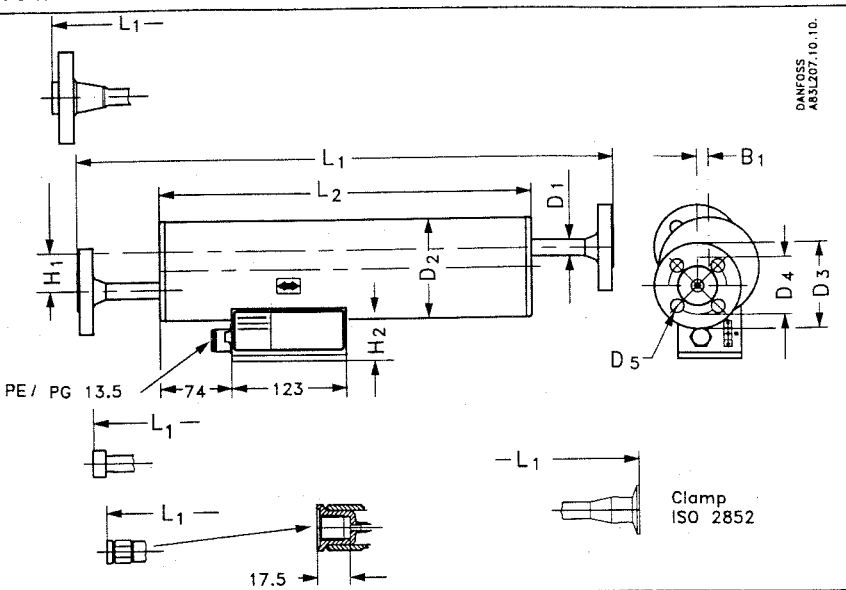
Mål / Dimensions / Maβbilder / Dimensions
Målehoved / Sensor / Meβaufnehmer / Tête de mesure MASS 2100

Flange / Flansch / Bride ANSI B16.5

Flange / Flansch / Bride DIN 2635

Mejeriforskruning DIN 11851 (gevindstuds)
Dairy screwed connection DIN 11851 (screwed)
Rohrverschraubung DIN 11851 (Gewindestutzen)
Raccord alimentaire DIN 11851 (vissé)

Gevindstuds til
Screwed connector for
Gewindestutzen für
Tubulure filetée pour
ISO 228/1 - G 1/4"
ANSI / ASME B1.20.1-1983 1/4" NPT
} DI 3



Målehoved Sensor Mebaufnehmer Tête de mesure Størrelse Size Größe Diamètre	Tilslutninger Connections Anschluβ Raccords Flange Flansch Bride		Tryktrin Press.stage Druckstufe Pression	Størrelse Size Größe Diamètre	L1 mm	L2 mm	H1 mm	H2 mm	B1 mm	D1 mm	D2 mm	D3 mm	D4 mm	D5 mm
DI 3	Rørgevind Pipe thread Rohrgewinde Filet de tuyau	ISO 228/1 - G 1/4	PN 100	1/4"	400	280	60	44	0	21,3	104	-	-	-
	Rørgevind Pipe thread Rohrgewinde Filet de tuyau	ANSI / ASME B 1.20.1 - 1/4" NPT	PN 100	1/4"	400	280	60	44	0	21,3	104	-	-	-
DI 6	Flange Flansch Bride	DIN 2635	PN 40	DN 10	560	390	40	44	12	17,0	104	90,0	60,0	14,0
	Flange Flansch Bride	ANSI B 16.5	CLASS 150	1/2"	624	390	40	44	12	17,0	104	88,9	60,5	15,7
	Flange Flansch Bride	ANSI B 16.5	CLASS 600	1/2"	608	390	40	44	12	17,0	104	95,3	66,5	15,7
	Forskruning Coupling Verschraubung Raccord	DIN 11851	PN 40	DN 10	532	390	40	44	12	17,0	104	-	-	-
	Clamp	ISO 2852	PN 16	25 mm	570	390	40	44	12	17,0	104	-	-	-
DI 15	Flange Flansch Bride	DIN 2635	PN 40	DN 15	620	444	44	46	20	21,3	129	95,0	65,0	14,0
	Flange Flansch Bride	ANSI B 16.5	CLASS 150	1/2"	639	444	44	46	20	21,3	129	88,9	60,5	15,7
	Flange Flansch Bride	ANSI B 16.5	CLASS 600	1/2"	660	444	44	46	20	21,3	129	95,3	66,5	15,7
	Forskruning Coupling Verschraubung Raccord	DIN 11851	PN 40	DN 15	586	444	44	46	20	21,3	129	-	-	-
	Clamp	ISO 2852	PN 16	25 mm	624	444	44	46	20	21,3	129	-	-	-
DI 25	Flange Flansch Bride	DIN 2635	PN 40	DN 25	934	700	126	50	25	33,7	219	115,0	85,0	14,0
	Flange Flansch Bride	ANSI B 16.5	CLASS 150	1"	967	700	126	50	25	33,7	219	108,0	79,2	15,7
	Flange Flansch Bride	ANSI B 16.5	CLASS 600	1"	992	700	126	50	25	33,7	219	124,0	88,9	19,1
	Forskruning Coupling Verschraubung Raccord	DIN 11851	PN 40	DN 32	922	700	126	50	25	33,7	219	-	-	-
	Clamp	ISO 2852	PN 16	38 mm	940	700	126	50	25	33,7	219	-	-	-
DI 40	Flange Flansch Bride	DIN 2635	PN 40	DN 40	1064	850	180	50	0	48,3	273	150,0	110,0	18,0
	Flange Flansch Bride	ANSI B 16.5	CLASS 150	1 1/2"	1100	850	180	50	0	48,3	273	127,0	98,6	15,7
	Flange Flansch Bride	ANSI B 16.5	CLASS 600	1 1/2"	1128	850	180	50	0	48,3	273	155,4	114,3	22,4
	Forskruning Coupling Verschraubung Raccord	DIN 11851	PN 25	DN 50	1090	850	180	50	0	48,3	273	-	-	-
	Clamp	ISO 2852	PN 16	51 mm	1062	850	180	50	0	48,3	273	-	-	-

Opvarmet målehoved / Heated sensor / Beheizbarer Meβaufnehmer / Tête de mesure réchauffée MASS 2100

DANFOSS
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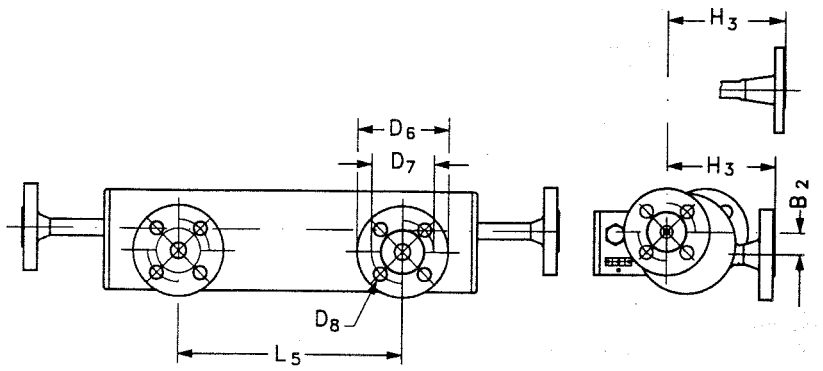


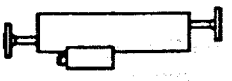
Flange / Flansch / Bride ANSI B16.5

Flange / Flansch / Bride DIN 2635

Målehoved Sensor Meβaufnehmer Tête de mesure	Tilslutninger, opvarmet Connections, heated Anschluβ, beheizbarer Raccords, réchauffée			L5	H3	B2	D6	D7	D8
Størrelse Size Größe Diamètre	Flange Flange Flansch Bride	Tryktrin Press.stage Druckstufe Pression	Størrelse Size Größe Diamètre	mm	mm	mm	mm	mm	mm
DI 3	DIN 2635	PN 40	DN 15	234	122,0	22,0	95,0	65,0	14,0
	ANSI B16.5	CLASS 150	1/2"	234	131,6	22,0	88,9	60,5	15,7
DI 6	DIN 2635	PN 40	DN 15	234	112,0	22,7	95,0	65,0	14,0
	ANSI B16.5	CLASS 150	1/2"	234	121,6	22,7	88,9	60,5	15,7
DI 15	DIN 2635	PN 40	DN 15	234	126,5	31,5	95,0	65,0	14,0
	ANSI B16.5	CLASS 150	1/2"	234	136,1	31,5	88,9	60,5	15,7
DI 25	DIN 2635	PN 40	DN 15	420	213,6	60,0	95,0	65,0	14,0
	ANSI B16.5	CLASS 150	1/2"	420	223,2	60,0	88,9	60,5	15,7
DI 40	DIN 2635	PN 40	DN 15	500	267,5	43,0	95,0	65,0	14,0
	ANSI B16.5	CLASS 150	1/2"	500	277,1	43,0	88,9	60,5	15,7

INSTRUCTIONS

MASSFLO® mass flowmeter type MASS 2100



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Introduktion
Introduction

DANSK

Danfoss MASSFLO® masse flowmåler er en flowmåler til direkte måling af:

- Masseflow
- Total masse
- Massefylde
- Temperatur
- Volumenflow
- Total volumen
- Fraktionsflow
- % fraktionsflow
- Total fraktion

MASSFLO® masse flowmåler måler den gennemstrømmende masse direkte i kilogram uden omregning, og målingen er uafhængig af ændringer i væsketemperatur, massefylde, tryk, viskositet, ledningsevne og flowprofil.

Med masse flowmåleren kan man også måle masseflowet af væsker med homogent fordelte luft- og faststofandele. Større luftansamlinger derimod forstyrrer målingen.

Denne instruktion beskriver den mekaniske montage af målehoved type MASS 2100.

Beskrivelse af den korrekte placering af målehoved type MASS 2100 i systemet er givet i manualen, som leveres med signalomsætteren. Elektrisk tilslutning er ligeledes angivet i manualen.

Målenøjagtighed
Monteres MASSFLO® masse flowmåleren i henhold til montageanvisningen, er den upåvirkelig af ydre forstyrrelser og kan måle med en stor nøjagtighed. Måleunøjagtigheden er mindre end ±0,15% af målt værdi i et stort måleområde.

Præcisionsmålesystem
Masse flowmåleren er et præcisionsmålesystem. Trods sin robuste opbygning er det vigtigt, at MASSFLO® masse flowmåler behandles og installeres efter anvisning, givet i denne instruktion.

Håndtering
Flowmåleren bør behandles forsigtigt.
Slag og stød kan i værste fald give anledning til ubalance i målehovedet MASS 2100 med forringet målenøjagtighed til følge.

Montering
Ved montering af masse flowmåleren er det ikke nødvendigt at tage hensyn til turbulensgenererende komponenter, såsom rørbøjninger, T-stykker, ventiler m.m., idet måleren ikke påvirkes af, hvordan indløbsforholdene er. Dog skal man undgå kavitation i anlægget, da det kan forstyrre målingen.

Det anbefales at montere måleren vandret. Derved hindres medførte faststofandele i at aflejres i måleren, og målehovedet kan lettere tømmes for væske.

Man bør **altid** sikre, at målehovedet **ikke** tømmes for væske under normal drift, da det medfører fejlmålinger.

Ønsker man målehovedet monteret lodret, anbefales, at flowet er nedefra og op for lettere at kunne fjerne evt. luftbobler.
For at opnå en optimal funktion af måleudstyret er det vigtigt at følge montageanvisningen punkt for punkt.

ENGLISH

Danfoss MASSFLO® mass flowmeters are units for the direct measurement of:

- Mass flow rate
- Total mass
- Density
- Temperature
- Volumetric flowrate
- Total volume
- Fraction flow
- % fraction
- Total fraction

MASSFLO® mass flowmeters measure the flow direct in kilogrammes, without conversion. Measurements are independent of changes in liquid temperature, pressure, viscosity, conductivity, and flow profile.

With the mass flowmeter it is also possible to measure the mass flow of liquids containing homogeneous mixtures of air and solids.
However, large collections of air can disturb measurement.

This instruction covers the mechanical installation of the sensor type MASS 2100. For guidance in selecting the correct place in the system to install the sensor type MASS 2100 please see the manual which is packed with the signal converter. Data on the wiring up of the system is also given in the manual.

Measuring accuracy
Provided the MASSFLO® mass flowmeter is installed in accordance with the instructions it will be unaffected by external disturbances and will measure with high accuracy. Measuring inaccuracy is less than ±0.15% of the measured value, throughout a wide measuring range.

Precision measuring system
The mass flowmeter is a precision measuring system. It is very robust, but must be handled and installed in accordance with the instructions given.

Einführung
roduction

Handling
The flowmeter should be handled carefully.
In the worst case impact and shock can produce imbalance in the MASS 2100 sensor, with consequent measuring inaccuracy.

Sensor mounting
When installing a mass flowmeter it is not necessary to take account of components that generate turbulence, such as pipe bends, T-pieces, valves, etc. because the meter is not affected by inlet conditions. However, cavitation in the system can disturb measurements and must be avoided.

Horizontal installation is recommended. This avoids solid particles being deposited in the meter and the sensor can be easier emptied.

Ensure that the sensor is **not** emptied during normal operation otherwise error measurement will occur.

If vertical installation is desired, upward flow in order to facilitate the removal of air bubbles is recommended.

To ensure the optimum function of measuring equipment it is important that the installation instructions be followed closely, point by point.

DEUTSCH

Der Danfoss MASSFLO® Masse Durchfluß–messer ist ein System für die direkte Messung von:
- Massedurchfluß
- Totaler Masse
- Dichte
- Temperatur
- Volumetrischem Durchfluß
- Totalem Volumen
- Fraktionsdurchfluß
- % Fraktion
- Totale Fraktion

MASSFLO® Masse Durchflußmesser messen die durchfließende Masse ohne jegliche Umrechnung direkt in Kilogramm, unabhängig von Änderungen der Flüssigkeitstemperatur, der Dichte, des Druckes, der Viskosität, der Leitfähigkeit oder des Durchflußprofils.

Der Masse Durchflußmesser ermöglicht auch die Messung von Flüssigkeiten mit homogen verteilten Gas- und Feststoffanteilen. Inhomogen verteilte Gaseinschlüsse (Gaspropfen) sind hingegen zu vermeiden.

In dieser Instruktion ist die Montage des Meßaufnehmers Typ MASS 2100 beschrieben.

Die Beschreibung der korrekten Anbringung des Meßaufnehmers Typ MASS 2100 im System ist aus dem Manual zu entnehmen, das dem Meßumformer beigefügt ist. Der elektrische Anschluß ist ebenfalls im Manual angegeben.

Meßgenauigkeit
Wird der MASSFLO® Masse Durchflußmesser entsprechend den Montageanweisungen installiert, können äussere Störquellen die hohe Meßgenauigkeit nicht beeinflussen. Die Meßgenauigkeit ist dann über einen grossen Meßbereich besser als ±0,15% des aktuellen Meßwertes.

Präzisionsmeßsystem
Masse Durchflußmesser sind Präzisionssysteme. Trotz des robusten Aufbaus ist es wichtig, daß MASSFLO® Masse Durchflußmesser entsprechend den Ausführungen dieser Instruktion behandelt und installiert werden.

Handhabung
Der Durchflußmesser muß, wie jedes andere Meßgerät auch, vorsichtig behandelt werden.
Schläge bzw. Stöße gegen den Meßaufnehmer können Instabilitäten und damit verbundene Ungenauigkeiten hervorrufen.

Montage
Bei der Montage des Meßaufnehmers müssen keine Ein- und Auslaufstrecken vorgesehen werden. Turbulenzerzeugende Komponenten wie Rohrbögen, Ventile usw. beeinflussen die Massedurchflußmessung nicht. Kavitation in der Anlage muß jedoch vermieden werden, da diese die Messung stören kann.

Die waagerechte Montage des Durchfluß–messers wird empfohlen. Dadurch werden Ablagerungen von mitgeführten Feststoffen im Meßaufnehmer vermieden, und gleichzeitig ist es leichter, den Meßaufnehmer von Flüssigkeit zu entleeren.

Es muß sichergestellt werden, daß der Meß–aufnehmer bei normalem Betrieb **nicht** von Flüssigkeit entleert wird, da das zu falschen Messungen führt.

Bei senkrechter Montage des Meßaufnehmers empfehlen wir die Fließrichtung von unten nach oben zu wählen, damit evtl. Luftblasen leichter zu entfernen sind.

Um eine sichere Funktion der Messung zu gewährleisten, sollte die Montageanweisung Punkt für Punkt beachtet werden.

FRANÇAIS

Le débitmètre massique MASSFLO® de Danfoss est conçu pour la mesure directe de:

- Débit massique
- Totalisation massique
- Masse volumique
- Température
- Débit volumétrique
- Totalisation volumétrique
- Débit fractionné
- Fractionnement en %
- Totalisation fractionnement

Le débitmètre massique MASSFLO® mesure directement en kilogramme la quantité massique qui s'écoule. La mesure est indépendante de toute variation de température, de masse volumique, de pression, de viscosité, de conductibilité et du profil d'écoulement.

Le débitmètre massique permet également de mesurer le débit de fluides contenant en suspension des particules de corps solides et de l'air répartis de façon homogène. Par contre, de fortes concentrations d'air perturbent la mesure.

Cette feuille d'instructions concerne seulement le montage mécanique de la tête de mesure type MASS 2100.
L'emplacement correct de la tête de mesure type MASS 2100 du système ressort du manual qui accompagne le convertisseur de signaux à la livraison. Il en est de même pour le raccordement électrique.

Précision de mesure
Lorsque le débitmètre massique MASSFLO® est installé conformément aux instructions de montage, il est insensible aux perturbations extérieures et mesure avec grande précision, les écarts de mesure étant inférieurs à ±0,15% de la valeur mesurée, sur une large plage de mesure.

Système de mesure précis
Le débitmètre massique MASSFLO® constitue un système de mesure tres précis. Malgré sa conception robuste, il est donc important qu'il soit manipulé et installé conformément aux indications données.

Maniement
Le débitmètre doit être manié avec précaution
Des coups ou des heurts pourraient engendrer un déséquilibre dans la tête de mesure MASS 2100 et compromettre de ce fait la précision de la mesure.

Montage
Ce débitmètre massique étant insensible aux effets des conditions d'écoulement menant à l'entrée, il est inutile de tenir compte des composants pouvant provoquer des turbulences tels que coudes, raccords en T, vannes, etc. Par contre, il faut éviter toute cavitation dans la tuyauterie puisque celles-ci risquent de perturber la messure.

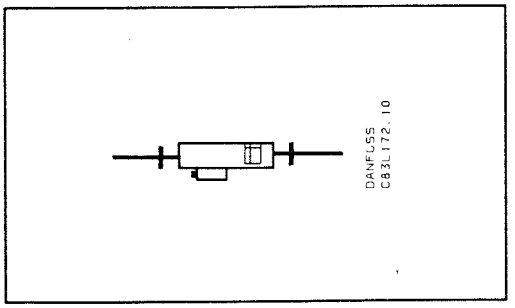
Toutefois, pour éviter tout dépôt de particules, il est recommandé de monter le débitmètre horizontalement. Il est ainsi facile de vidanger la tête de mesure.

La tête de mesure **ne doit pas se vider** en fonctionnement normal (erreur de mesure).

Si le montage vertical s'impose, il est recommandé d'établir le débit de bas en haut pour faciliter l'élimination des bulles d'air éventuelles.

Pour obtenir le fonctionnement optimal du matériel de mesure, il est important de suivre point par point les instructions de montage.

Befæstigelse
Mounting
Befestigung
Montage



MASS 2100 målehoved kræver ingen montagebeslag, men kan frit monteres mellem to flanger i et eksisterende rørsystem. Kraftige vibrationer bør dog afkobles.

Sensor MASS 2100 requires no mounting bracket, but can be mounted between two flanges in existing piping. However, the unit should not be subject to severe vibration.

Der Meßaufnehmer MASS 2100 benötigt keine Montagebeschläge. Eine freie Montage zwischen zwei Flanschen im vorhandenen Rohrnetz ist möglich. Größere Vibrationen sollten vermieden werden.

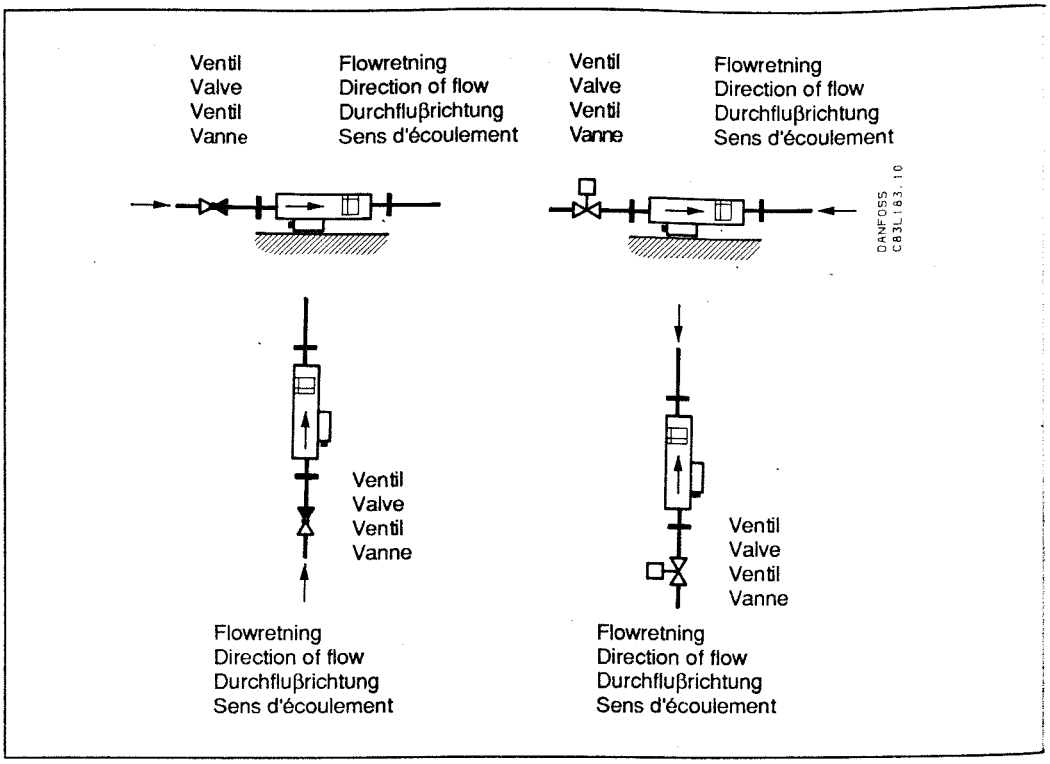
La tête de mesure type MASS 2100 ne demande pas de fers de montage: il suffit de la monter entre deux brides dans la tuyauterie existante. Toutefois, en cas de fortes vibrations, les amortir convenablement.

Ventil 0-punktsjustering

Valve 0-point adjustment

Nullpunktkalibrierung

Utilisation de vannes pour l'étalonnage du point zéro



Der bør altid anbringes en tætsluttende ventil i forbindelse med målehovedet til 0-punktsjustering.

Vor der Einstellung des Nullpunktes ist darauf zu achten, daß
- der Meßaufnehmer völlig gefüllt ist
- vorhandene Absperrventile geschlossen sind bzw.
- der Massedurchfluß Null beträgt.

To facilitate 0-point adjustment, a valve with good shut-off should always be mounted in connection with the sensor.

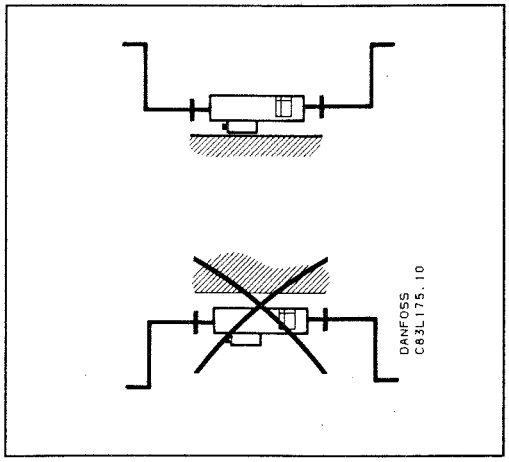
Pour l'étalonnage du point zéro, il faut toujours monter près de la tête de mesure une vanne fermant hermétiquement.

Vandret placering i rørsystemet

Horizontal mounting in pipe

Waagerechter Einbau

Montage horizontal dans la tuyauterie



Locate the sensor low in the pipe system in order to avoid under-pressure in the sensor and consequent air separation in the liquid. If the sensor is mounted horizontally it is self-emptying.
With low flow, horizontal mounting is recommended, in that air bubbles are easier to remove.

Der Meßaufnehmer sollte möglichst tief im Rohrsystem angebracht werden, um eine vollständige Befüllung sicherzustellen. Bei waagerechtem Einbau ist der Meßaufnehmer selbstentleerend. Bei kleinem Durchfluß wird der waagerechte Einbau empfohlen. Dadurch werden evtl. vorhandene Luftblasen leichter mitgerissen.

Monter målehovedet lavt i rørsystemet for at undgå undertryk i målehovedet og dermed udskillelse af luft fra væsken. Monteres målehovedet vandret, er målehovedet selvtømmende.
Ved små flow anbefales det at montere målehovedet vandret, idet evt. luftbobler da lettere vil kunne fjernes.

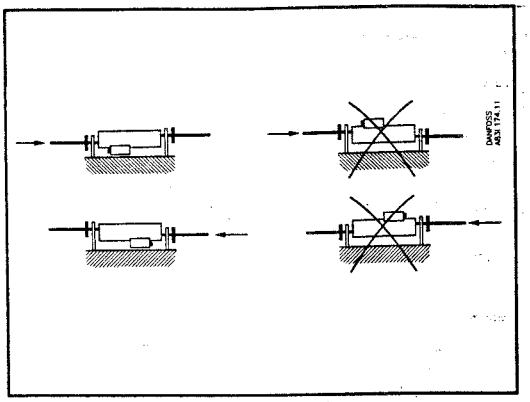
Monter la tête de mesure en position basse dans la tuyauterie afin d'éviter une dépression dans la tête de mesure et la séparation de l'air qui en résulterait. La tête de mesure se vide automatiquement si elle est montée horizontalement. Pour les faibles débits, il est recommandé de monter la tête de mesure horizontalement pour faciliter l'élimination des bulles d'air éventuelles.

Klemkasse-orientering

Terminal box orientation

Lage des Klemmenkastens

Orientation de la boîte à bornes



The terminal box can be orientated as shown. The measuring pipes will then be lower than the outlet pipe, i.e. collections of air can be more easily removed from the measuring pipes. For the sensor to be self-emptying the terminal box must be face downwards.

Bei einer Einbaulage des Klemmenkastens entsprechend der Abbildung befindet sich das Auslaufrohr im höchsten Punkt, d.h. evtl. Lufteinschlüsse können besser entweichen. Nur in den gezeigten Einbaulagen kann sich der Meßaufnehmer selbst entleeren.

Tilslutningsklemkassen kan vende som vist, målerøret vil da være placeret lavere end afgangsrøret, dvs. eventuelle luftansamlinger vil da lettere kunne fjernes fra målerørene. Men for at være selvtømmende skal klemkassen vende nedad.

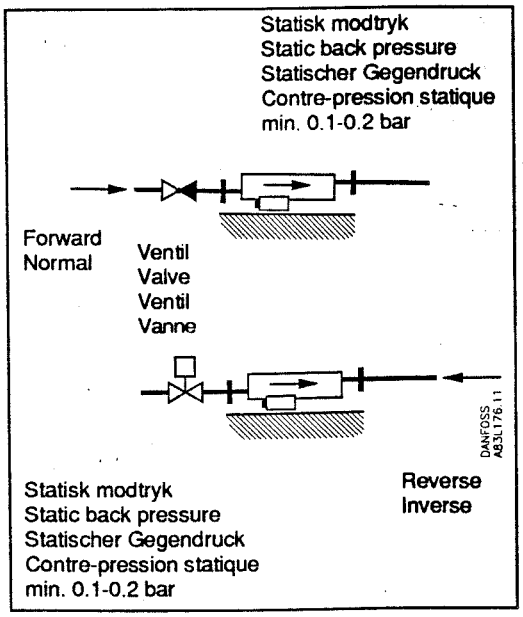
Orienter la boîte à bornes comme montré pour que le tube de mesure soit plus bas que la conduite de départ; d'éventuelles accumulations d'air dans les tubes de mesure pourront ainsi être éliminées plus facilement. Pour obtenir le vidange automatique du tube de mesure, orienter la boîte à bornes vers le bas.

Flowretning

Direction of flow

Durchflußrichtung

Sens d'écoulement



The arrow on the sensor indicates the direction of flow defined as "positive" (the meter is able to measure flow in both directions).
As far as possible, the liquid should flow in the direction of the arrow (on the sensor) to avoid partial emptying of the sensor, especially with low flow.
In addition there should be a valve (check/solenoid) that closes when the flow is 0 so that the liquid does not flow back to produce partial emptying of the sensor.

Pilen på målehovedet angiver den gennemstrømningsretning, der er defineret som positiv (måleren kan måle flow i begge retninger).
Væsken bør så vidt muligt strømme i pilens retning (angivet på målehovedet) for at undgå delvis tømning af målehovedet, specielt ved små flow. Der bør anbringes en ventil (kontra-/magnetventil), som lukker, når flowet er 0, således at væsken ikke strømmer tilbage med delvis tømning af målehovedet til følge.

Der Pfeil auf dem Meßaufnehmer gibt die positive (forward) Fließrichtung an (der Durchflußmesser kann Durchfluß in beiden Richtungen messen).
Die Flüssigkeit sollte möglichst in Pfeilrichtung fließen (am Meßaufnehmer angegeben), damit eine teilweise Entleerung des Meßaufnehmers besonders bei kleinen Durchflußmengen vermieden wird. Es sollte außerdem ein Ventil (Rückschlag-/Magnetventil) eingebaut werden.
Beträgt der Durchfluß Null, verhindert dies das Zurückströmen der Flüssigkeit und somit eine teilweise oder völlige Entleerung des Meßaufnehmers.

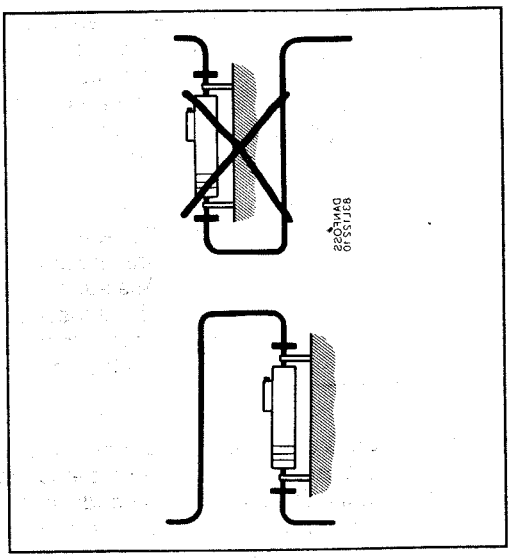
La flèche sur la tête de mesure indique le sens d'écoulement défini comme positif (le débitmètre peut mesurer dans les deux sens). Dans la mesure du possible, le fluide doit s'écouler dans le sens indiqué par la flèche: on évite ainsi le remplissage partiel du tube de mesure en cas de faible débit. Il faut également monter une vanne (électrovanne ou clapet antiretour) qui se ferme lorsque de débit est nul; on évite ainsi le vidange partiel du tube de mesure causé par le retour du fluide.

Lodret placering i rørsystemet

Vertical mounting in pipe

Senkrechter Einbau

Montage vertical dans la tuyauterie



Monter målehovedet lavt i rørsystemet for at undgå undertryk i målehovedet og dermed udskillelse af luft fra væsken.

Locate the sensor low in pipe system in order to avoid under-pressure in the sensor and consequent air separation in the liquid.

Der Meßaufnehmer sollte möglichst tief im Rohrsystem angebracht werden, um eine vollständige Befüllung sicherzustellen.

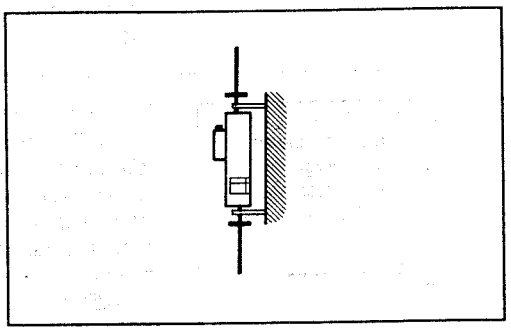
Monter la tête de mesure en position basse dans la tuyauterie afin d'éviter une dépression dans la tête de mesure et la séparation de l'air qui en résulterait.

Klemkasse-orientering

Terminal box orientation

Lage des Klemmenkastens

Orientation de la boîte à bornes



Ved lodret montering kan tilslutningsklemkassen vende vilkårligt.

With vertical mounting the orientation of the terminal box is not important.

Die Lage des Klemmenkastens kann bei senkrechtem Einbau beliebig gewählt werden.

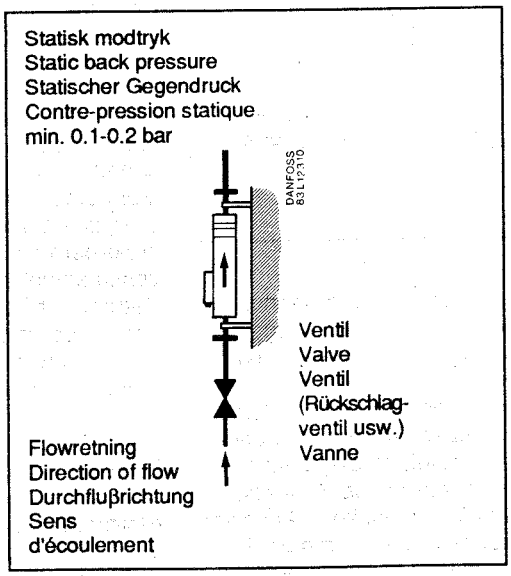
En cas de montage vertical l'orientation de la boîte à bornes est arbitraire.

Flowretning

Direction of flow

Durchflußrichtung

Sens d'écoulement



Væsken bør så vidt muligt strømme nedefra og opefter for lettere at fjerne evt. luftbobler. Ved lodret montage skal der altid være anbragt en ventil (kontraventil), som lukker, når flowet er 0, således at mediet ikke strømmer tilbage med delvis tømning af målehovedet til følge. Pilen på målehovedet angiver positiv (forward) flowretning.

As far as possible, the liquid should flow upwards to make bubble removal easier.
With vertical mounting, a check valve, which closes on zero flow, must always be installed so that the liquid cannot flow back and partially empty the sensor.
The arrow on the sensor indicates positive (forward) flow direction.

Der Durchfluß sollte von unten nach oben erfolgen. Dadurch werden eventuell vorhandene Luftblasen im Meßaufnehmer leichter mitgerissen.
Bei senkrechter Montage muß darauf geachtet werden, dass z.B. bei Dosier-Ende keine Flüssigkeit zurückfließt und damit Teilfüllung im Meßaufnehmer entsteht.
Der Pfeil auf dem Meßaufnehmer gibt die positive (forward) Durchflußrichtung an.

Si possible, le fluide doit s'écouler de bas en haut afin d'éliminer les bulles d'air éventuelles.
En cas de montage vertical, il faut toujours monter une vanne (clapet antiretour) qui se ferme à débit nul pour empêcher le fluide de refluer, ce qui viderait partiellement la tête de mesure.
La flèche sur la tête de mesure indique le sens positif (normal) d'écoulement du fluide.

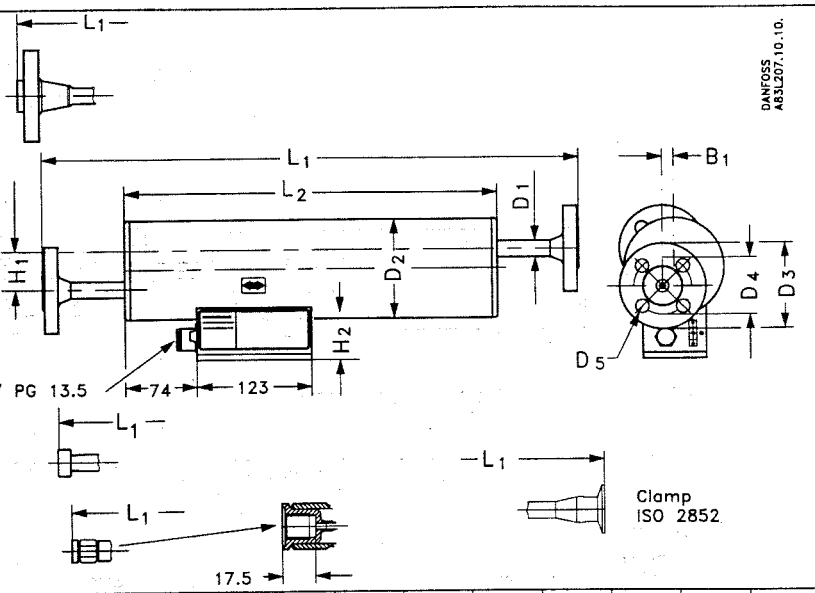
Mål / Dimensions / Maßbilder / Dimensions
Målehoved / Sensor / Meßaufnehmer / Tête de mesure MASS 2100

Flange / Flansch / Bride ANSI B16.5

Flange / Flansch / Bride DIN 2635

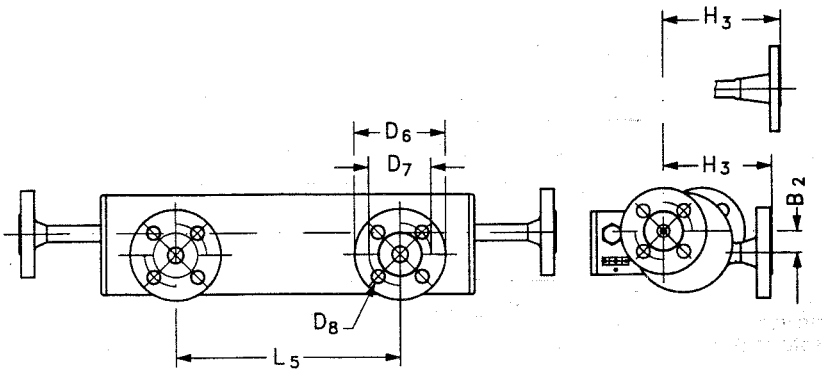
Mejeriforskruning DIN 11851 (gevindstuds)
Dairy screwed connection DIN 11851 (screwed)
Rohrverschraubung DIN 11851 (Gewindestutzen)
Raccord alimentaire DIN 11851 (vissé)

Gevindstuds til
Screwed connector for
Gewindestutzen für
Tubulure filetée pour
ISO 228/1 - G 1/4"
ANSI / ASME B1.20.1-1983 1/4" NPT
} DI 3



Målehoved Sensor Mebaufnehmer Tête de mesure Størrelse Size Größe Diamètre	Tilslutninger Connections Anschluß Raccords: Flange Flange Flansch Bride		Tryktrin Press.stage Druckstufe Pression	Størrelse Size Größe Diamètre	L1 mm	L2 mm	H1 mm	H2 mm	B1 mm	D1 mm	D2 mm	D3 mm	D4 mm	D5 mm
DI 3	Rørgevind Pipe thread Rohrgewinde Filet de tuyau	ISO 228/1 - G 1/4	PN 100	1/4"	400	280	60	44	0	21,3	104	-	-	-
	Rørgevind Pipe thread Rohrgewinde Filet de tuyau	ANSI / ASME B 1.20.1 - 1/4" NPT	PN 100	1/4"	400	280	60	44	0	21,3	104	-	-	-
DI 6	Flange Flansch Bride	DIN 2635	PN 40	DN 10	560	390	40	44	12	17,0	104	90,0	60,0	14,0
	Flange Flansch Bride	ANSI B 16.5	CLASS 150	1/2"	624	390	40	44	12	17,0	104	88,9	60,5	15,7
	Flange Flansch Bride	ANSI B 16.5	CLASS 600	1/2"	608	390	40	44	12	17,0	104	95,3	66,5	15,7
	Forskruning Coupling Verschraubung Raccord	DIN 11851	PN 40	DN 10	532	390	40	44	12	17,0	104	-	-	-
	Clamp	ISO 2852	PN 16	25 mm	570	390	40	44	12	17,0	104	-	-	-
DI 15	Flange Flansch Bride	DIN 2635	PN 40	DN 15	620	444	44	46	20	21,3	129	95,0	65,0	14,0
	Flange Flansch Bride	ANSI B 16.5	CLASS 150	1/2"	639	444	44	46	20	21,3	129	88,9	60,5	15,7
	Flange Flansch Bride	ANSI B 16.5	CLASS 600	1/2"	660	444	44	46	20	21,3	129	95,3	66,5	15,7
	Forskruning Coupling Verschraubung Raccord	DIN 11851	PN 40	DN 15	586	444	44	46	20	21,3	129	-	-	-
	Clamp	ISO 2852	PN 16	25 mm	624	444	44	46	20	21,3	129	-	-	-
DI 25	Flange Flansch Bride	DIN 2635	PN 40	DN 25	934	700	126	50	25	33,7	219	115,0	85,0	14,0
	Flange Flansch Bride	ANSI B 16.5	CLASS 150	1"	967	700	126	50	25	33,7	219	108,0	79,2	15,7
	Flange Flansch Bride	ANSI B 16.5	CLASS 600	1"	992	700	126	50	25	33,7	219	124,0	88,9	19,1
	Forskruning Coupling Verschraubung Raccord	DIN 11851	PN 40	DN 32	922	700	126	50	25	33,7	219	-	-	-
	Clamp	ISO 2852	PN 16	38 mm	940	700	126	50	25	33,7	219	-	-	-
DI 40	Flange Flansch Bride	DIN 2635	PN 40	DN 40	1064	850	180	50	0	48,3	273	150,0	110,0	18,0
	Flange Flansch Bride	ANSI B 16.5	CLASS 150	1 1/2"	1100	850	180	50	0	48,3	273	127,0	98,6	15,7
	Flange Flansch Bride	ANSI B 16.5	CLASS 600	1 1/2"	1128	850	180	50	0	48,3	273	155,4	114,3	22,4
	Forskruning Coupling Verschraubung Raccord	DIN 11851	PN 25	DN 50	1090	850	180	50	0	48,3	273	-	-	-
	Clamp	ISO 2852	PN 16	51 mm	1062	850	180	50	0	48,3	273	-	-	-

Opvarmet målehoved / Heated sensor / Beheizbarer Meβaufnehmer / Tête de mesure réchauffée MASS 2100



Flange / Flansch / Bride ANSI B16.5

Flange / Flansch / Bride DIN 2635

Målehoved Sensor Meβaufnehmer Tête de mesure Størrelse Size Größe Diamètre	Tilslutninger, opvarmet Connections, heated Anschluβ, beheizbarer Raccords, réchauffée Flange Flange Flansch Bride	Tryktrin Press.stage Druckstufe Pression	Størrelse Size Größe Diamètre	L5 mm	H3 mm	B2 mm	D6 mm	D7 mm	D8 mm
DI 3	DIN 2635	PN 40	DN 15	234	122,0	22,0	95,0	65,0	14,0
	ANSI B16.5	CLASS 150	1/2"	234	131,6	22,0	88,9	60,5	15,7
DI 6	DIN 2635	PN 40	DN 15	234	112,0	22,7	95,0	65,0	14,0
	ANSI B16.5	CLASS 150	1/2"	234	121,6	22,7	88,9	60,5	15,7
DI 15	DIN 2635	PN 40	DN 15	234	126,5	31,5	95,0	65,0	14,0
	ANSI B16.5	CLASS 150	1/2"	234	136,1	31,5	88,9	60,5	15,7
DI 25	DIN 2635	PN 40	DN 15	420	213,6	60,0	95,0	65,0	14,0
	ANSI B16.5	CLASS 150	1/2"	420	223,2	60,0	88,9	60,5	15,7
DI 40	DIN 2635	PN 40	DN 15	500	267,5	43,0	95,0	65,0	14,0
	ANSI B16.5	CLASS 150	1/2"	500	277,1	43,0	88,9	60,5	15,7

CALIBRATION REPORT

Danfoss Industrial Instrumentation

Identity

Customer	:		
Converter type	: MAG3000	Serial no. :	Reference converter
Sensor type	: MAG1100 DN25	Serial no. :	422510N335
Cal. factor	: 0.43100		

Calibration Data

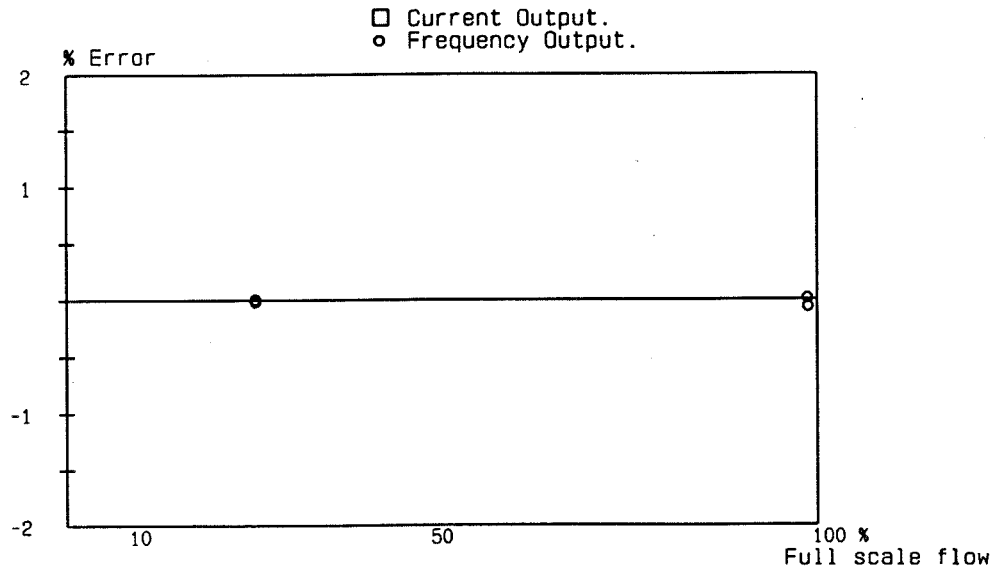
Full scale flow	: 2.15 L/S	Calibration liquid :	Water
Calibration rig	: 8635		

Settings

Frequency output	: 0-10000 Hz	Current output	: Not Recorded

Calibration Results

Test No.	Full scale Flow	Water Temp	True Flowrate	Flowmeter Current Output			Flowmeter Frequency Output		
				Output	Flowrate	Error	Output	Flowrate	Error
	%	°C	L/S	mA	L/S	%	Hz	L/S	%
1	99	28.9	2.129				9874.1	2.128	-0.06
2	99	28.9	2.127				9873.4	2.128	0.01
3	25	29.2	0.542				2516.3	0.542	0.00
4	25	29.2	0.542				2516.1	0.542	-0.02
5									
6									
7									
8									
9									
10									



Calibrated by : EF

Date : 95.08.25 Time : 11.27

Approved by :

Date : 95-08-29

Ver. 4.28 P LZ.25.N1.02

CALIBRATION REPORT

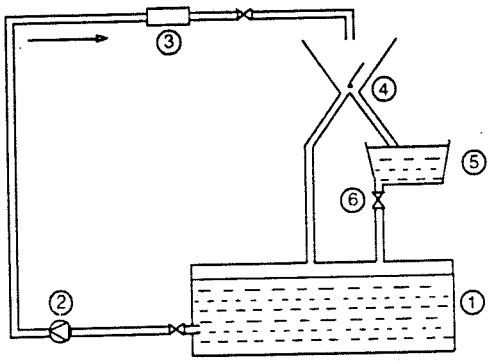
Danfoss Industrial Instrumentation

Reference Conditions

Calibration Rig

The test rigs work according to the static weighing method, of the ISO 4185 "Measurement of fluid flow in closed conduits". See diagram below.

During calibration the meter under test (3) is compared with a weighing-out from a weighing tank (5). The diverter (4) controls start/stop of the required weighing-out. This quantity is compared with the totalized flowrate. Hence, the meter sensitivity can be derived from this.



1. Sump
2. Pump
3. Meter under calibration
4. Diverter
5. Weighing tank
6. Drain valve

Specification

Calibration Rig	DN 10, Rig No: 8634	DN 25, Rig No.: 8635	DN 50, Rig No: 8636
Liquid	Water	Water	Water
Meter capacity	DN 3 - DN 15	DN 15 - DN 25	DN 40 - DN 50
Max. Flowrate	2100 Kg/h	11000 Kg/h	22000 Kg/h
Min. Flowrate	30 Kg/h	350 Kg/h	500 Kg/h
Max. Mass	18 Kg	118 Kg	380 Kg
Uncertainty *)	E < 0,02%	E < 0,02%	E < 0,02%

*) The uncertainty has been set according to ISO 9368-1.

Traceability.

All readings which enter into the uncertainty calculations from the calibration rigs come from measuring instruments which in an uninterrupted row are traceable to international standards.

Measurement	Type	Manufacture	Traceable to
Temperature	Pt 1000	Danfoss	Jydsk Teknologisk Lab.
Mass	HBM27A	HBM	Dantest via Reference Weights
Time	3852.A	HP	DCF77 Braunschweig (freq.normal)

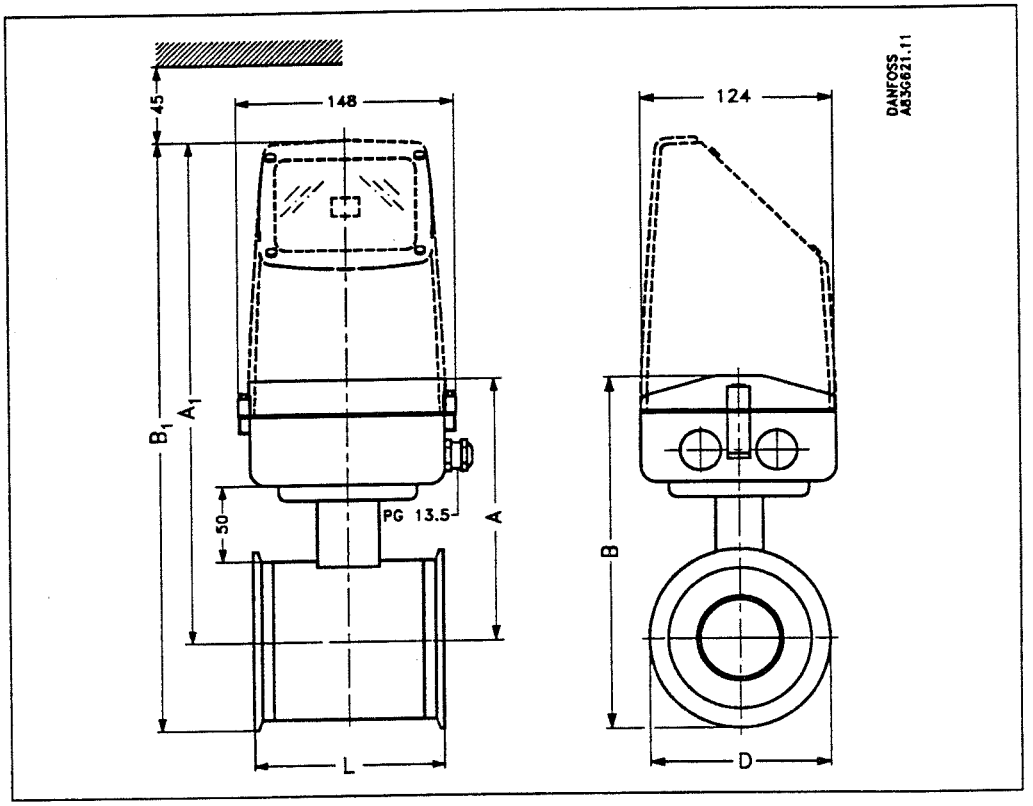
INSTRUCTIONS

DANSK

MAGFLO®
Magnetisk induktiv flowmåler
type MAG 1100 FOOD

083R9057

Mål og vægt

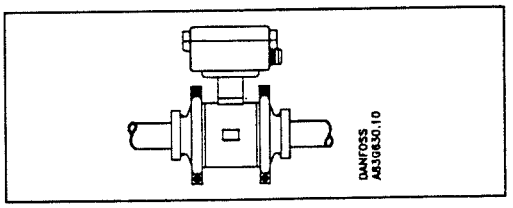


DN	L [mm]	A [mm]	B [mm]	A_1 [mm]	B_1 [mm]	D [mm]	[kg]¹⁾
10	66	143	175	300	332	64	2,2
15	66	143	175	300	332	64	2,2
25	81	151	190	308	347	77,5	2,7
40	96	161	207	318	364	91	3,4
50	106	170	230	327	387	119	4,2
65	133	178	243	335	400	130	5,5
80	158	186	264	343	421	155	7,0

¹⁾ Ved kompakt montage med signalomsætter MAG 2500 eller MAG 3000 øges vægten med ca. 2 kg.

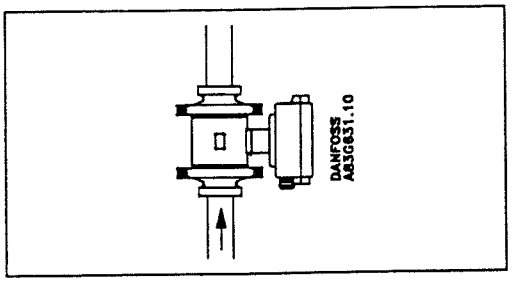
Målehoved MAG 1100 FOOD kan også anvendes sammen med signalomsætter MAG 2500 eller MAG 3000 monteret kompakt (vist stiplet på måltegningen).

Potentialeudligning



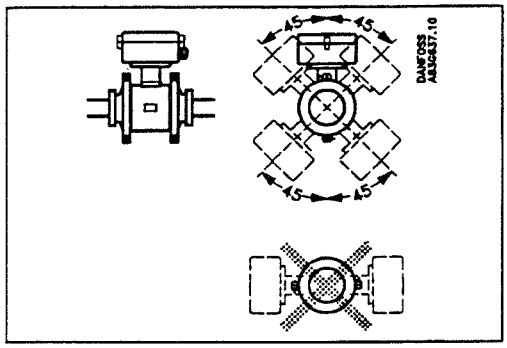
Målehovedet monteres mellem to adapterflanger, hvorved potentiale udligningen til væsken sker automatisk.

Installation i lodrette rør



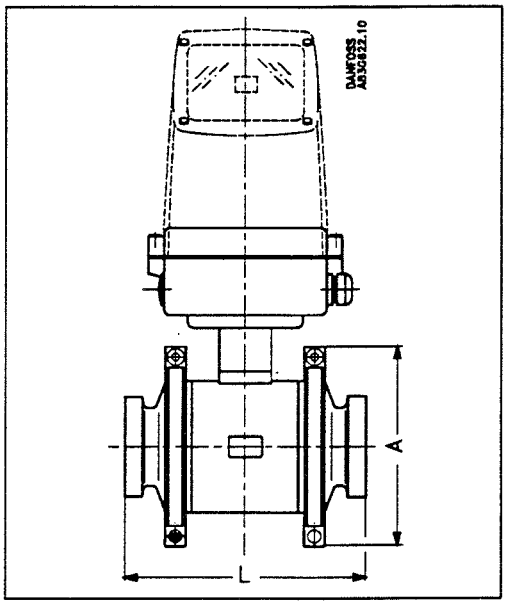
Anbefalet flowretning: Opad. Dette minimerer indflydelse på måling fra evt. gas-/luftbobler i væsken.

Installation i vandrette rør



Målehovedet monteres som vist på den øverste figur. Af hensyn til måleprincippet må målehovedet ikke monteres som vist på den nederste figur.

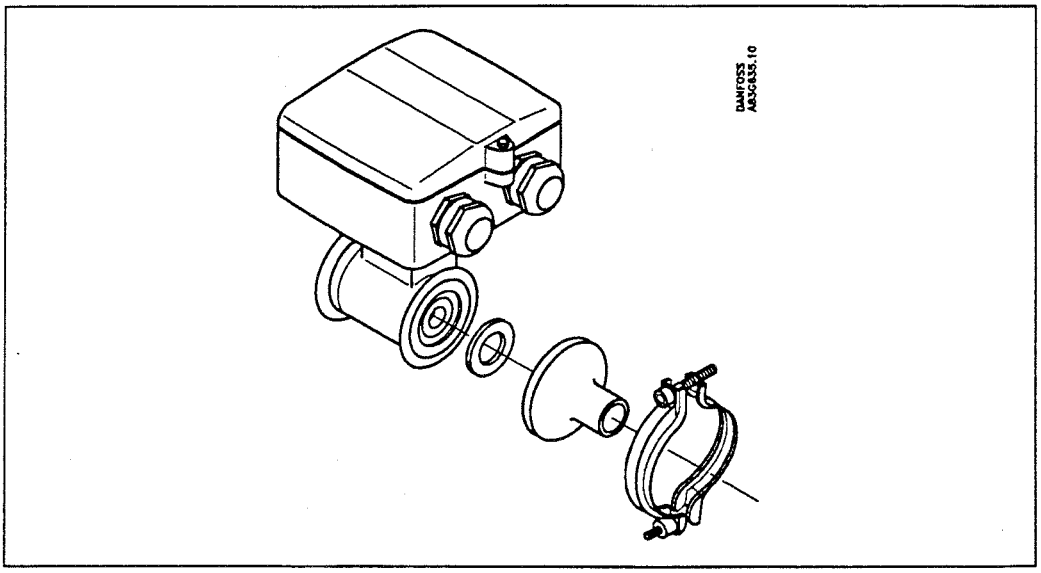
Indbygningslængde



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

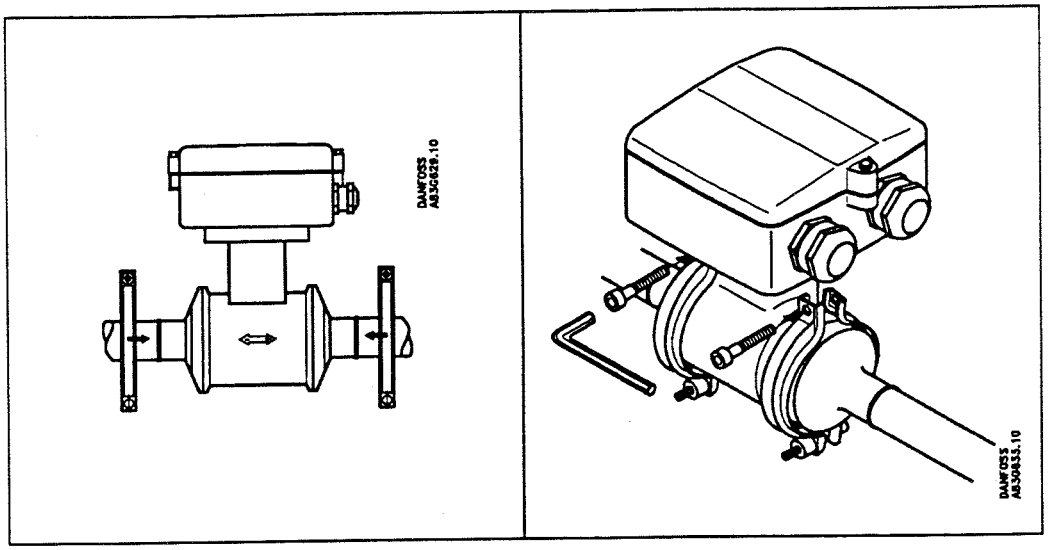
Den angivne indbygningslængde "L" er uafhængig af den valgte adapterflange.

Montage



Målehovedet MAG 1100 FOOD har en integreret clamp tilslutning og er beregnet for montage mellem to adapterflanger, der leveres separat. Disse adapterflanger findes i flere varianter, som er tilpasset gængse standarder: ISO, DIN, SS, SMS, BS og DS, for henholdsvis isvejsning i mejerirør eller med clamp- eller gevindtilslutning.
Ved samling placeres pakningen i adapterflangen, som herefter fastgøres til målehovedet med clampringen. Denne placeres, lukkes og tilspændes således, at hele pakfladen mellem målehoved og adapter har kontakt metal mod metal.
For at opnå optimal nøjagtighed og hygiejniske forhold er det vigtigt, at målehovedets og rørets centerlinie er sammenfaldende, at fittings er monteret vinkelret i forhold til røret, og at indløbsstrækningen ikke buer eller har skævheder.

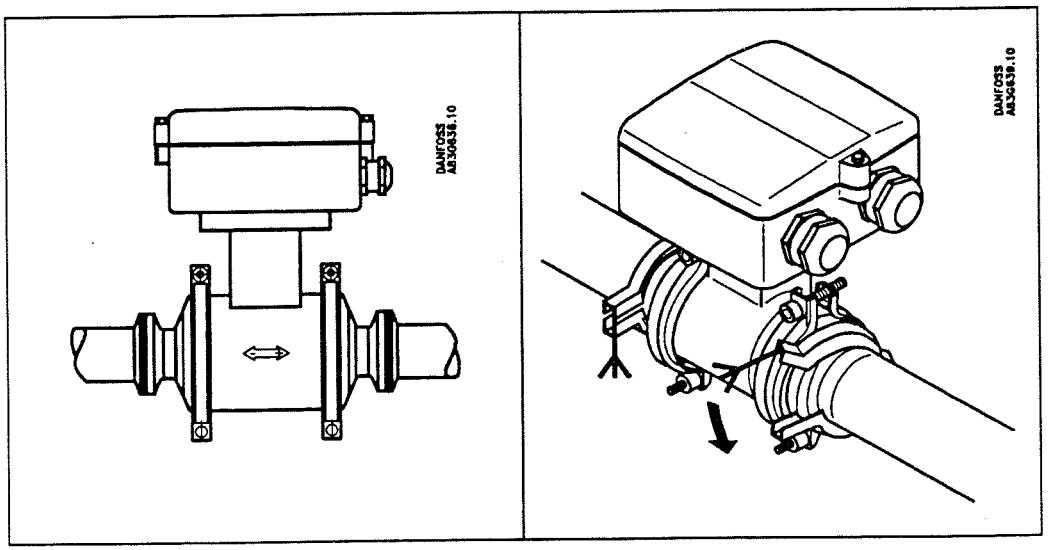
Montage med isvejst adapter



De to adapterflanger svejses fast til den eksisterende rørstrækning. Det er vigtigt at sikre en vinkelret isvejsning af adapteren for at undgå en skæv pakflade mod målehovedet.
Montage foregår bedst på følgende måde:

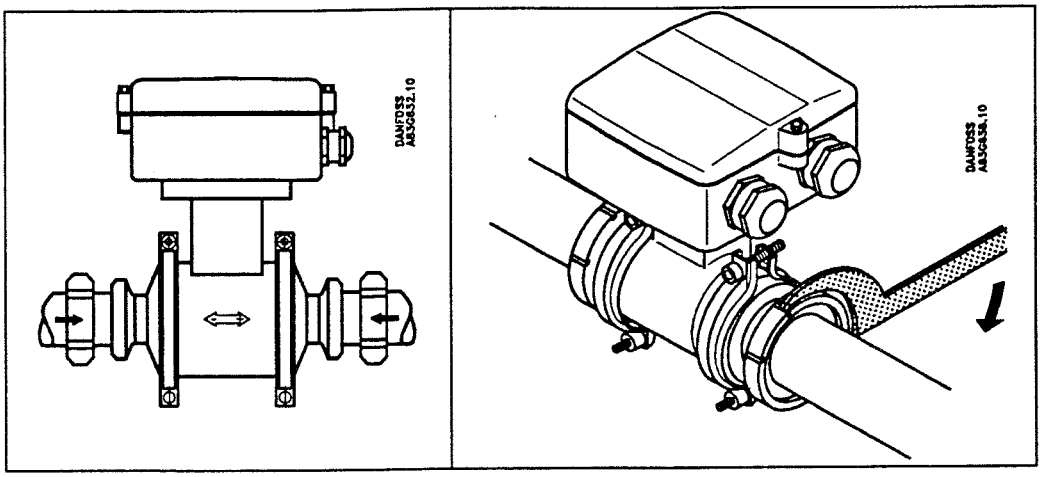
1. Skær et stykke ud af rørstrækningen svarende til den angivne indbygningslængde "L" for den pågældende dimension.
2. Saml målehovedet og adapterne med clampringene - **uden pakninger**.
3. Sæt målehovedet i rørstrækningen og hæftesvejs adapterne.
4. Fjern clampringene og tag målehovedet ud.
5. Fuldsvejs adapterne med røret.
6. Monter målehovedet med pakninger og clampringe.

Montage med clamp-adapter



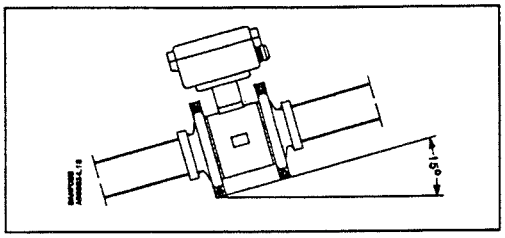
Målehoved, pakninger og adapterflanger samles til én enhed og monteres i selve rørstrækningen, som er monteret med passende fittings. Der skal anvendes pakninger efter gældende tilslutningsnorm for den aktuelt anvendte clamptilslutning.
Clampringen placeres, lukkes og tilspændes.

Montage med gevind-adapter



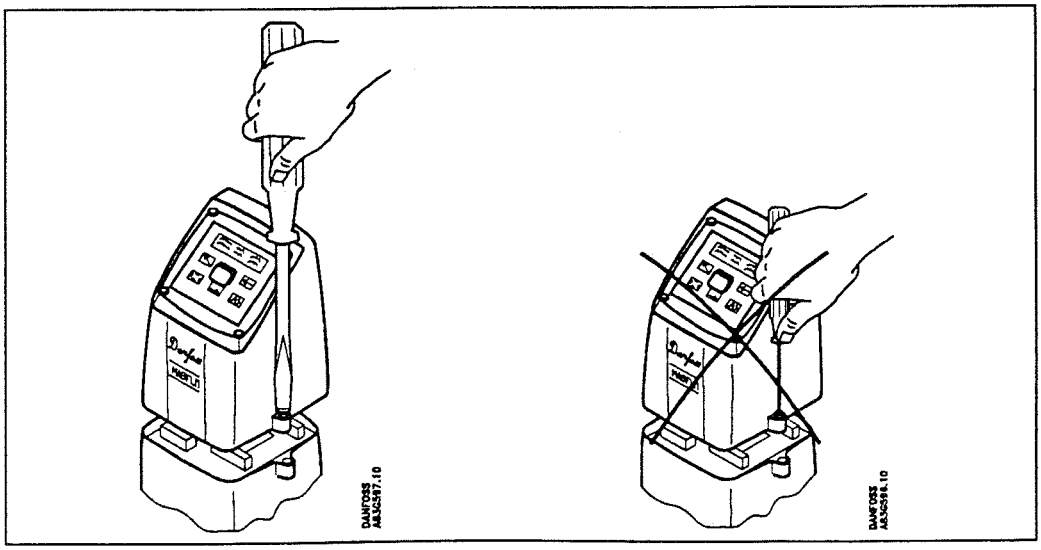
Målehoved, pakninger og adapterflanger samles til én enhed og monteres i selve rørstrækningen, som er monteret med passende fittings. Der skal anvendes pakninger efter gældende tilslutningsnormer for den aktuelt anvendte gevindtilslutning.
Tilspænding foretages med specialnøgle for anvendt tilslutning.

Selvtømning



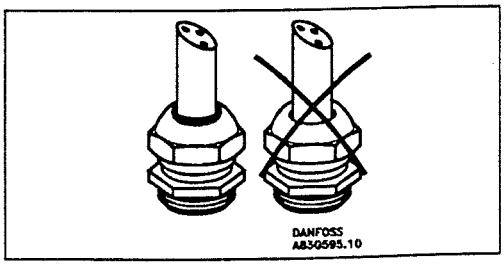
I de applikationer, hvor der er ønske om selvtømning af rørsystemet, skal målehovedet monteres med en hældning på minimum 15° i forhold til vandret plan.

Montage af låg eller signalomsætter på klemkasse



1. Monter pakningen på klemkassen og sørg for, at pakningen er på plads overalt.
2. Monter låget eller signalomsætteren på klemkassen.
3. Det er vigtigt, at skruerne spændes godt (min. 4 Nm). Dette gøre bedst med en stor skruetrækker, der passer til skruekærven.

Montage, kabel



Spænd forskruninger fast til for at opnå optimal tæthed. Pakningen i forskruningen skal tydeligt klemme om kablet.

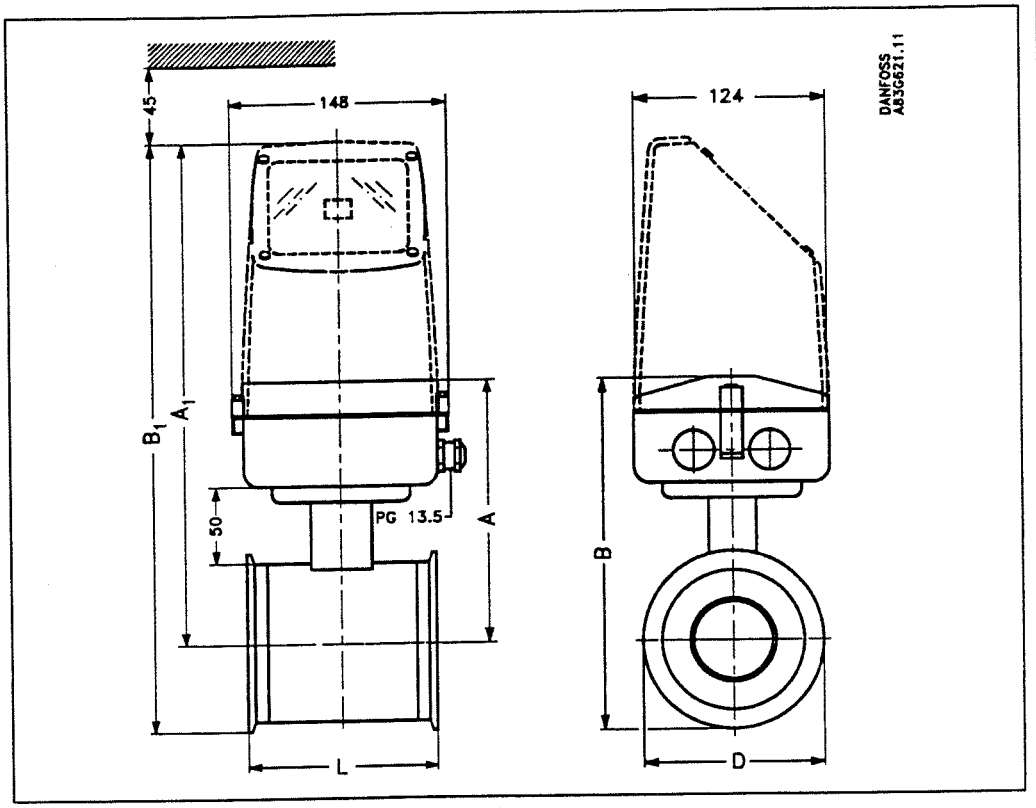
INSTRUCTIONS

ENGLISH

MAGFLO®
Electromagnetic flowmeter
type MAG 1100 FOOD

083R9057

Dimensions and weight

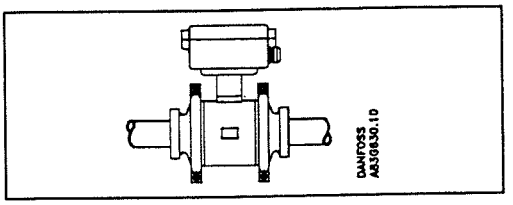


DN	L [mm]	A [mm]	B [mm]	A_1 [mm]	B_1 [mm]	D [mm]	[kg][1]
10	66	143	175	300	332	64	2.2
15	66	143	175	300	332	64	2.2
25	81	151	190	308	347	77.5	2.7
40	96	161	207	318	364	91	3.4
50	106	170	230	327	387	119	4.2
65	133	178	243	335	400	130	5.5
80	158	186	264	343	421	155	7.0

[1] With signal converter MAG 2500 or MAG 3000 installed weight is increased by approx. 2 kg.

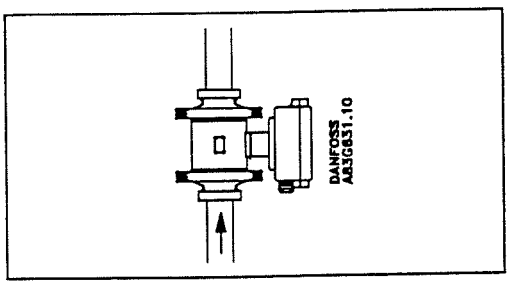
The MAG 1100 FOOD sensor can also be used with signal converter MAG 2500 or MAG 3000 installed in compact mode (shown by the dashed line on the dimensional sketch).

Potential equalisation



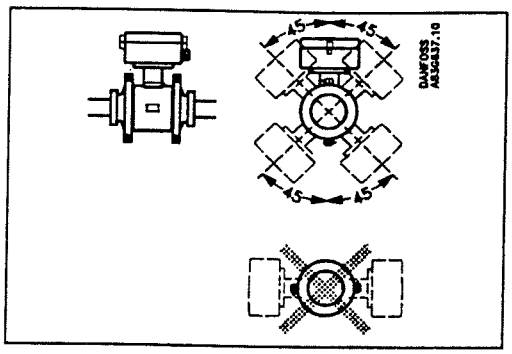
The sensor must be installed between two adapters. Potential equalisation with the liquid occurs automatically via these adapters and through the adjacent pipe.

Installation in vertical pipes



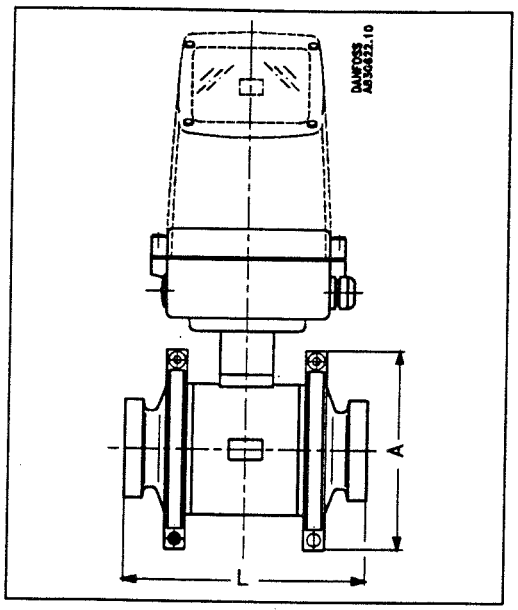
Recommended flow direction is upwards. This minimises the effect on the measurement of any gas/air bubbles in the liquid.

Installation in horizontal pipes



The sensor must be mounted as shown in the upper figure. Do not mount the sensor as shown in the lower figure due to the measuring principle (positioning of the electrodes).

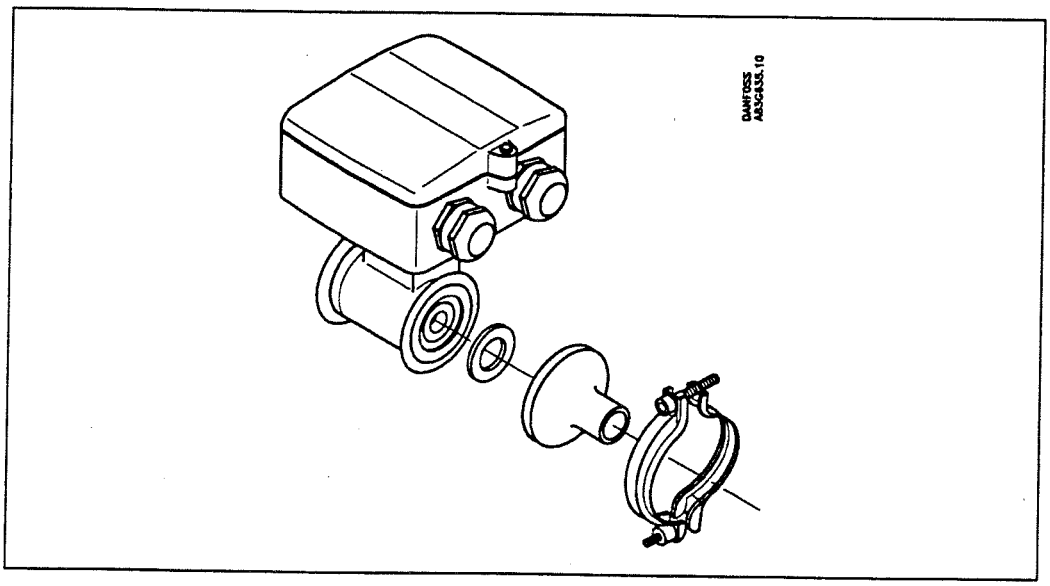
Total built-in length



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

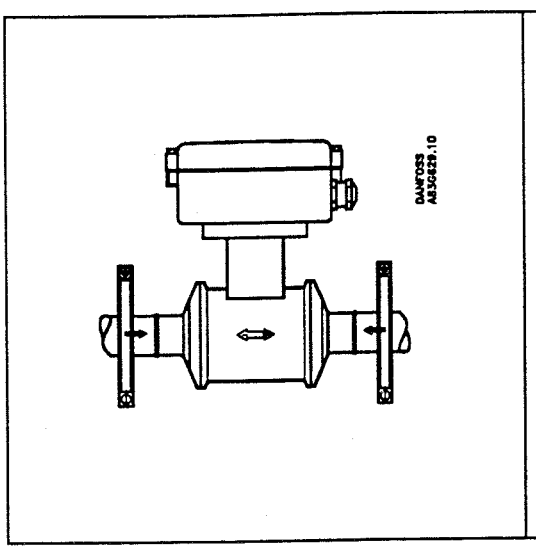
The total built-in length "L" is independant of the adapter type selected.

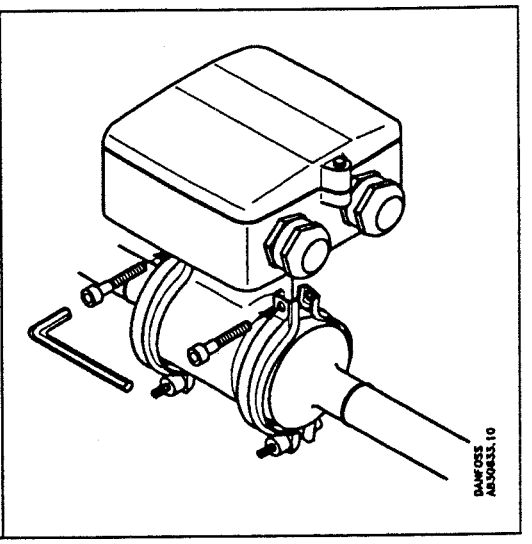
Installation



The MAG 1100 FOOD sensor has an integrated clamp connection and is designed for installation between two adapters, which are supplied separately. The adapters are available for a variety of standards according to: ISO, DIN, SS, SMS, BS and DS, for direct welding into dairy pipes or with clamp- or threaded fittings.
At assembly the gasket is placed in the adapter. The adapter is then fastened with a clamp ring. The clamp ring must be located, closed and tightened in order to ensure complete metallic contact between sensor and adapter facing.
To obtain optimum accuracy and hygienic conditions it is important that the sensor and the pipes are correctly aligned around their centerline, fittings must be perpendicular to the pipeline and upstream pipelines must be straight without curves.

Installation, welding type

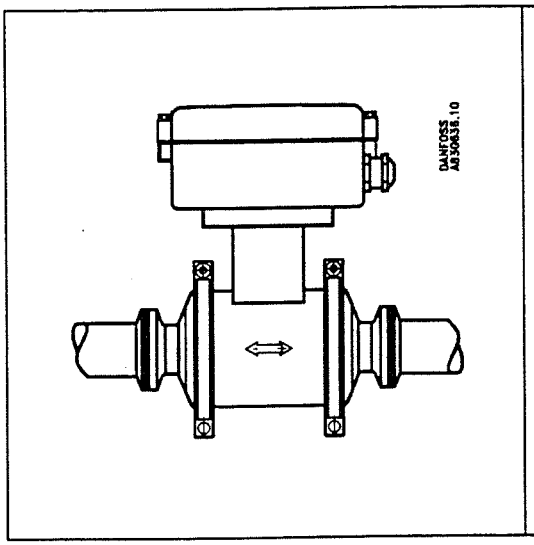


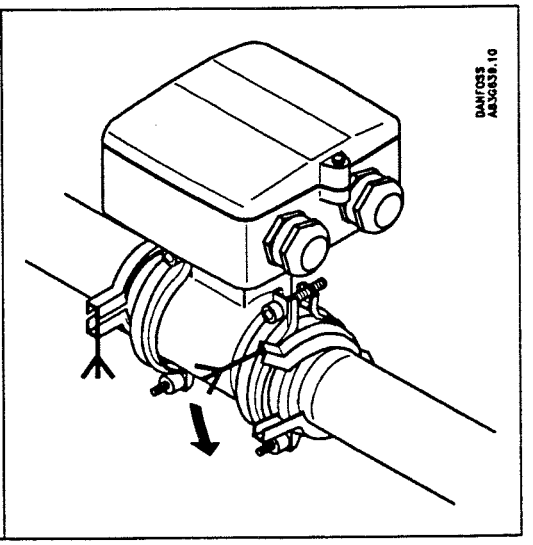


The two adapters are welded directly into the dairy pipes.
It is important to ensure a perpendicular welding to the pipeline in order to omit misalignment between sensor and adapter facing.
Installation to be as follows:

1. Cut a piece of the pipeline equal to the built-in length "L" stated for the actual sensor dimension.
2. Assemble the sensor and the adapters with the clamp rings - **leave the gaskets off.**
3. Mount the sensor and tag-weld the adapters to the pipe
4. Remove clamp rings and dismount the sensor
5. The adapters are firmly welded to the pipe
6. Re-install the sensor with gaskets and clamp rings

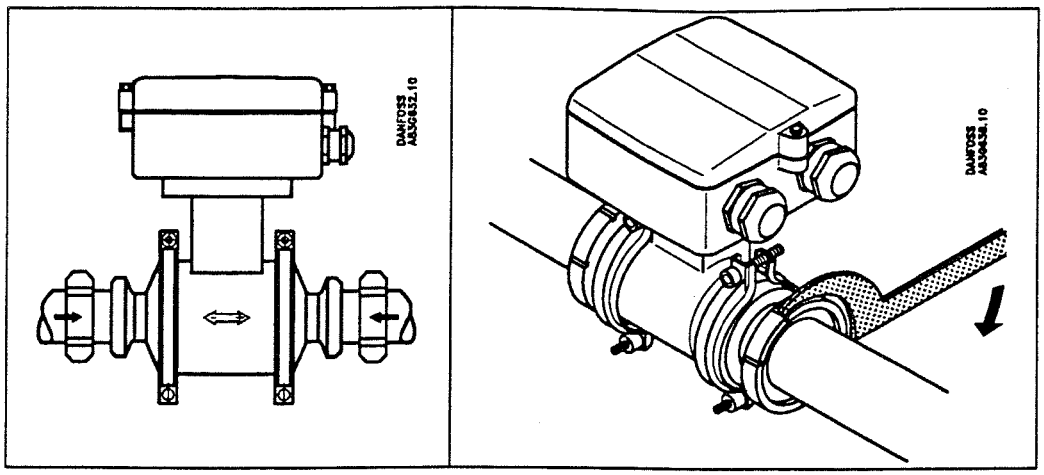
Installation, clamp type adapter





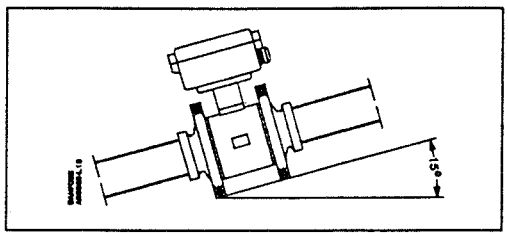
Sensor, gaskets and adapters are assembled to one unit and then installed in the pipeline prepared with a suitable fitting. Standard gaskets for the actual clamp connection must be used. The clamp rings must be located, closed and tightened.

Installation, thread type adapter



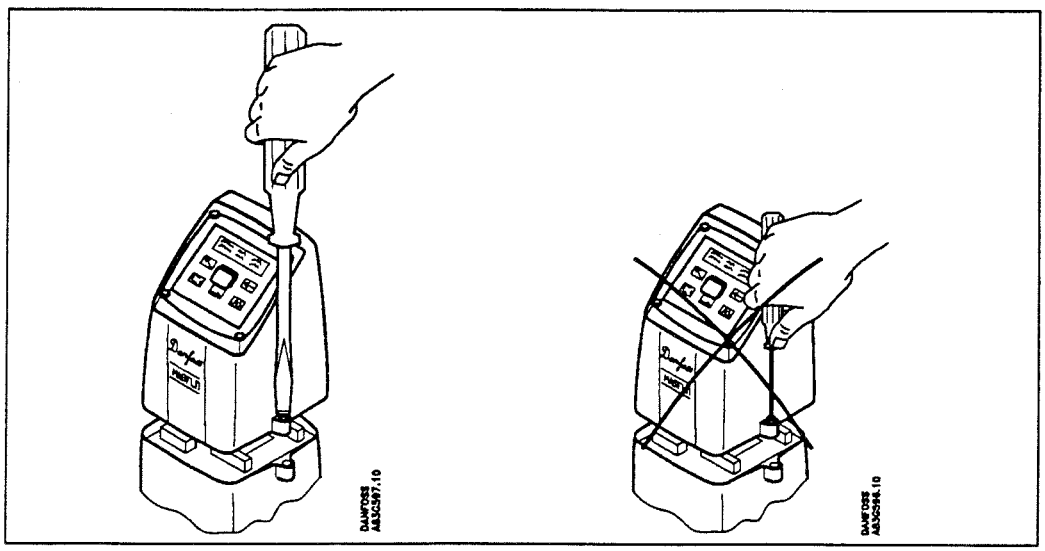
Sensor, gaskets and adapters are assembled to one unit and then installed in the pipeline prepared with a suitable fitting.
Standard gaskets for the actual thread connection must be used.
Tightening must be performed with a suitable union spanner.

Self-draining



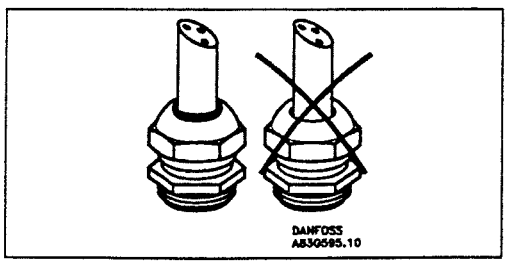
For applications where self-draining is required, the sensor must be mounted with a minimum incline of 15° to the horizontal plane.

Installation of the cover or signal converter on the terminal box



1. Mount the gasket on the terminal box and ensure the gasket is fitted correctly.
2. Mount the cover or the signal converter on the terminal box.
3. It is important that the screws are firmly tightened (4 Nm). Use a large screwdriver fitting into the screw slot.

Installation, cable



Tighten the cable entries to obtain optimum sealing. The cable entry gasket must obtain firm contact with the cable.

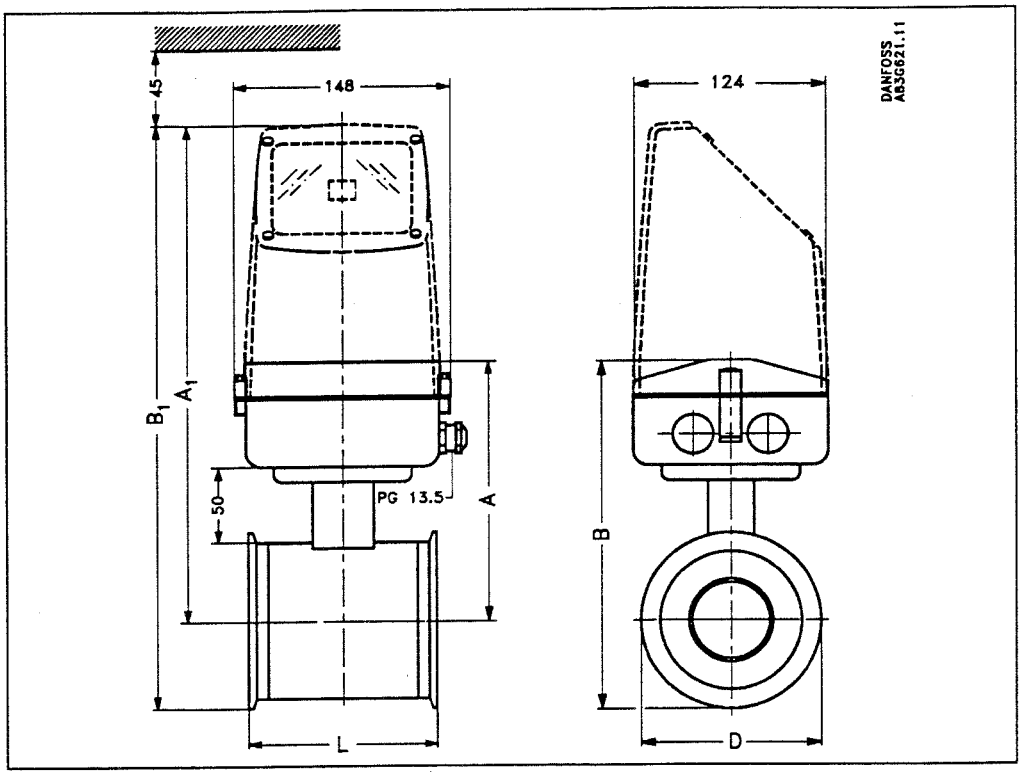
INSTRUCTIONS

DEUTSCH

MAGFLO®
Magnetisch-induktive Durchflußmesser
Typ MAG 1100 FOOD

083R9057

Abmessungen und Gewichte

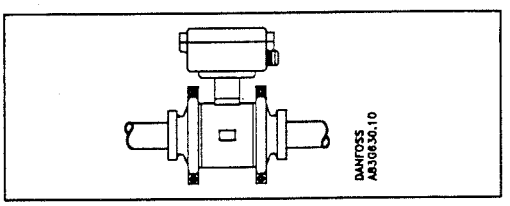


DN	L [mm]	A [mm]	B [mm]	A_1 [mm]	B_1 [mm]	D [mm]	[kg][1]
10	66	143	175	300	332	64	2,2
15	66	143	175	300	332	64	2,2
25	81	151	190	308	347	77,5	2,7
40	96	161	207	318	364	91	3,4
50	106	170	230	327	387	119	4,2
65	133	178	243	335	400	130	5,5
80	158	186	264	343	421	155	7,0

[1] Bei kompakter Montage mit dem Meßumformer MAG 2500 oder MAG 3000 erhöht das Gewicht um etwa 2 kg.

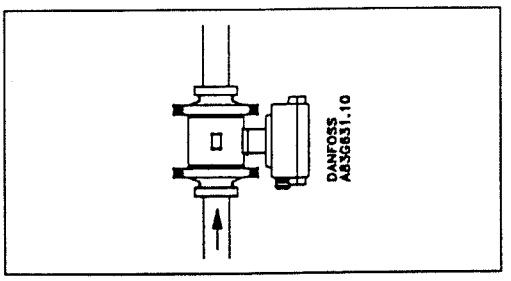
Der Meßaufnehmer MAG 1100 FOOD kann auch zusammen mit den kompakt montierten Meßumformern MAG 2500 oder MAG 3000 verwendet werden (siehe Darstellung auf der Abbilung).

Potentialausgleich



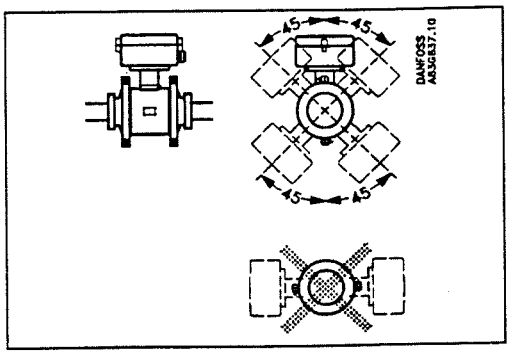
Falls der Meßaufnehmer zwischen zwei Adapterflanschen und der Potentialausgleich montiert erfolgt der Potentialausgleich mit dem Meßmedium automatisch.

Einbau in senkrechte Rohrleitungen



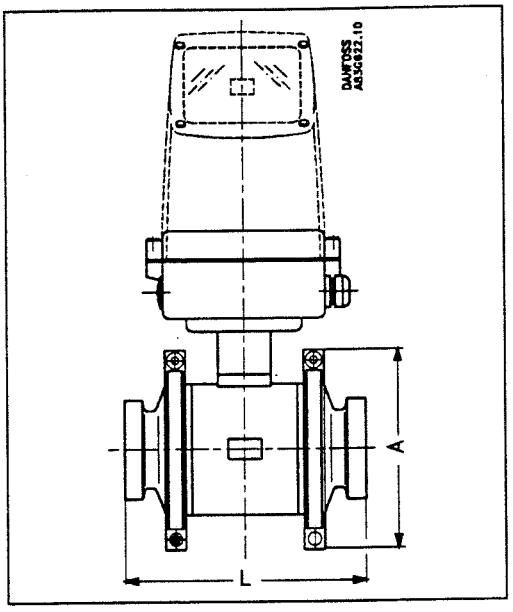
Die Fließrichtung sollte von unten nach oben erfolgen. Dies minimiert den Einfluß von eventuellen Gas- oder Luftblasen im Meßmedium.

Einbau in waagerechte Rohrleitungen



Der Meßaufnehmer sollte, wie auf der oberen Abbildung gezeigt, eingebaut werden.

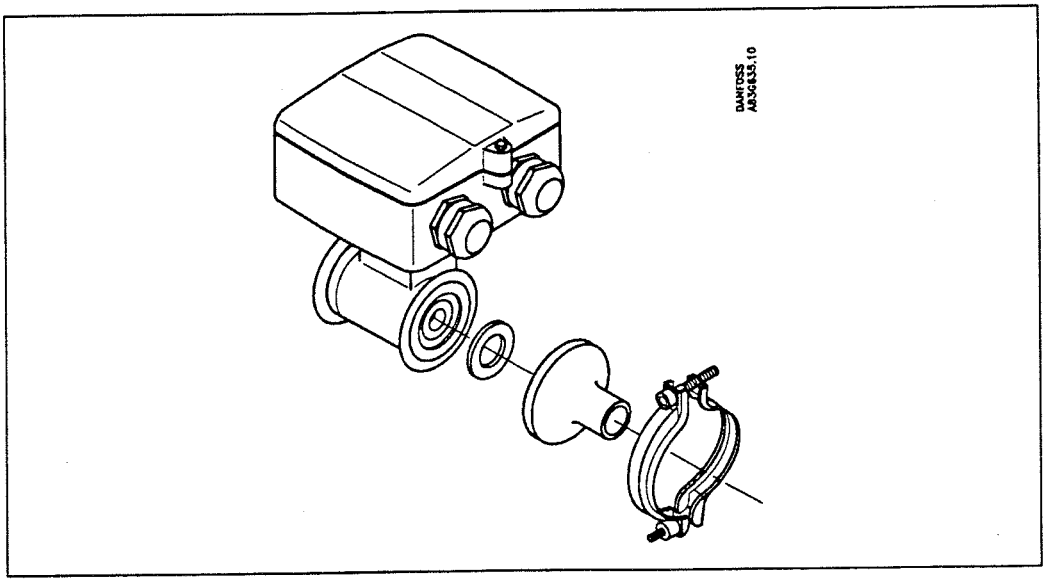
Einbaulänge



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

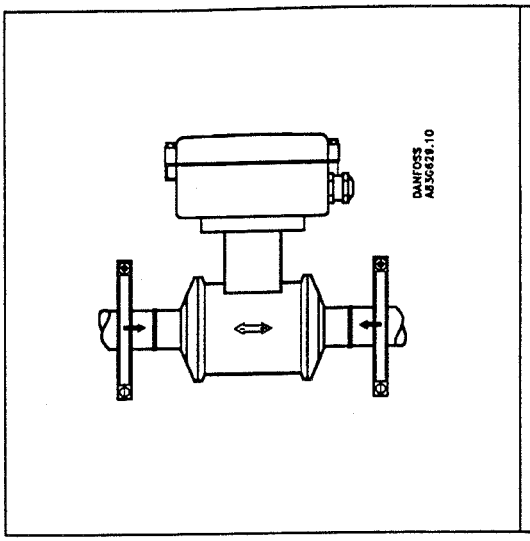
Die Einbaulänge „L" ist unabhängig von der Wahl der Adapterflansche.

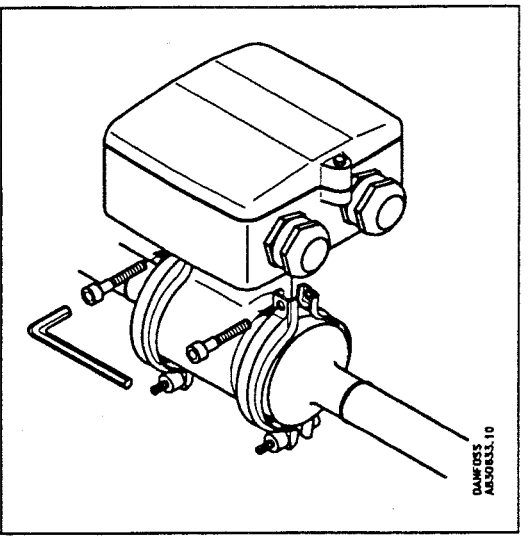
Montage



Der Meßaufnehmer MAG 1100 FOOD hat einen integrierten Clamp-Anschluß und ist für die Montage zwischen zwei separat gelieferten Adapterflanschen ausgelegt. Diese sind in mehreren Varianten erhältlich und den üblichen Normen angepaßt: ISO, DIN, SS, SMS, BS und DS für Einschweißen in Milchrohren oder mit Clamp- oder Gewindeanschluß.
Bei Zusammenbau die Dichtung in den Adapterflanschen einlegen und ihn dann mit dem Klemmring am Meßaufnehmer befestigen. Dieser muß plaziert, geschlossen und so gespannt werden, daß an der ganzen Dichtfläche zwischen Meßaufnehmer und Adapter Metal gegen Metal eng anliegt.
Um optimale Genauigkeit und hygienische Verhältnisse zu erreichen, ist es wichtig, daß die Mittelinien von Meßaufnehmer und Rohr zusammenfallen, so daß die Armaturen senkrecht zu dem Rohr montiert sind, und daß die Einlaufstrecke sich nicht biegt oder schief liegt.

Montage mit angeschweißtem Adapter

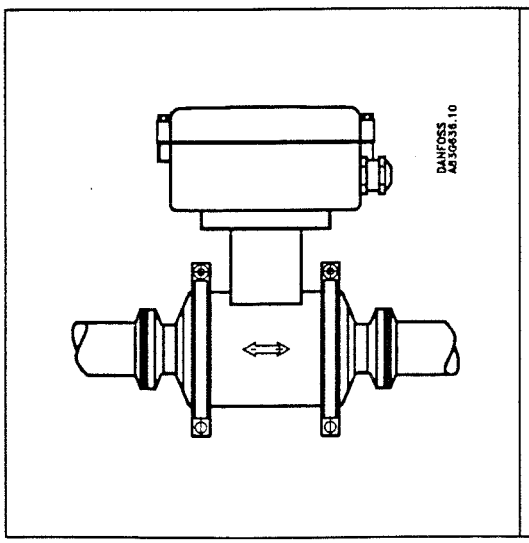


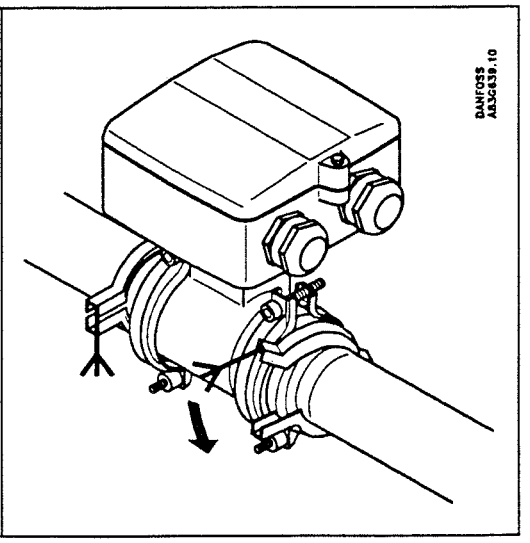


Die zwei Adapterflanschen werden an die vorhandene Rohrleitung geschweißt. Es ist wichtig, eine senkrechte Schweißung der Adapter sicherzustellen um eine schiefe Dichtfläche gegen den Meßaufnehmer zu vermeiden.
Die Montage sollte wie nachfolgend beschriebend, durchgeführt werden:

1. Ein Stück aus der Rohrleitung sägen, das mit dem Maß für die Einbaulänge „L" übereinstimmt.
2. Der Meßaufnehmer und die Adapter mit den Klemmring ohne Dichtungen zusammenbauen.
3. Den Meßaufnehmer in die Rohrleitung einfügen und die Adapter heftschweißen.
4. Klemmringe entfernen und den Meßaufnehmer herausnehmen.
5. Die Adapter an den Rohren festschweißen.
6. Den Meßaufnehmer mit Dichtungen und Klemmringen montieren.

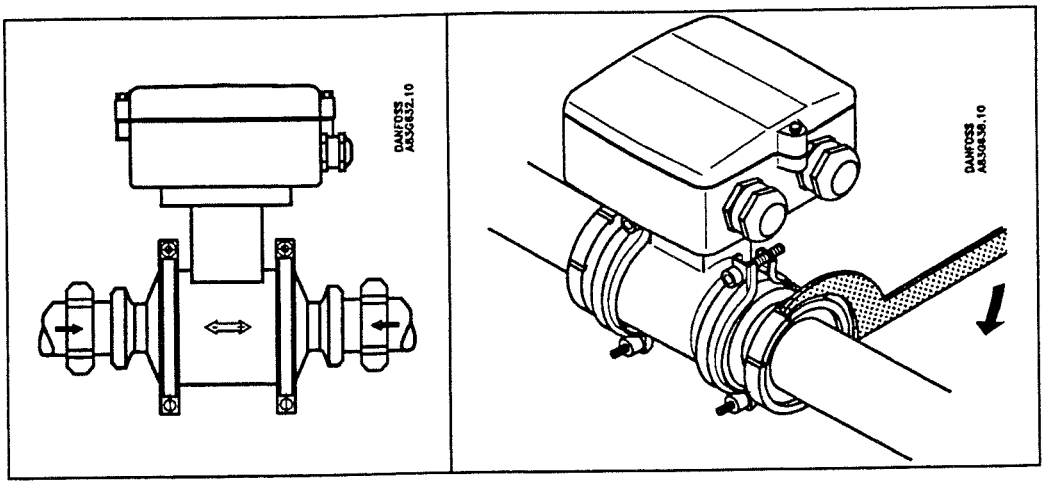
Montage mit Clamp-Adapter





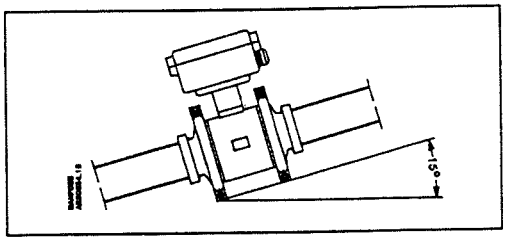
Meßaufnehmer und Adapterflansche zu einer Einheit zusammenbauen und in die Rohrleitung montieren, die mit passenden Armaturen versehen ist. Dichtungen nach geltender Anschlußnorm müssen für den aktuell benutzten Clamp-Anschluß verwendet werden.
Der Klemmring muß plaziert, geschlossen und festgespannt werden.

Montage mit Gewindadapter



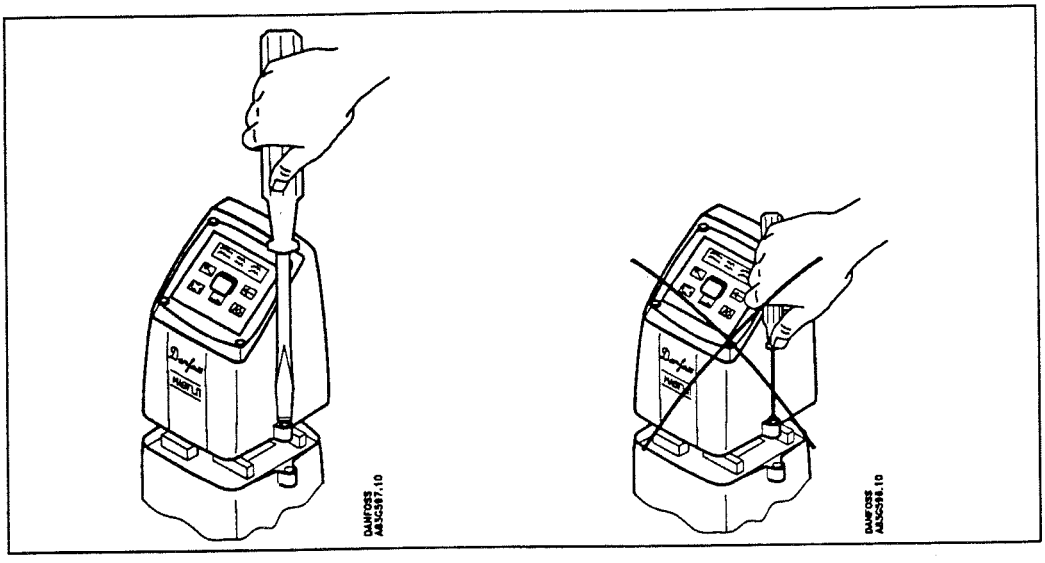
Meßaufnehmer, Dichtungen und Adapterflansche werden zu einer Einheit zusammengebaut und in die Rohrleitung montiert, die mit passenden Armaturen versehen ist. Dichtungen nach geltenden Anschlußnormen für den aktuell benutzten Gewindeanschluß verwenden. Das Spannen erfolgt mit eine für den Anschluß passenden Spezialschlüssel.

Selbstentleerung



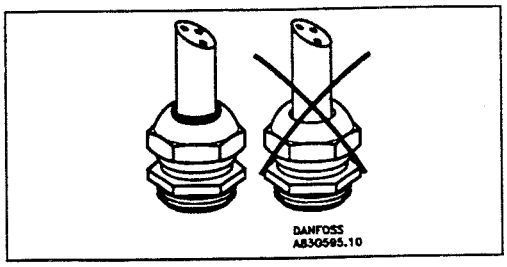
In den Anwendungen, bei denen man Selbstentleerung des Rohrsystems wünscht, muß der Meßaufnehmer mit einer Neigung von min. 15° zur waagerechten Ebene montiert werden.

Montage von Deckel oder Meßumformer auf den Klemmenkasten



1. Die Dichtungen auf den Klemmenkasten montieren. Dabei auf korrekten Sitz achten.
2. Ausschließend den Deckel oder den Meßumformer auf den Klemmenkasten montieren.
3. Darauf achten, daß die Schrauben gut festgezogen werden (min. 4Nm).

Montage, Kabel



Die Kabelverschraubungen gut festigen, um optimale Dichtung zu bekommen. Die Dichtungen in der Kableverschraubung sollen deutlich um das Kabel klemmen.

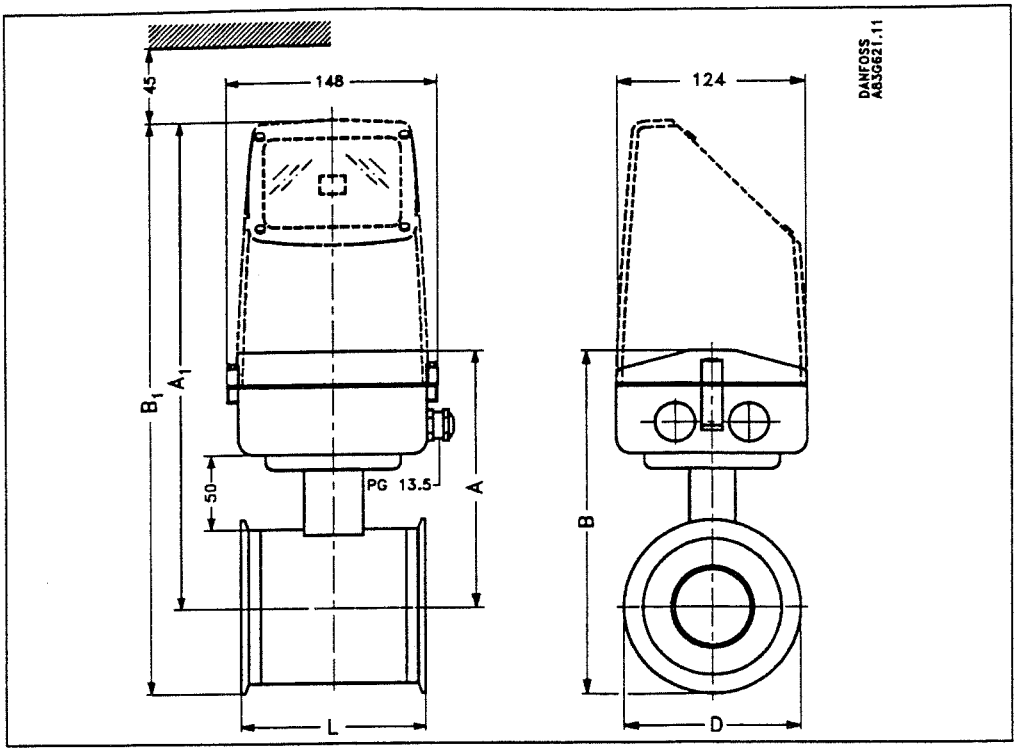
INSTRUCTIONS

FRANÇAIS

Débitmètre à induction magnétique MAGFLO® type MAG 1100 FOOD

083R9057

Dimensions et poids

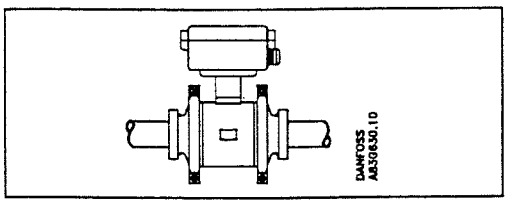


DN	L [mm]	A [mm]	B [mm]	A_1 [mm]	B_1 [mm]	D [mm]	[kg][1]
10	66	143	175	300	332	64	2,2
15	66	143	175	300	332	64	2,2
25	81	151	190	308	347	77,5	2,7
40	96	161	207	318	364	91	3,4
50	106	170	230	327	387	119	4,2
65	133	178	243	335	400	130	5,5
80	158	186	264	343	421	155	7,0

[1] En cas d'utilisation des convertisseurs de signaux MAG 2500 ou MAG 3000, le poids est majoré de 2 kg env.

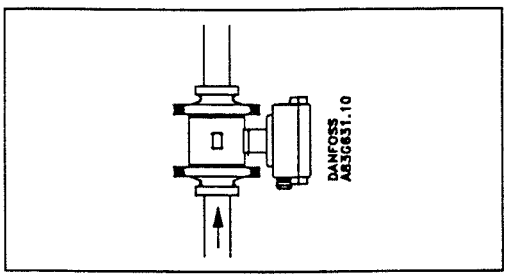
La tête de mesure MAG 1100 FOOD peut aussi être employée avec le convertisseur de signaux MAG 2500 ou MAG 3000 installé en mode compact (représenté par la ligne pointillée sur le croquis coté).

Egalisation de potentiel



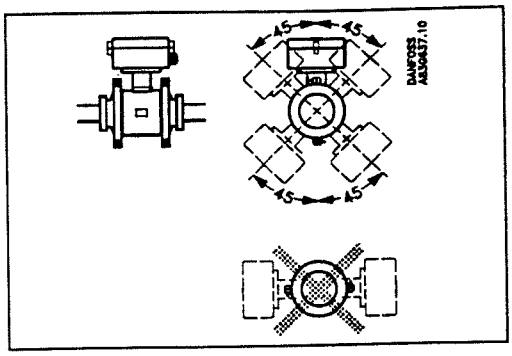
La tête de mesure doit être installée entre deux adaptateurs. L'égalisation de potentiel avec le fluide s'effectue automatiquement par l'intermédiaire de ces adaptateurs et de la conduite adjacente.

Installation sur conduites verticales



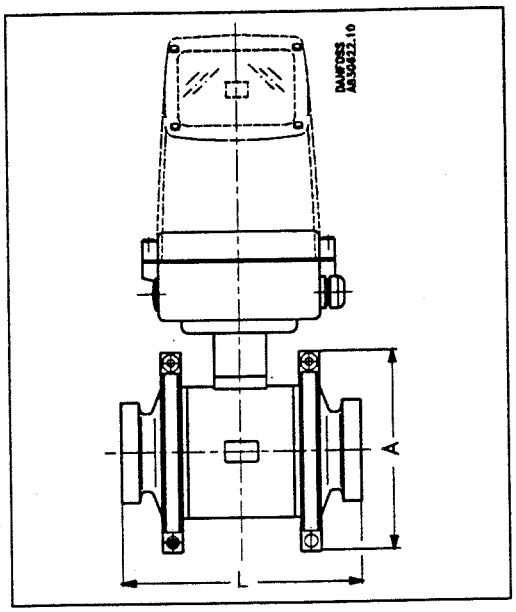
Sens d'écoulement recommandé: vers le haut, afin de minimiser l'influence des bulles d'air/de gaz du fluide sur la prise de mesure.

Installation sur conduites horizontales



La tête de mesure doit être installée comme indiqué par la figure du haut. Ne jamais la monter de la manière indiquée par la figure du bas afin de respecter le principe de mesure (positionnement des électrodes).

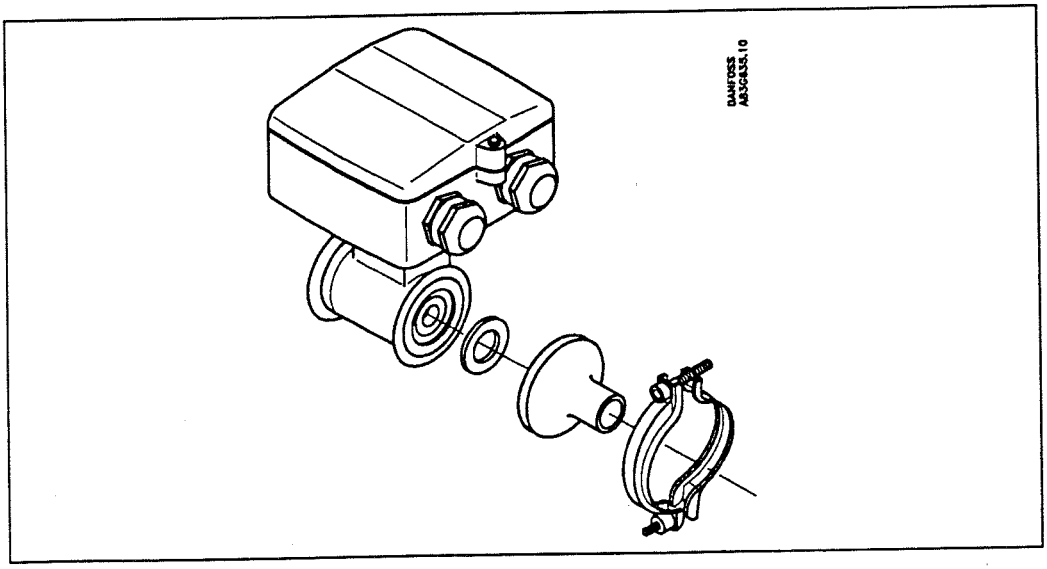
Longueur de montage totale



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

La longueur de montage totale "L" est indépendante du type d'adaptateur choisi.

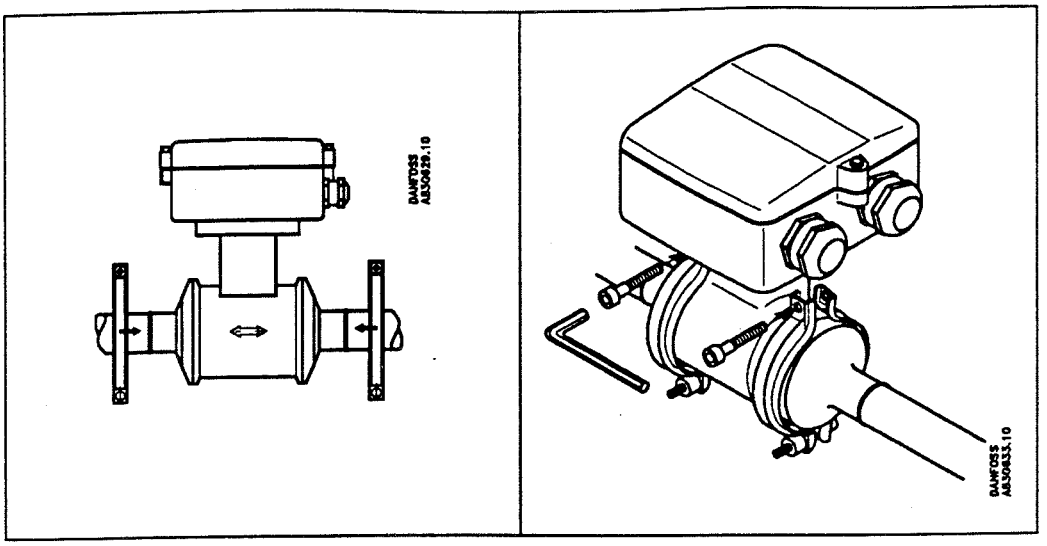
Installation



La tête de mesure MAG 1100 FOOD possède un raccord clamp incorporé et doit être montée entre deux adaptateurs, fournis séparément. Ces adaptateurs existent en différentes versions, conformes aux normes ISO, DIN, SS, SMS, BS et DS, pour soudage direct sur conduites alimentaires ou avec raccords clamp ou filetés.

Lors de l'assemblage, le joint doit être placé dans l'adaptateur. On fixe ensuite l'adaptateur à l'aide d'une bague de serrage, qui doit être mise en place, fermée et serrée de manière à garantir un contact parfait entre les parties métalliques de la tête de mesure et du revêtement de l'adaptateur. Pour obtenir une précision et des conditions d'hygiènes optimales, il est important de veiller au bon alignement de la tête de mesure et des conduites le long de l'axe médian, les raccords doivent être perpendiculaires à la canalisation et les canalisations amont doivent être rectilignes, sans courbes.

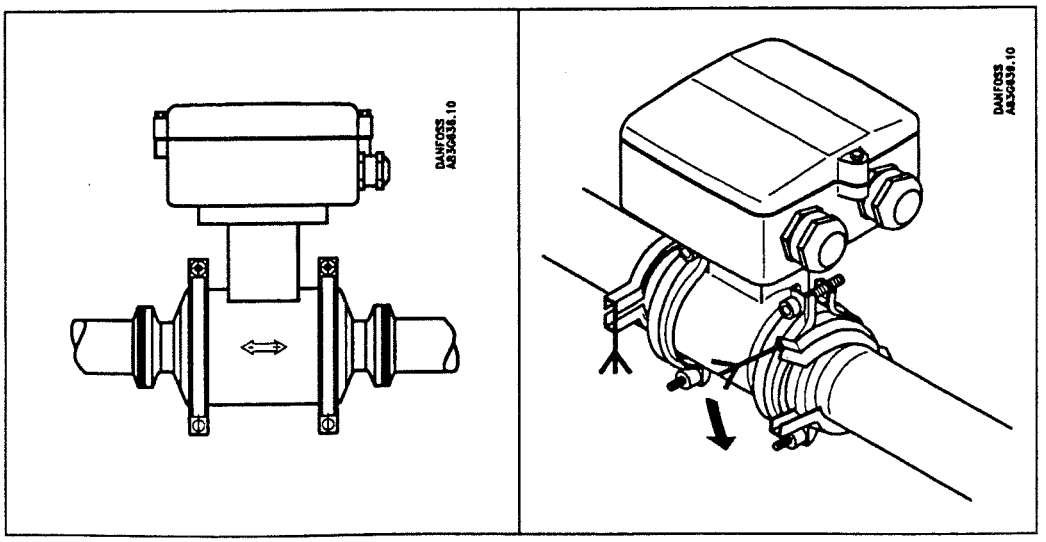
Installation, type de soudure



Les deux adaptateurs se soudent directement sur les conduites alimentaires. La soudure doit être perpendiculaire à la canalisation afin d'éviter tout défaut d'alignement entre la tête de mesure et le revêtement de l'adaptateur.
L'installation doit être effectuée de la manière suivante :

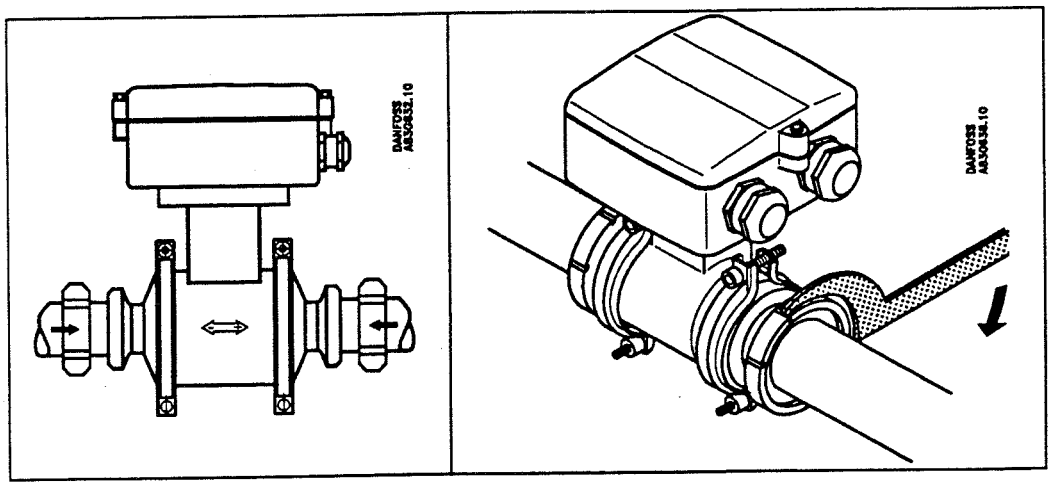
1. Couper un tronçon de canalisation égal à la longueur de montage totale "L", fournie avec les dimensions effectives de la tête de mesure.
2. Monter la tête de mesure et les adaptateurs à l'aide des bagues de serrage, **sans les joints**.
3. Monter la tête de mesure et souder les adaptateurs sur la conduite.
4. Retirer les bagues de serrage et démonter la tête de mesure.
5. Souder les adaptateurs solidement sur la conduite.
6. Réinstaller la tête de mesure, avec les joints et les bagues de serrage.

Installation, adaptateur de type clamp



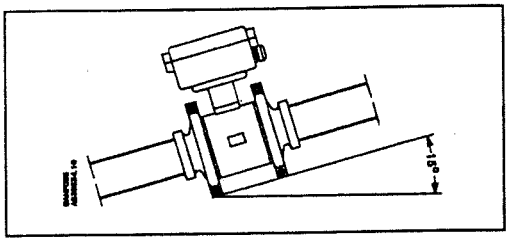
Monter les joints et les adaptateurs sur la tête de mesure puis installer l'ensemble sur une canalisation dotée d'un raccord adapté. Employer les joints standard correspondant au raccord clamp effectivement utilisé. Mettre en place, fermer et serrer les bagues de serrage.

Installation, adaptateur ité



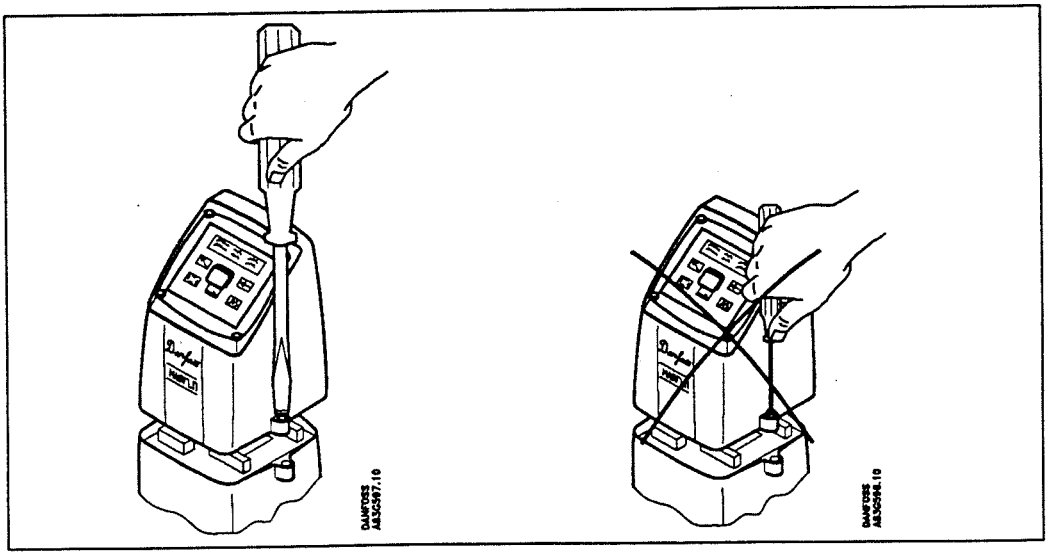
Monter les joints et les adaptateurs sur la tête de mesure puis installer l'ensemble sur une canalisation dotée d'un raccord adapté. Employer les joints standard correspondant au raccord fileté effectivement utilisé. Pour le serrage, utiliser une clé pour raccords adaptée.

dange automatique



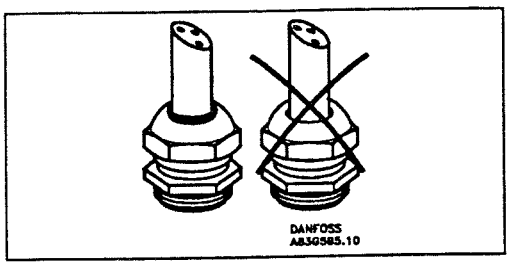
Pour les applications exigeant une vidange automatique, la tête de mesure doit être installée selon un angle minimum de 15° par rapport au plan horizontal.

Installation du couvercle ou du convertisseur de signaux sur la boîte à bornes



1. Monter le joint sur la boîte à bornes et vérifier qu'il est correctement mis en place.
2. Monter le couvercle ou le convertisseur de signaux sur la boîte à bornes.
3. Veiller au serrage correct des vis (4 Nm). Employer pour cela un tournevis de grande taille adapté à la tête de vis.

Installation, câble



Serrer les entrées de câble de manière à garantir une étanchéité optimale. Veiller à assurer un contact parfait entre le joint d'entrée de câble et le câble.

Section 9

The Wincanton Standardiser Model TW-200/ TW-250

Massflo Data

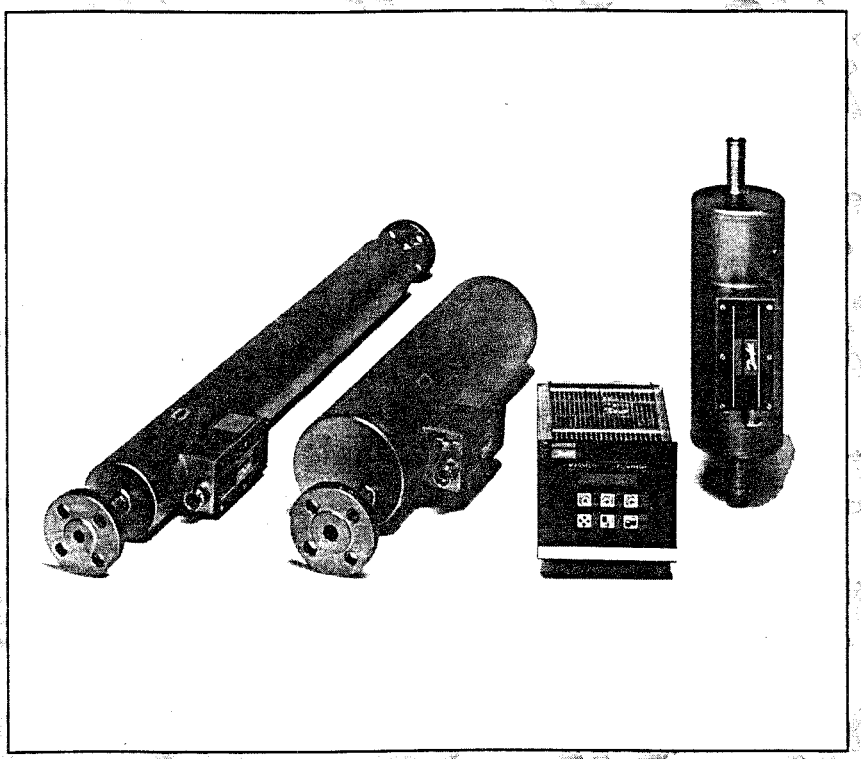
Manual

Instrumentation

MASSFLO®

Mass flowmeter

Sensor type MASS 1100, MASS 2100
Signal converter type MASS 3000



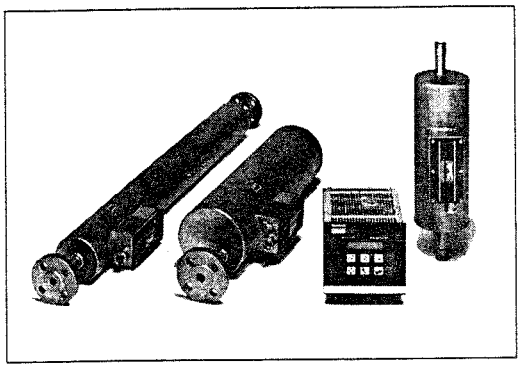
oss range of mass flowmeters

Sensor	MASS 1100 	MASS 2100 
Dimension [mm]	10 - 25 - 50	3 - 6 - 15 - 25 - 40
Measuring range [kg/h]	40 - 80000	1 - 52000
Versions	2-pipe system	1-pipe system (self-draining)
	Standard or heated	Standard or heated
Materials (wetted)	1.4439 (Stainless steel)	1.4539 (Stainless steel) 2.4602 (Hastelloy C-22)
Liquid temperature [°C]	–50 to +180	
Pressure [bar]	Max. 130	Max. 500
Types of end fittings or flanges	Flange: DIN 2635 ANSI B. 16.5 Dairy: Screwed connections DIN 11851 Screwed connections ISO 2853 Clamp ISO 2852	
Enclosure (sensor)	Stainless steel 1.4301, IP 65	
Ex-version	EEx ia II C T3-T6 (EEx ia II C T4-T6)	EEx ia II C T3-T6 (EEx ia II B T3-T6)

Signal converter	MASS 3000 	
Outputs	2 current outputs 1 frequency/pulse output 2 relay outputs	3 current outputs 2 frequency/pulse outputs 2 relay outputs
Display	Indication of:	Measuring values Settings Error codes Alarms Internal totalizing (2 pcs.)
Measurement of	- Mass flow rate - Total mass - Density - Temperature	- Volumetric flowrate - Total volume - Fraction flow - % fraction (e.g. Brix) - Total fraction
Accuracy (error limit)	±0.15% of actual flow	
Ex-version	[EEx ia] II C	

Contents

Introduction



Danfoss MASSFLO® mass flowmeters are for the direct measurement of:

- Mass flow rate
- Total mass
- Density
- Temperature
- Volumetric flowrate
- Total volume
- Fraction flow
- % fraction (e.g. °Brix)
- Total fraction

MASSFLO® mass flowmeters measure flow in kilogrammes. Measurement is independent of changes in liquid temperature, density, pressure, viscosity, conductivity and flow profile.

A mass flowmeter will also measure the mass flow of liquids with homogeneously distributed air and solid particles. However, large concentrations of air/solid particles will distort the measurement.

MASSFLO® mass flowmeters provide measurement with high accuracy. Accuracy is better than 0.15% over a wide measuring range.

The MASS 3000 signal converter is common to all sensors and is 115/230 V a.c. and 24 V d.c. compatible. An Ex-version is also available.

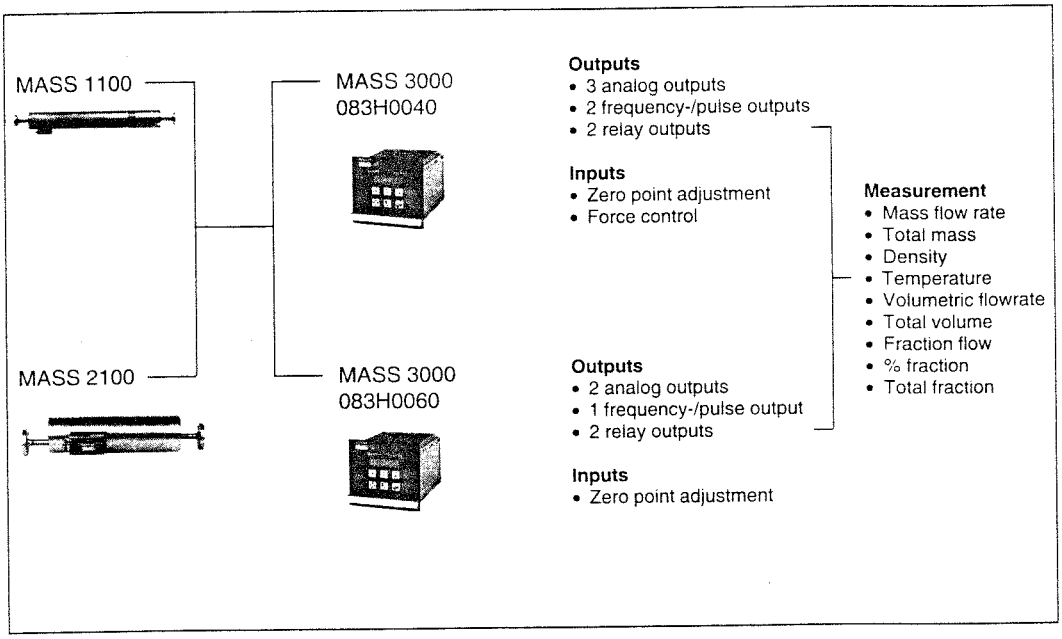
Precision measuring system

The mass flowmeter is a precision measuring system. It is very robust, but must be handled and installed in accordance with the instructions given in this manual.

Handling

The flowmeter should be handled carefully.
In the worst case impact and shock can produce imbalance in the MASS 1100 and MASS 2100 sensors with consequent measuring inaccuracy.

System overview

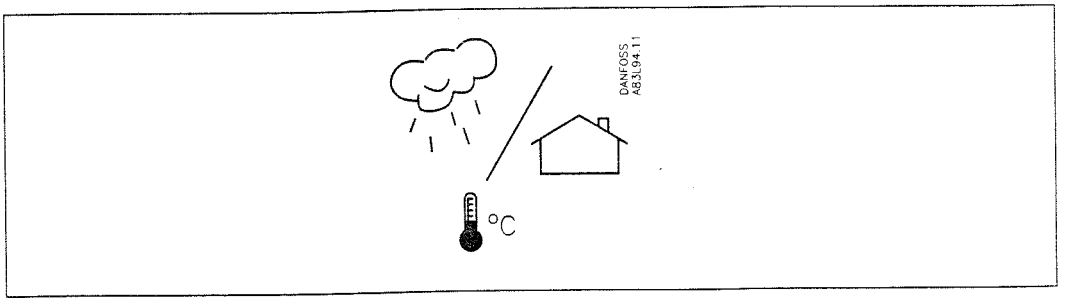


2. Sensor mounting. General guidelines for MASS 1100 and MASS 2100

To ensure the optimum function of measuring equipment it is important that the installation instructions are followed closely, point by point.

Location

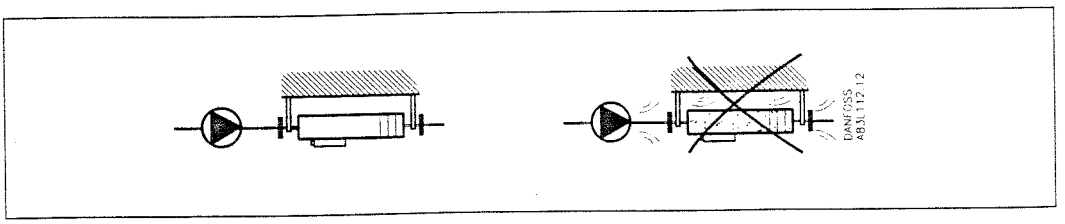
The sensor MASS 1100/2100 can be located both indoors and outdoors, but the following conditions must be observed.



The sensor is reliable for liquids and ambient temperatures from –50 to +180°C.
The grade of enclosure is IP 65.

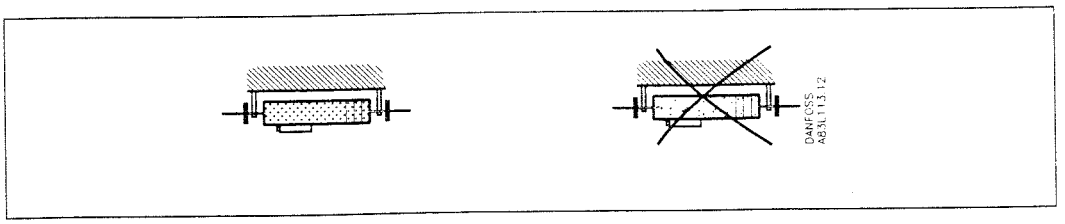
When the temperature difference between a liquid and the surroundings is large, the sensor must be insulated to prevent 2-phase flow and thereby measuring inaccuracy. This applies especially in the case of low flow.

Cavitation



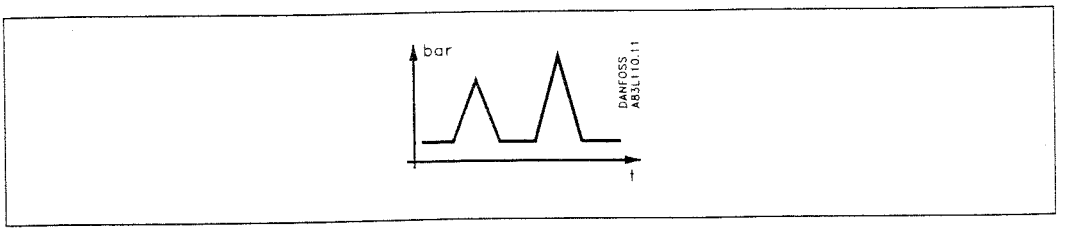
Avoid cavitation in the system, i.e. sucking in or releasing air into the system, because this may produce errors.
Static back pressure minimum 0.1-0.2 bar.

Air bubbles



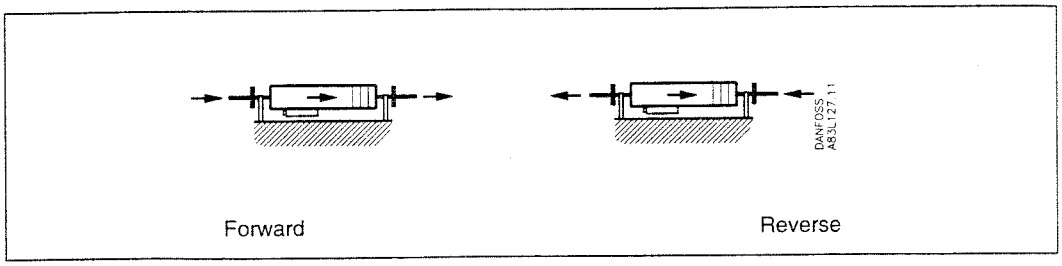
Avoid large quantities of air collecting in the sensor because these will disturb measurement.
Homogeneous mixtures of air and solids, however, will not disturb measurement.
When there is air in the liquid, installation of an air trap ahead of the meter is recommended.

Pressure range



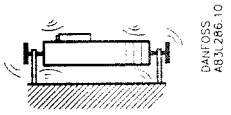
Avoid strong pressure surge in or immediately ahead of the flowmeter.

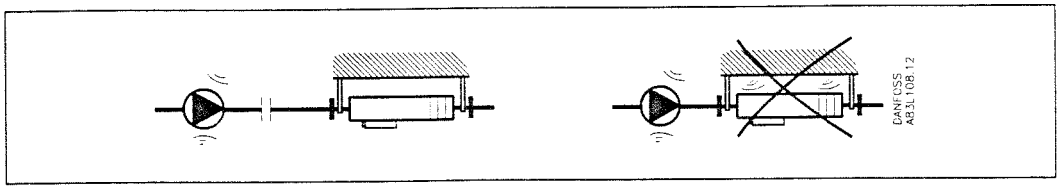
Direction of flow



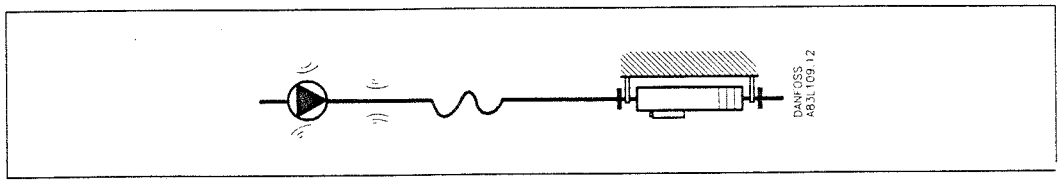
The arrow on the sensor indicates the direction of flow defined as "positive" (the meter is able to measure flow in both directions).

Vibration



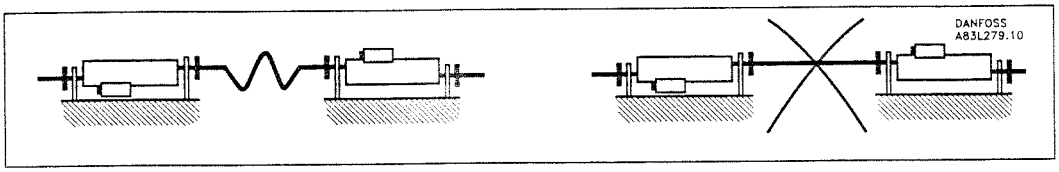


Locate the sensor as far away as possible from components that generate mechanical vibration in the piping.

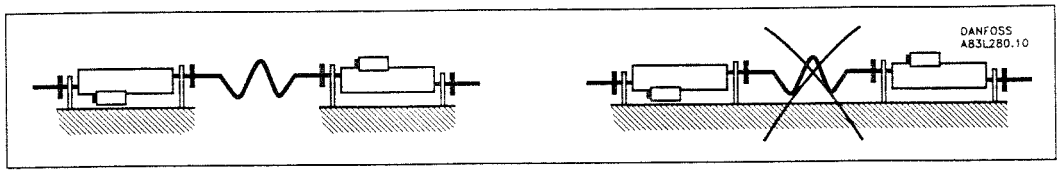


Or ensure that there is no direct connection with them e.g. by using flexible connections. Altenatively, the sensor can be located after a bend.

Cross-talk

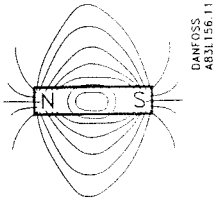


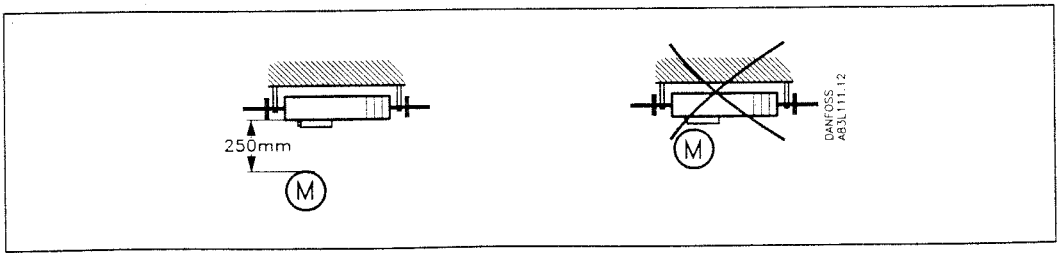
If the sensors are located close to each other, e.g. in the same pipe section, the meters may disturb each other in measurement, especially with low flow. Locate the sensor with a flexible connection instead of a permanent connection.



Avoid mounting the meter on the same steel frame. I.e. insulate the meters mechanically.

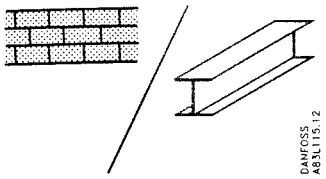
Magnetic fields

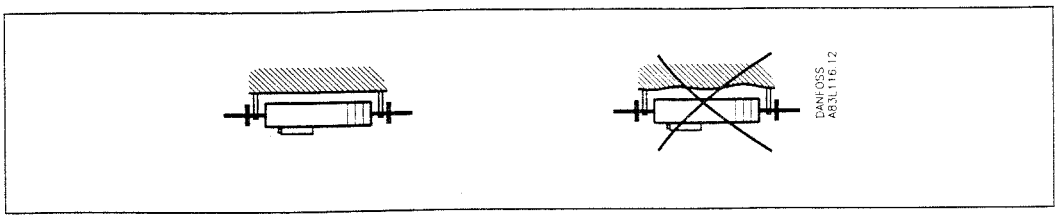




Locate the sensor a minimum of 25 cm from strong magnetic fields (motors, transformers, electrically operated valves, etc.).

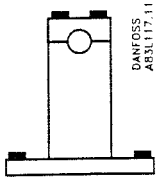
Mounting

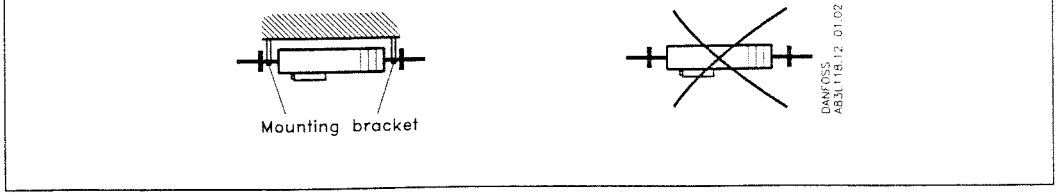




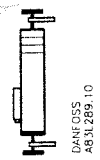
The unit must be mounted on a flat wall or steel frame (vibration-free).

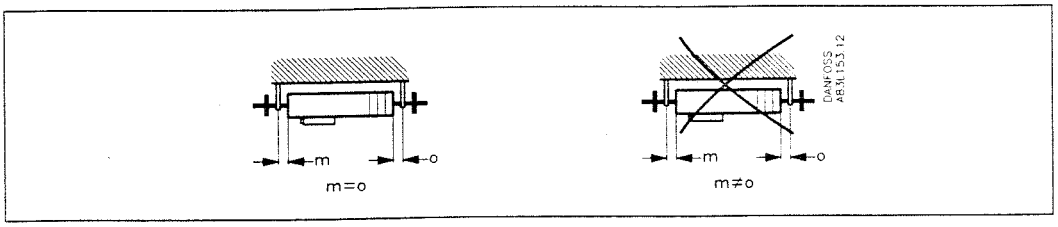
Mounting brackets





The mounting brackets supplied with the sensor must always be used.





The centre distance between mounting brackets is shown below.

1. Locate the mounting brackets on the wall or frame without tightening.
2. Mount the sensor in the brackets and tighten them up.
3. Tighten the mounting brackets on wall or chassis.
4. Mount and tighten connection flanges.

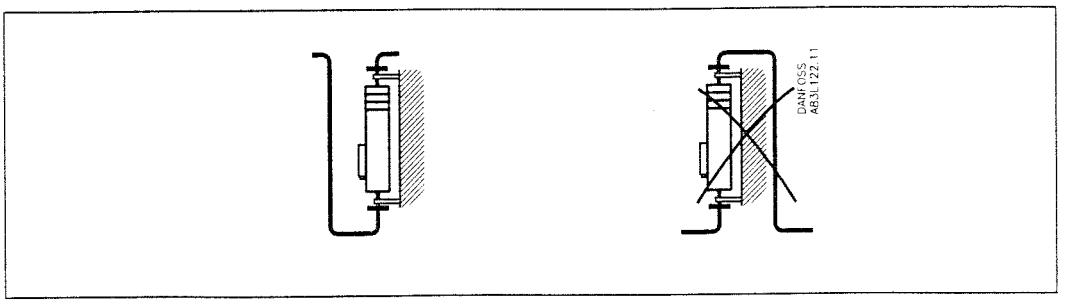
Sensor	Tightening torque Nm
DN 10	12
DN 25	30
DN 50	40

Wall bracket	Tightening torque Nm
DN 10	25
DN 25	60
DN 50	80

Do not twist the sensor or allow it to be under tension!

3. Sensor mounting MASS 1100, vertical mounting

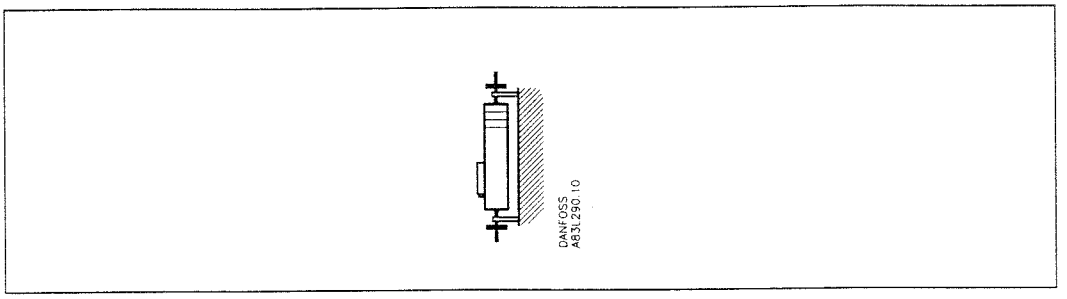
Mounting in pipe system



Locate the sensor low in the pipe system in order to avoid under-pressure in the sensor and consequent air separation in the liquid.

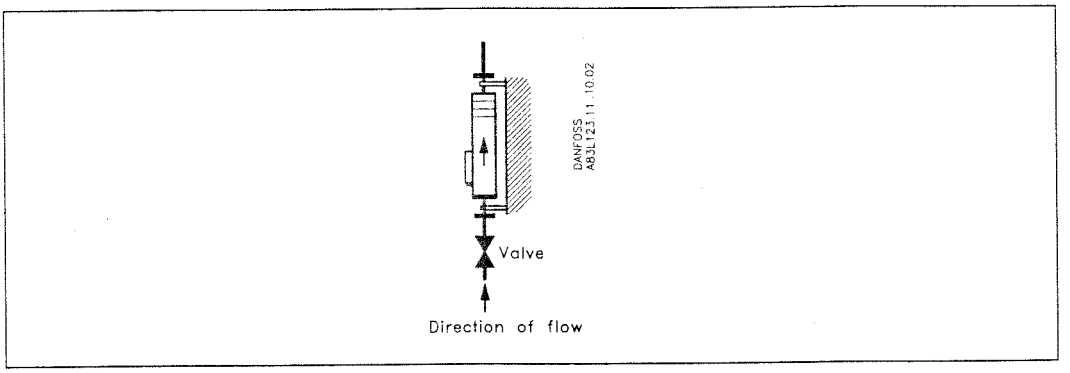
Terminal box orientation

With vertical mounting the orientation of the terminal box is not important.



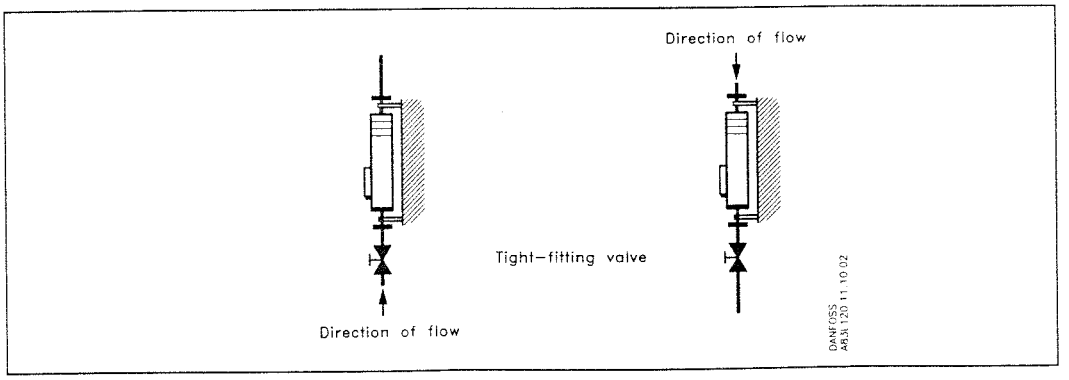
Direction of flow

As far as possible, the liquid should flow upwards to make bubble removal easier.



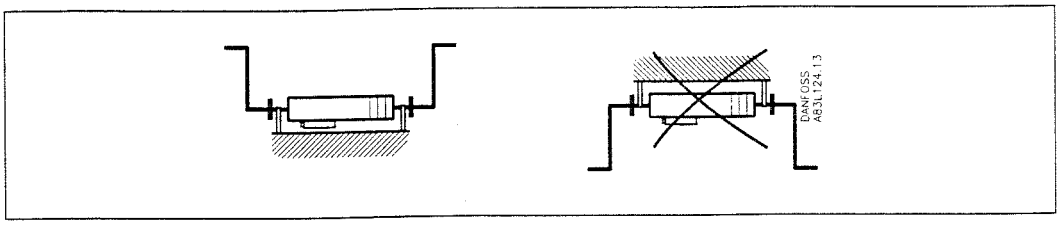
With vertical mounting, a check valve **must always** be installed which closes on zero flow so that the liquid **cannot** flow back and partially empty the sensor.
The arrow on the sensor indicates positive (forward) flow direction.

Valve 0-point adjustment



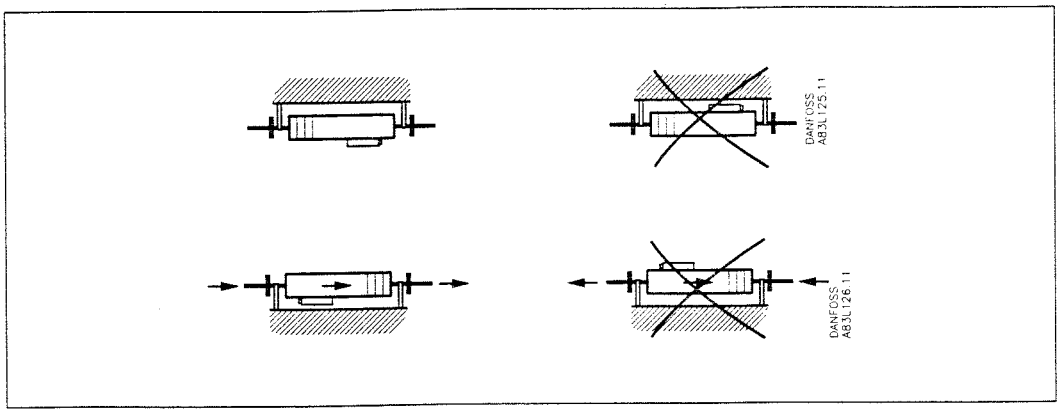
To facilitate 0-point adjustment, a valve with good shut-off should always be mounted in connection with the sensor. See "Starting up".

ıting in pipe



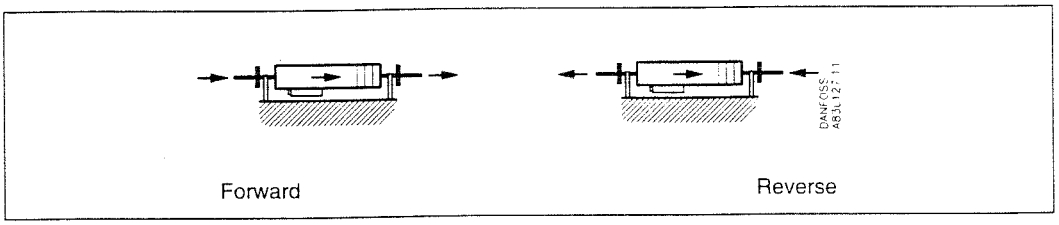
Locate the sensor low in the pipe system in order to avoid under-pressure in the sensor and consequent air separation in the liquid.

Terminal box orientation



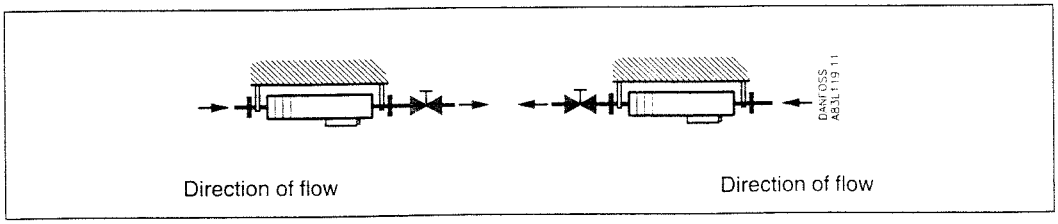
The terminal box must always point downwards so that the measuring pipes are lower than inlet and outlet pipes. It then becomes easier to remove air from measuring pipes.
When liquids contain solid particles the terminal box must turn upwards, especially at low flow, to make it easier to flush out the particles with the liquid.

Direction of flow



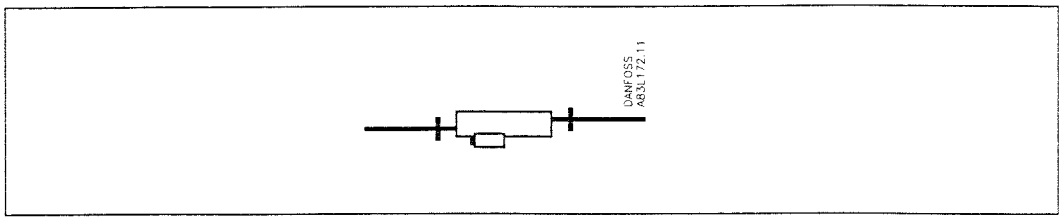
The arrow on the sensor indicates the direction of flow defined as "positive" (the meter is able to measure flow in both directions).

Valve 0-point adjustment



To facilitate 0-point adjustment, a valve with good shut-off should always be mounted in connection with the sensor. See "Starting up".

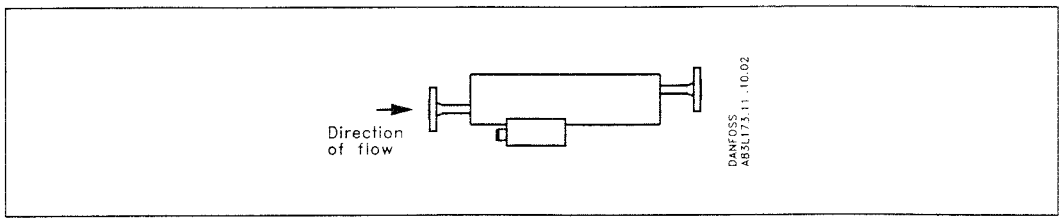
Mounting



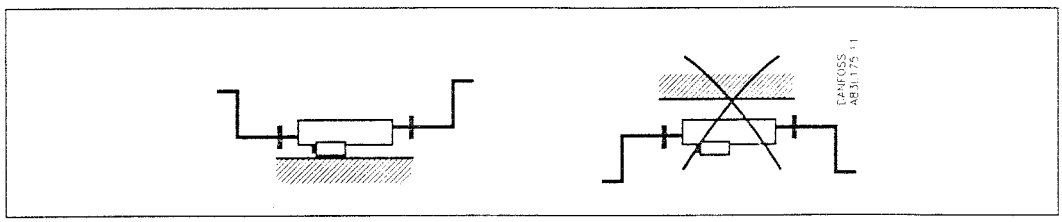
The MASS 2100 sensor requires **no** mounting bracket, but can be mounted between two flanges in existing piping. However, the unit should not be subjected to severe vibration.
The recommendation is that wherever possible the flowmeter be mounted horizontally. Where this is not possible, follow the instructions for vertical mounting.

Horizontal mounting in pipe

If the sensor is mounted horizontally it is **self-emptying**.

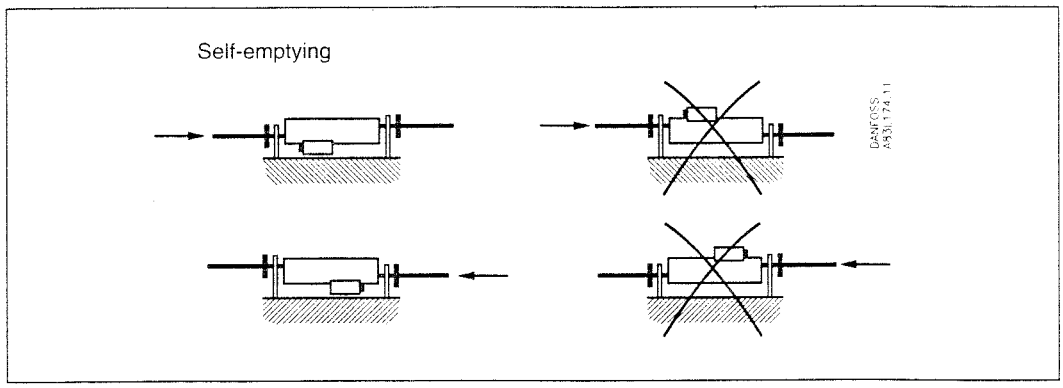


With low flow, horizontal mounting is recommended, thereby air bubbles are easier to remove.



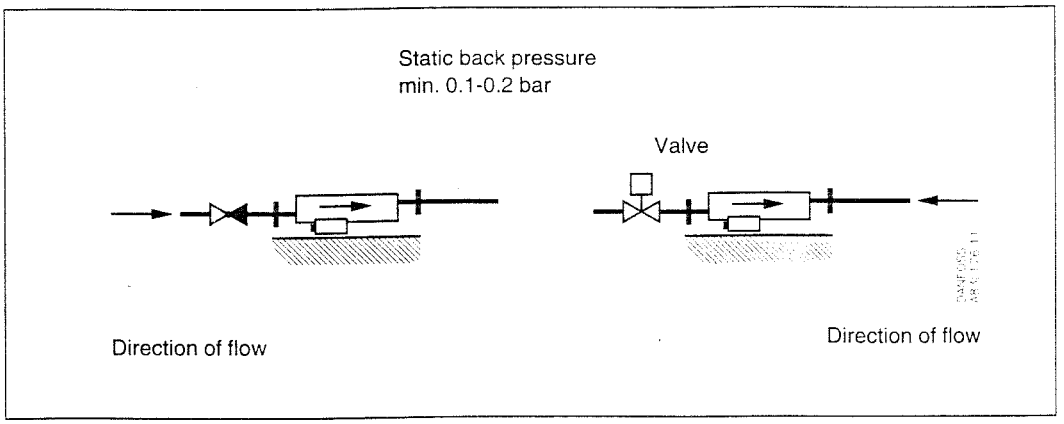
Locate the sensor low in the pipe system in order to avoid under-pressure in the sensor and consequent air separation in the liquid.

Terminal box orientation



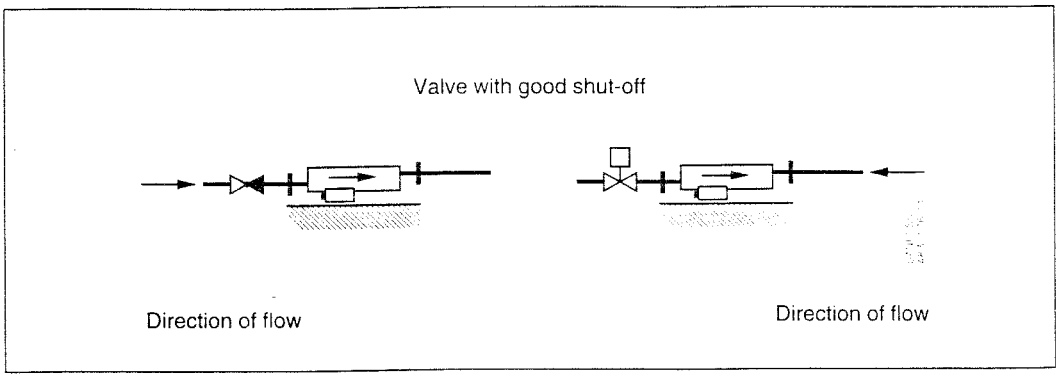
The terminal box can be orientated as shown. The measuring pipes will then be lower than the outlet pipe, i.e. collections of air can be more easily removed from the measuring pipes. For the sensor to be self-emptying the terminal box must be downwards.

Direction of flow



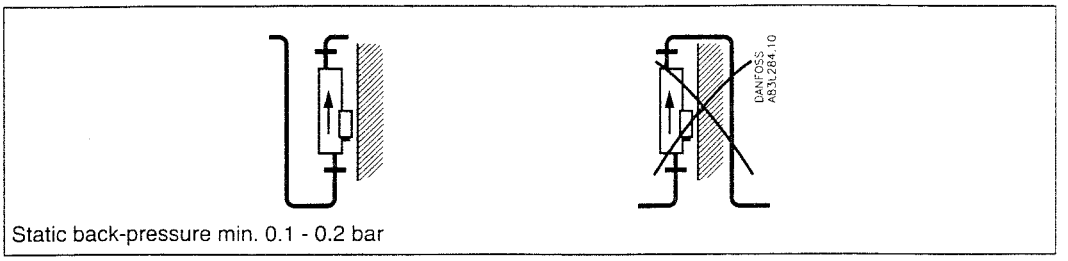
The arrow on the sensor indicates the direction of flow defined as "positive" (the meter is able to measure flow in both directions).
As far as possible, the liquid should flow upwards to make bubble removal easier. With vertical mounting, a check valve, which closes on zero flow, must always be installed so that the liquid cannot flow back and partially empty the sensor.
In addition there should be a valve (check/solenoid) that closes when the flow is 0 so that the liquid does not flow back to produce partial emptying of the sensor.

Valve 0-point adjustment



To facilitate 0-point adjustment, a valve with good shut-off should always be installed in connection with the sensor. See "Starting up".

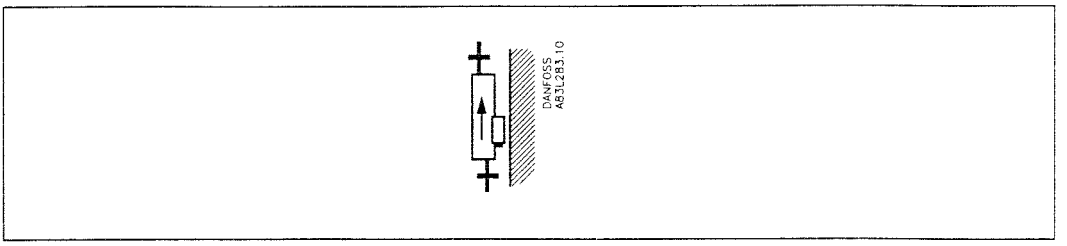
Vertical mounting in pipe



Static back-pressure min. 0.1 - 0.2 bar

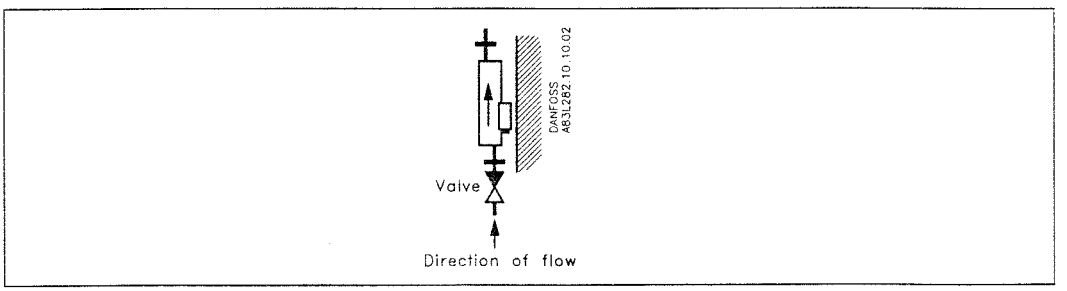
Locate the sensor low in pipe system in order to avoid under-pressure in the sensor and consequent air separation in the liquid.

Terminal box orientation



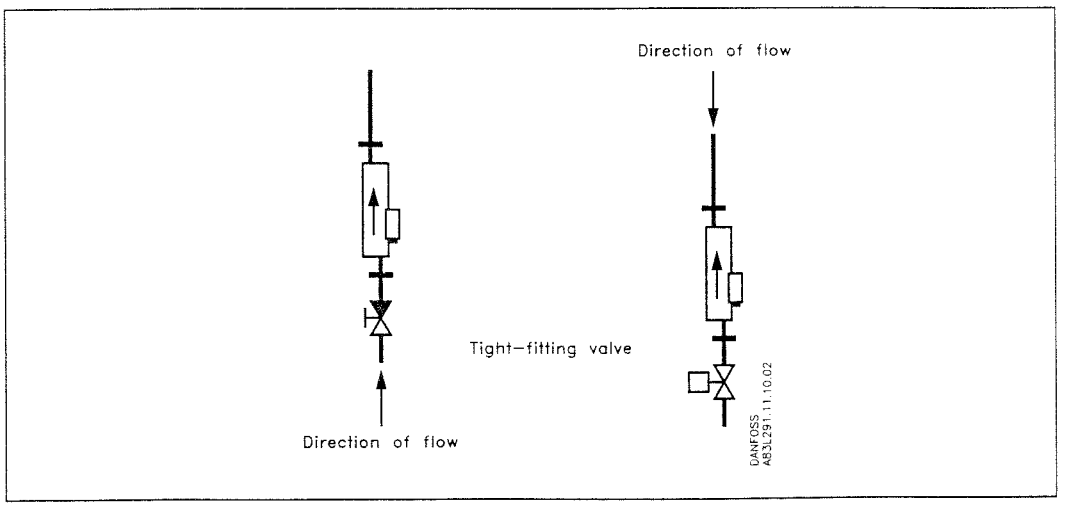
With vertical mounting the orientation of the terminal box is not important.

Direction of flow



The arrow on the sensor indicates the direction of flow defined as "positive" (the meter is able to measure flow in both directions).
As far as possible, the liquid should flow in the direction of the arrow (on the sensor) to avoid partial emptying of the sensor, especially with low flow.
When the liquid contains solid particles, horizontal mounting of the sensor is recommended with flow in the opposite direction of the arrow on the meter.
In addition there should be a valve (check/solenoid) that closes for the flow so that the liquid does not flow back to produce partial emptying of the sensor.

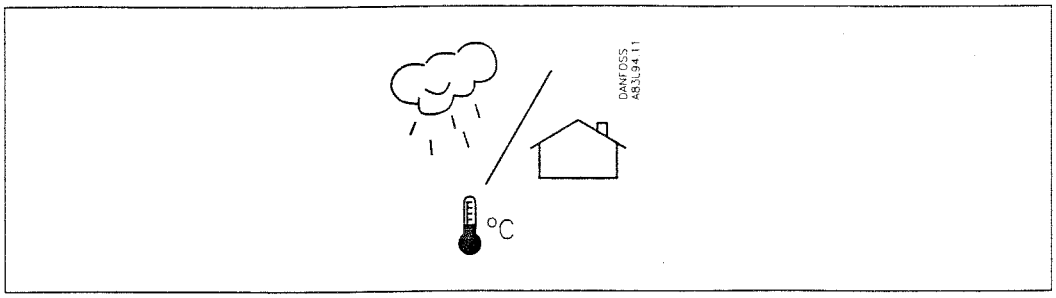
Valve 0-point adjustment



To facilitate 0-point adjustment, a valve with good shut-off should always be installed in connection with the sensor. See "Starting up".

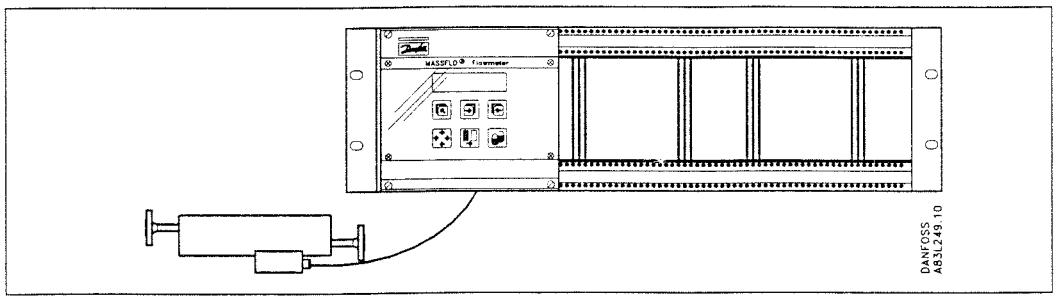
Location

Signal converter MASS 3000 can be located both indoors and outdoors, but the following conditions must be observed.



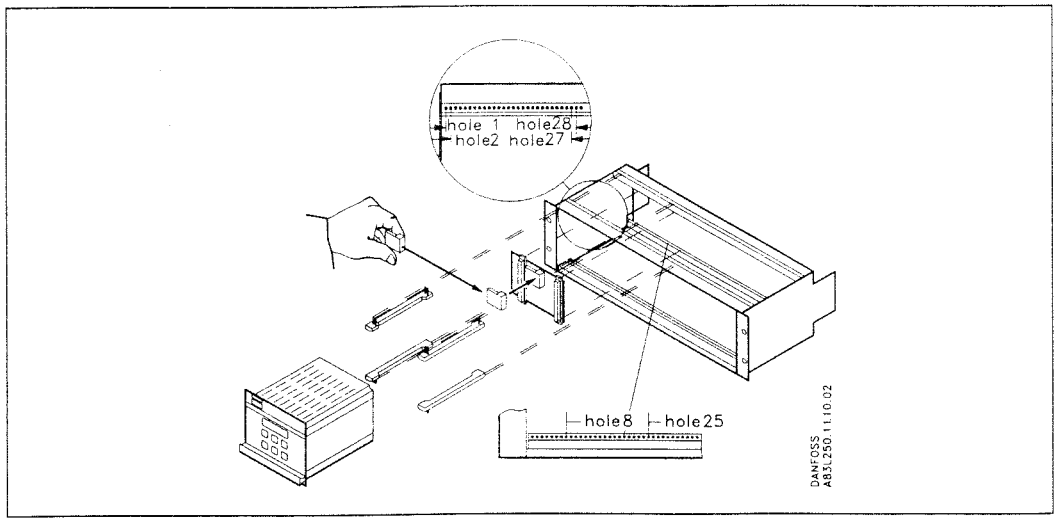
The signal converter will operate in ambient temperatures from –20 to +55°C.

The signal converter in IP 00 version



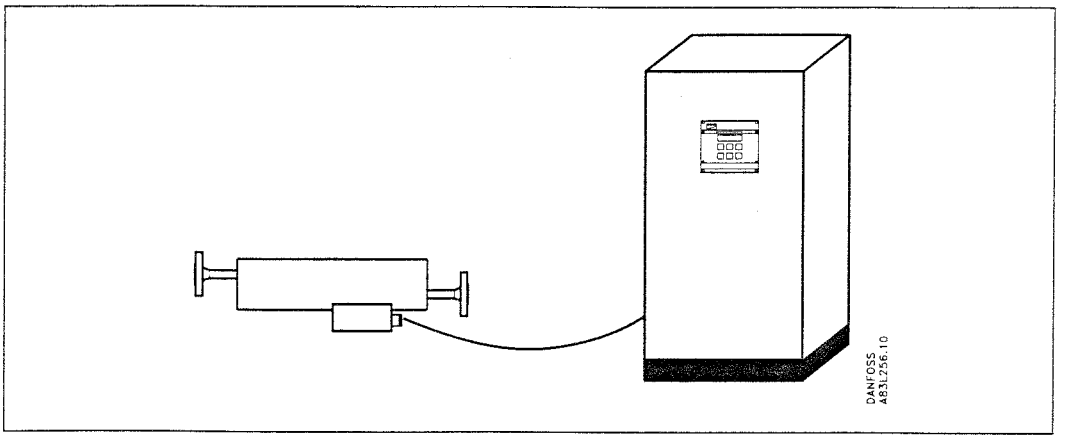
The signal converter is designed as a standard 19" insert for installation in a 19" rack. The insert has a width of 28 TE (142 mm), a height of 3 U (128 mm) and a module depth of 160 mm. The signal converter can be installed directly in a 19" rack or on a wall in the IP 65 version. A mounting kit for front of panel mounting and back of panel mounting is available as a supplement. The various types of installation are shown on the following figures.

Installation in 19" rack



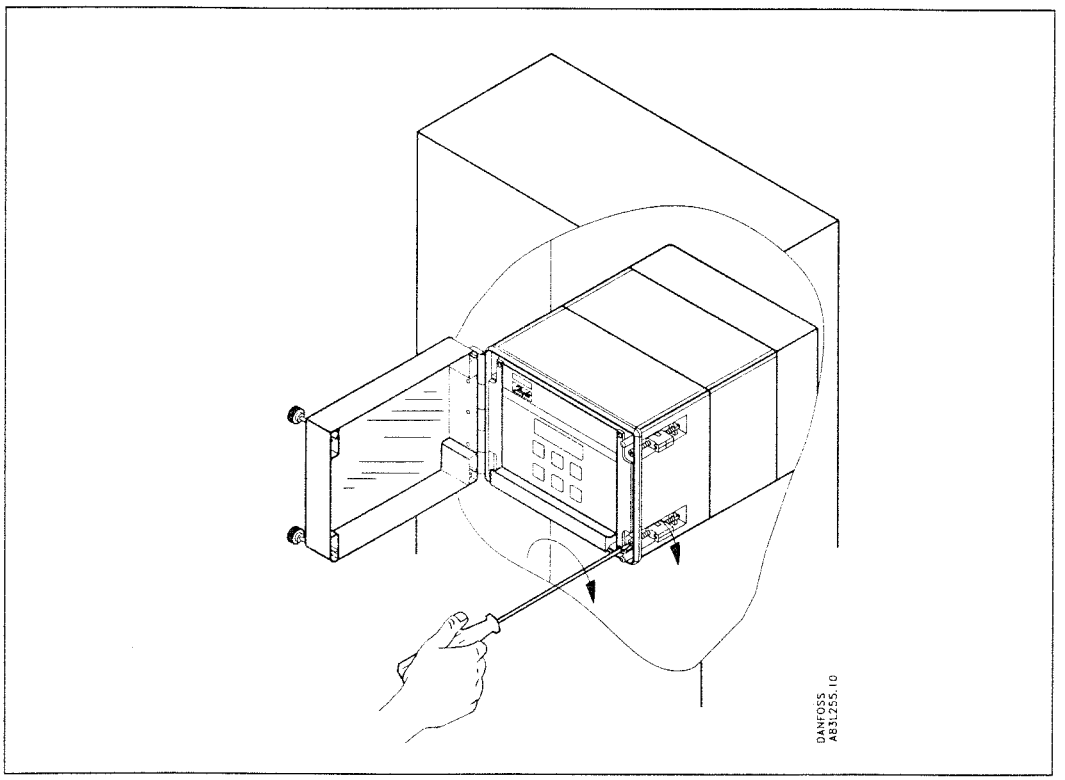
1. Fit the SENSORPROM™ on the connection board (The SENSORPROM™ is located in the terminal box of the sensor)
2. Mount the connection board and the guide rails in the rack system as shown
3. Mount the signal converter in the rack system
4. Connect the cables as shown under "Electrical connection"

Front of panel



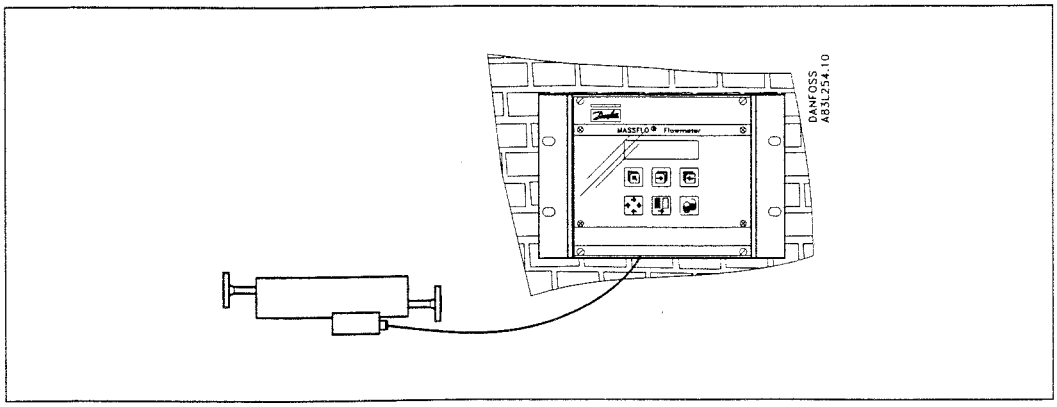
The signal converter can be located in a panel using a **front of panel** mounting kit.

Installation of front of panel



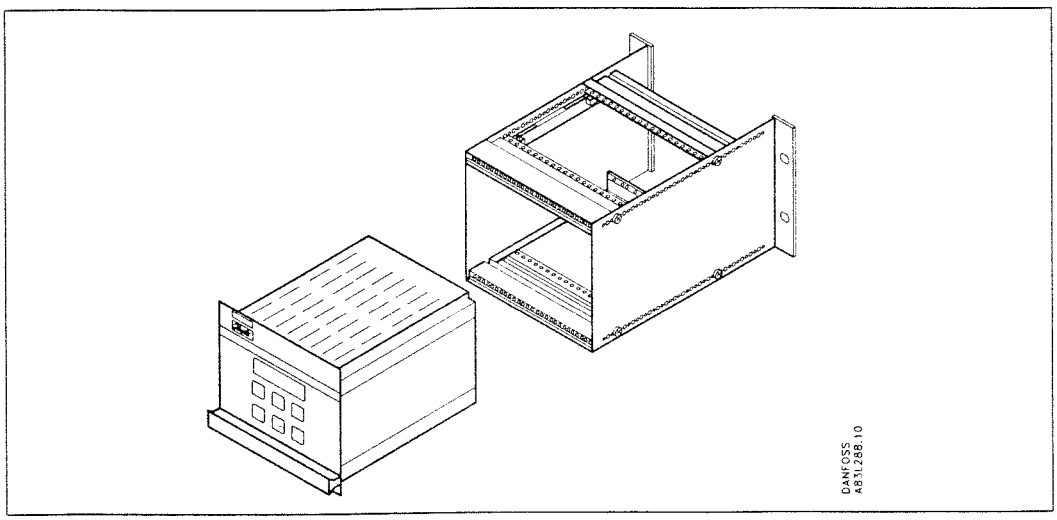
1. Mount the box as shown on the figure.
2. Fit the SENSORPROM™ on the connection board.
   (The SENSORPROM™ is located in the terminal box of the sensor).
3. Insert the signal converter into the frame and fasten the four captive screws accessible from the front panel.
4. Connect the cables as shown under "Electrical connection".

Back of panel



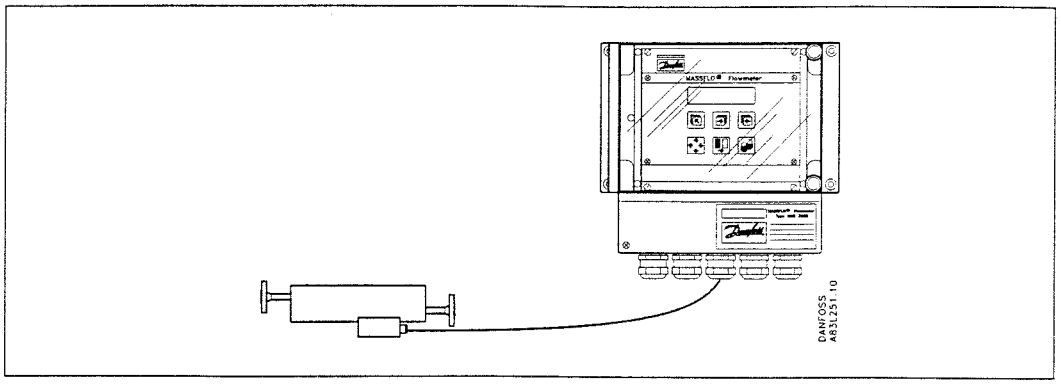
The signal converter can be mounted on a wall without additional protection using the kit for **back of panel** mounting.

Installation of back of panel



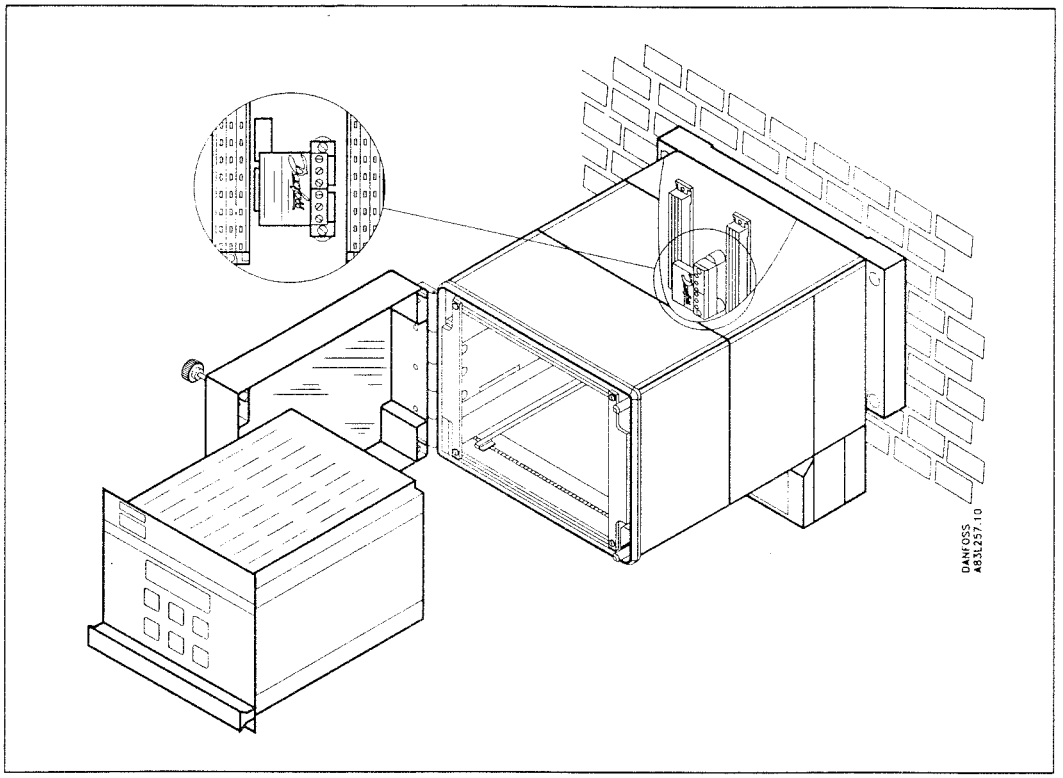
1. Mount the back of panel housing with four screws to the wall.
2. Fit the SENSORPROM™ on the connection board.
   (The SENSORPROM™ is located in the terminal box of the sensor).
3. Connect the cables as shown under "Electrical connection".
4. Mount the connection board in the back of the panel with four screws and insert the signal converter.

IP 65 version



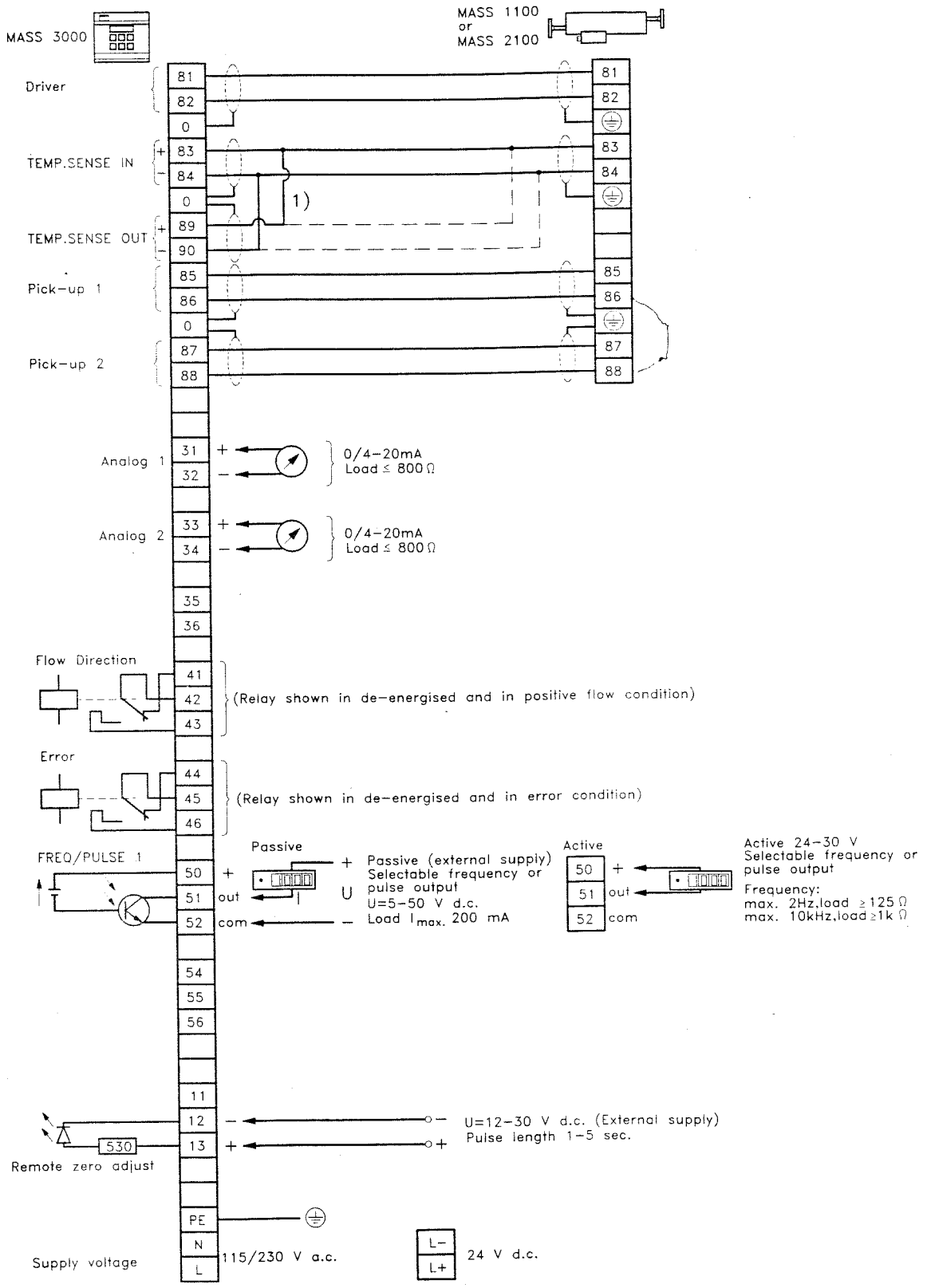
The signal converter is available in an IP 65 housing for wall mounting.

Mounting of IP 65



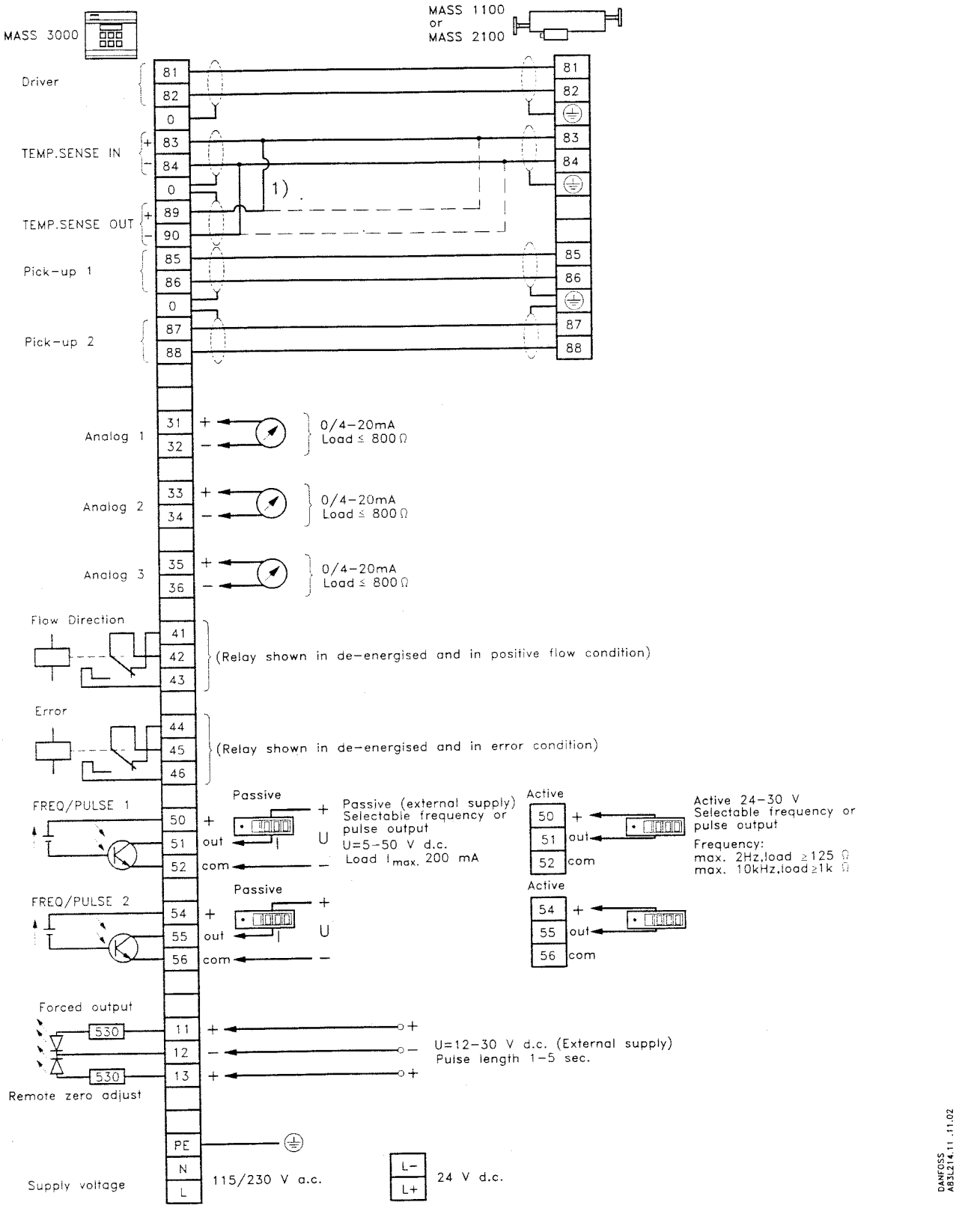
1. Fasten the IP 65 housing to the wall with four screws.
2. Remove the signal converter from the IP 65 housing and mount the SENSORPROM™ on the connection board located in the back of the housing.
   (The SENSORPROM™ is located in the terminal box of the sensor).
3. Insert the signal converter and close the cover carefully.
4. Connect the cable to the terminals accessible in the connection box located under the box, see "Electrical connection".

Electrical connection MASS 3000 with: 2 current outputs, 1 frequency/pulse output



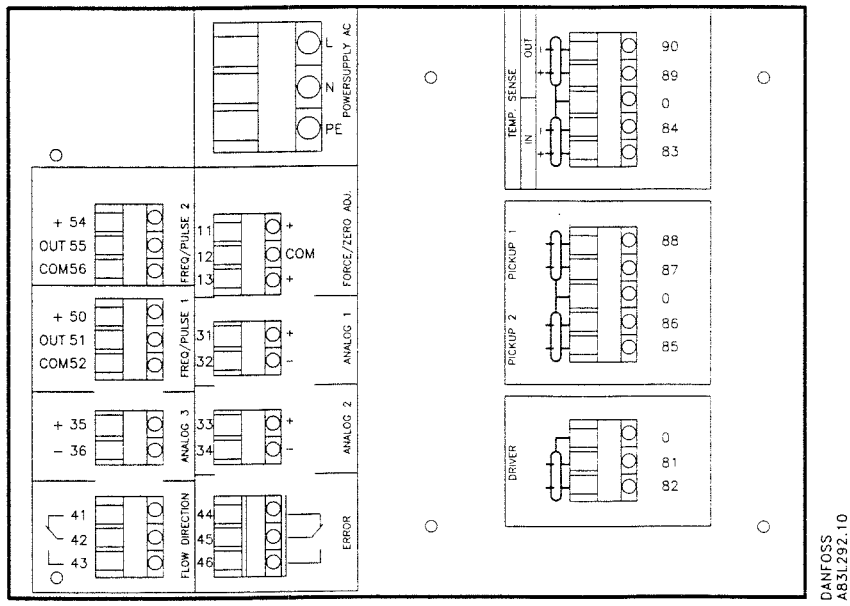
1) MASS 3000 is delivered with jumpers between terminals 83 - 89 and 84 - 90 and the temperature sensor thus operates as a 2-wire unit. With this type of connection, the error in temperature measurement is 0.027 °C/m cable between sensor and signal converter. The error can be eliminated by coupling the temperature transmitter as a 4-wire unit, i.e. by removing the jumpers and instead making the connection as shown by the dotted lines.

Electrical connection MASS 3000 with: 3 current outputs, 2 frequency/pulse outputs

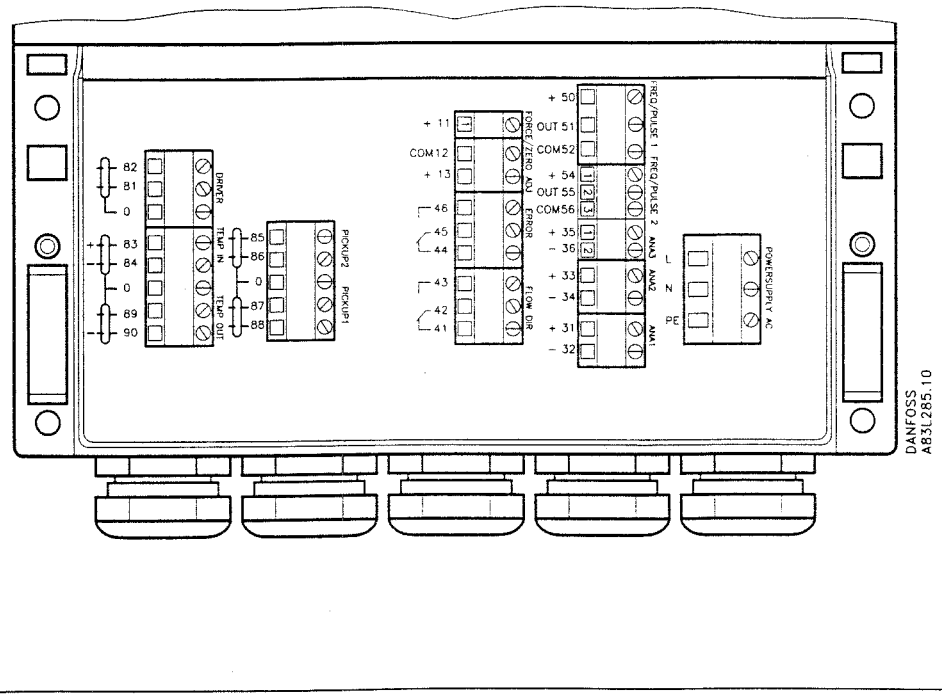


[1]) MASS 3000 is delivered with jumpers between terminals 83 - 89 and 84 - 90 and the temperature sensor thus operates as a 2-wire unit. With this type of connection, the error in temperature measurement is 0.027 °C/m cable between sensor and signal converter. The error can be eliminated by coupling the temperature transmitter as a 4-wire unit, i.e. by removing the jumpers and instead making the connection as shown by the dotted lines.

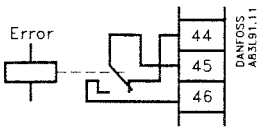
Connection board 19" version



Connection board IP 65 version

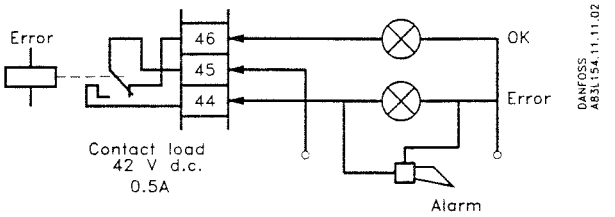


Error relay

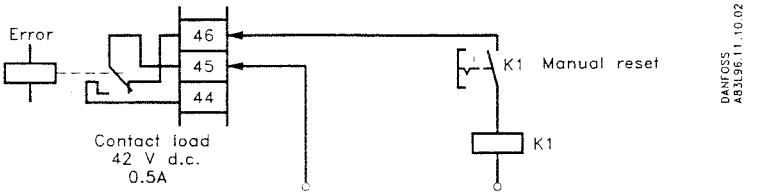


The changeover relay is shown in de-energised condition. When supply voltage is connected to MASS 3000 the "ERROR" relay pulls in and terminals 45 and 46 make, providing there is no error. In the event of fault, the "ERROR" relay drops out and terminals 45 and 44 make. The error is indicated in the MASS 3000 display, see section on fault location.

Remote display of operating condition

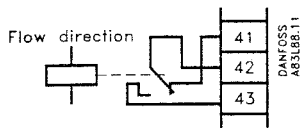


Valve closes in fault condition



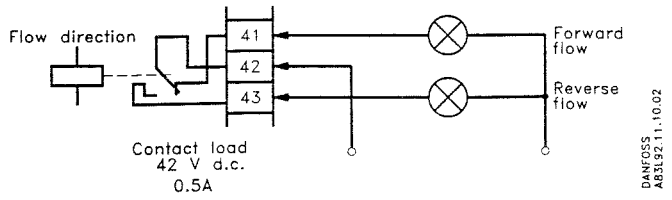
When 44 and 45 break, relay K1 drops out. This closes the valve, and flow through the sensor becomes 0. Restart is manual.

...N relay

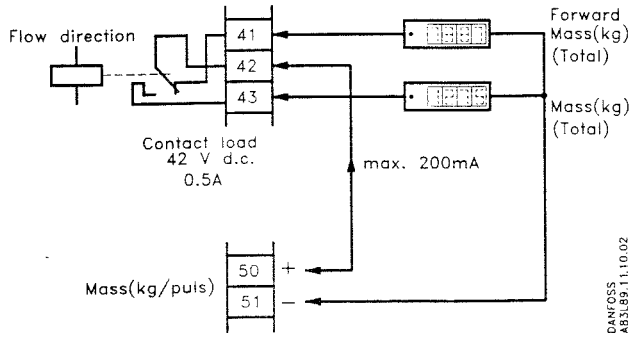


The changeover relay is shown in de-energised condition. The relay makes only in case of negative flow direction, as described in the menu "BASIC SETTINGS - FLOW DIRECTION".

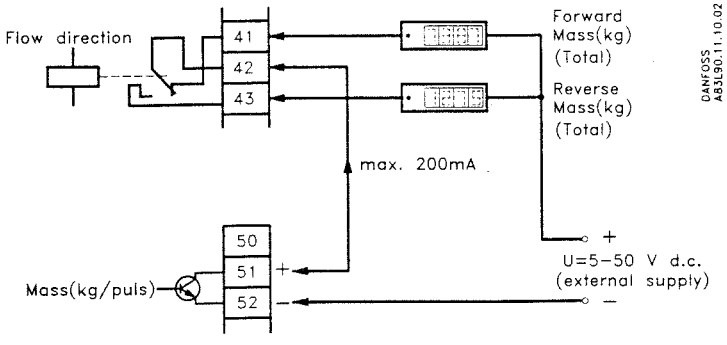
Remote display of flow direction



Totalizing of mass in both directions

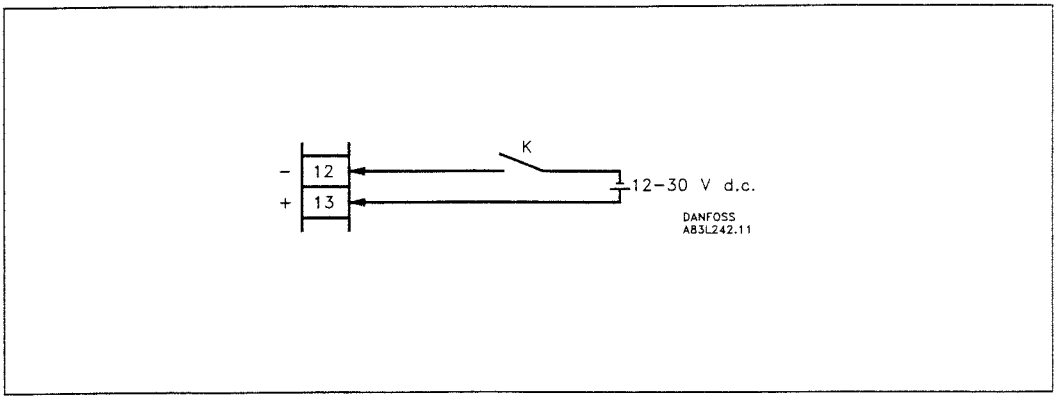


Active pulse output



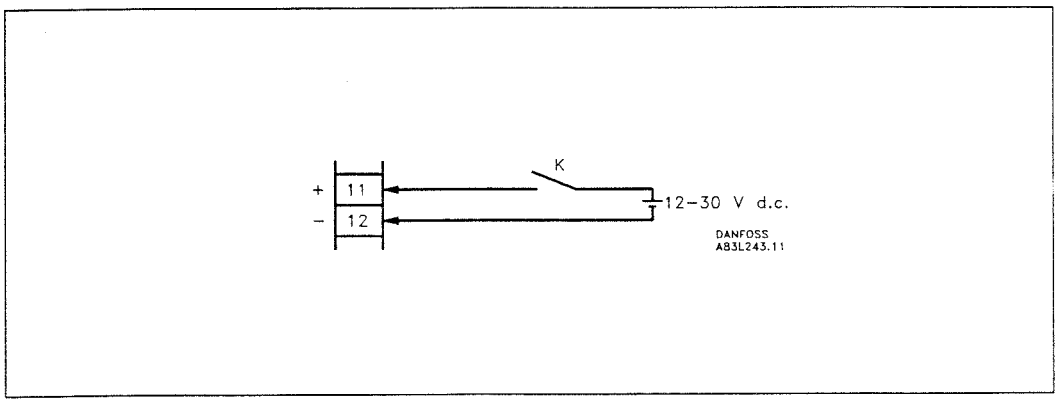
Passive pulse output

Remote zero point adjustment



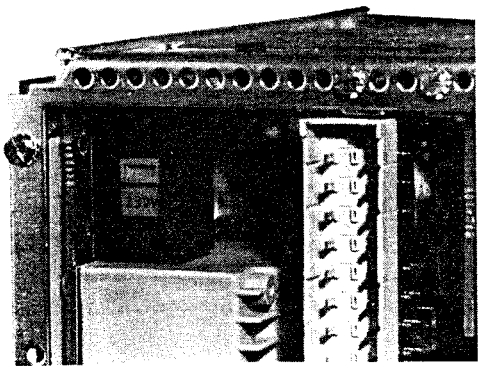
MASS 3000 is zero point adjusted over the keypad in the menu "RESET MODE - ZERO FLOW" or by applying an external voltage of 12-30 V to the terminals 12 and 13, marked **ZERO ADJ.** The zero point adjustment takes approx. 60 seconds, being indicated in the top line of the display as "BUSY" and shown as countdown in the bottom line. For further description, see section "Starting up".

Current outputs forced



Forced operation of all outputs at the maximum or minimum value is possible by applying an external voltage of 12-30 V d.c. to terminals 11 and 12, marked **FORCE**.
The function is activated in the menu "BASIC CONTROL". Settings "OFF", "MIN" or "MAX" can be chosen.

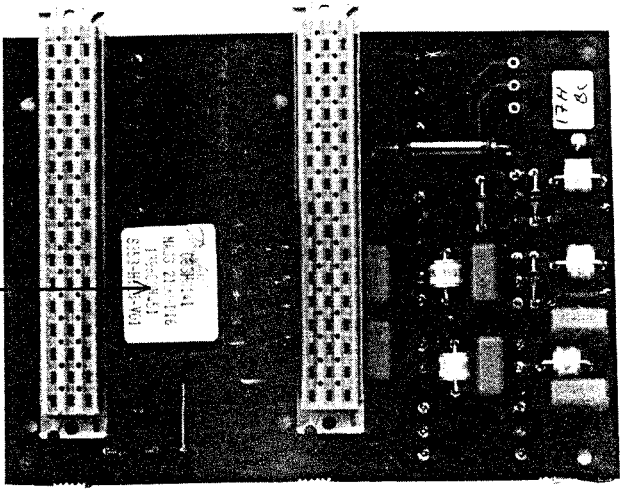
Setting the voltage selector



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.

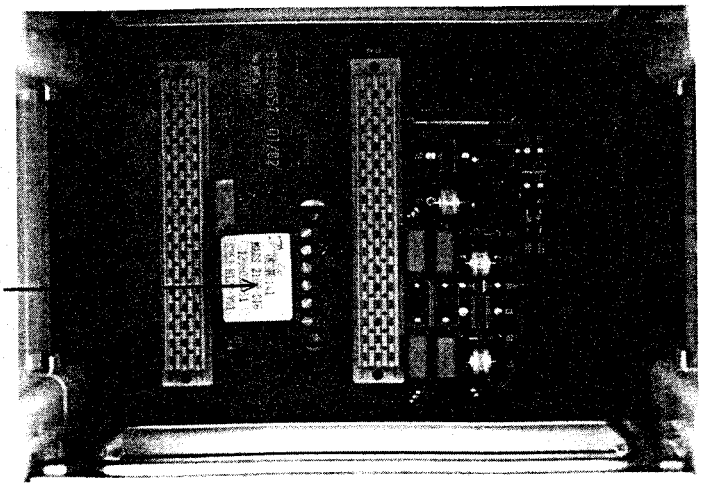
Mounting of SENSORPROM™

IP 00

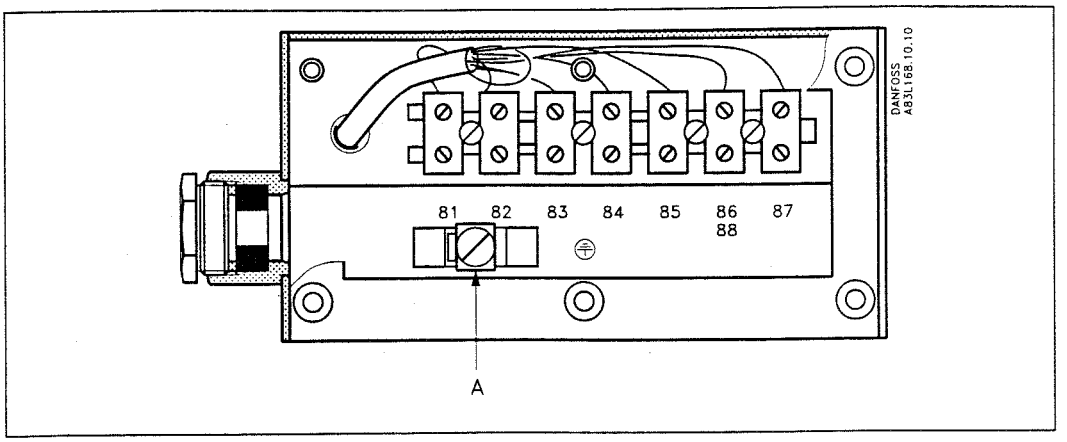


SENSORPROM™ is located on the back of the connection board, see fig.
SENSORPROM™ is sensor specific and is supplied with each sensor, being packed in the terminal housing of the sensor.
To identify the SENSORPROM™ a label has been put on it, indicating sensor type and serial number. This number can be found again on the sensor identification plate.
Furthermore, the identity can be read on MASS 3000 under the menu SENSOR CHARACTERISTICS. At starting up it should always be checked that the identity in the menu conforms to the identity on the plate at the sensor.

IP 65



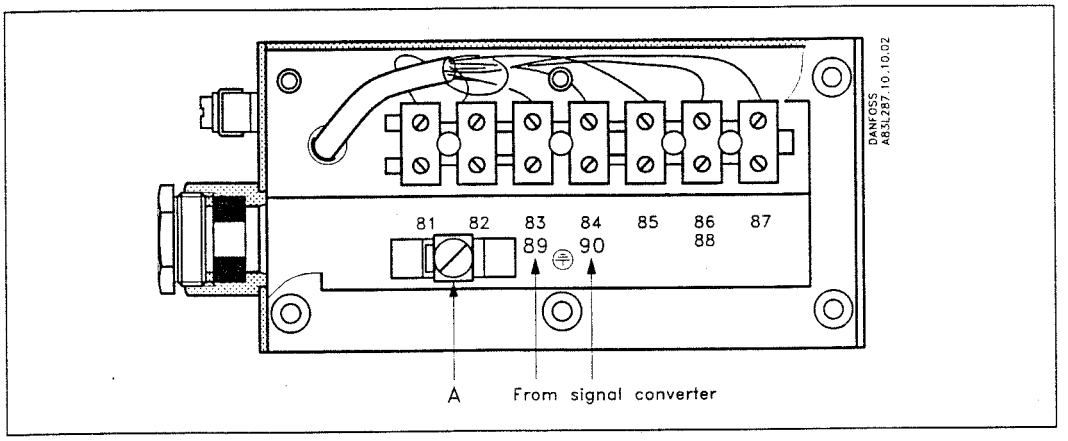
Electrical connection Sensor MASS 1100/2100 installation



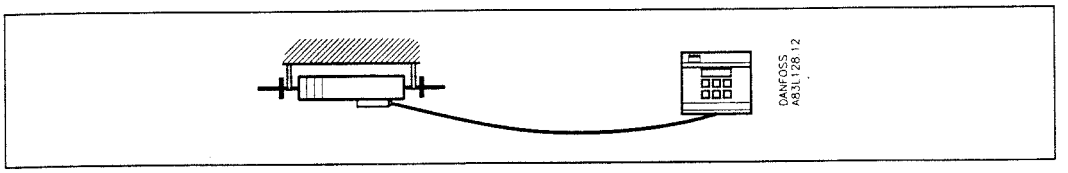
A: All cable screens to be connected here.

Connection of 4-wire temperature measurement function in sensor MASS 1100/2100

In the MASS 1100/2100 sensor the temperature is measured by means of a Pt 1000 temperature sensor. In order to eliminate measuring errors due to the cable length, it is possible to eliminate this by connecting two additional wires, the meter now is coupled as a 4-wire device. The two additional wires are connected to the terminals 89 and 90 of the signal converter marked TEMP. SENSE OUT. The terminals of the sensor are connected in parallel to the terminals 83 and 84 marked TEMP. See "Electrical connection" page 19 and 20.



Cable



Max. cable length between sensor and signal converter is 150 m. For larger distances, please contact Danfoss.

The cable is 4 x 2 x 0.34 or 4 x 2 x 0.23 twisted and screened in pairs.

5 m cable is supplied with MASS 3000 (temp. –20 to +100°C).

Furthermore, on request Danfoss can supply 5-wire cable.

Location of SENSORPROM™

Note: The SENSORPROM™, belonging to the sensor, is packed in an antistatic bag in the terminal box of the sensor. The SENSORPROM™ contains all calibration data, factory settings and special data for °Brix measurement, measurement of solids etc. Please take care that the SENSORPROM™ is not lost during installation, if this happens data can, however, be entered manually, see section "Starting up". However, this does not include date for fraction flow measurements due to a comprehensive quality of data.

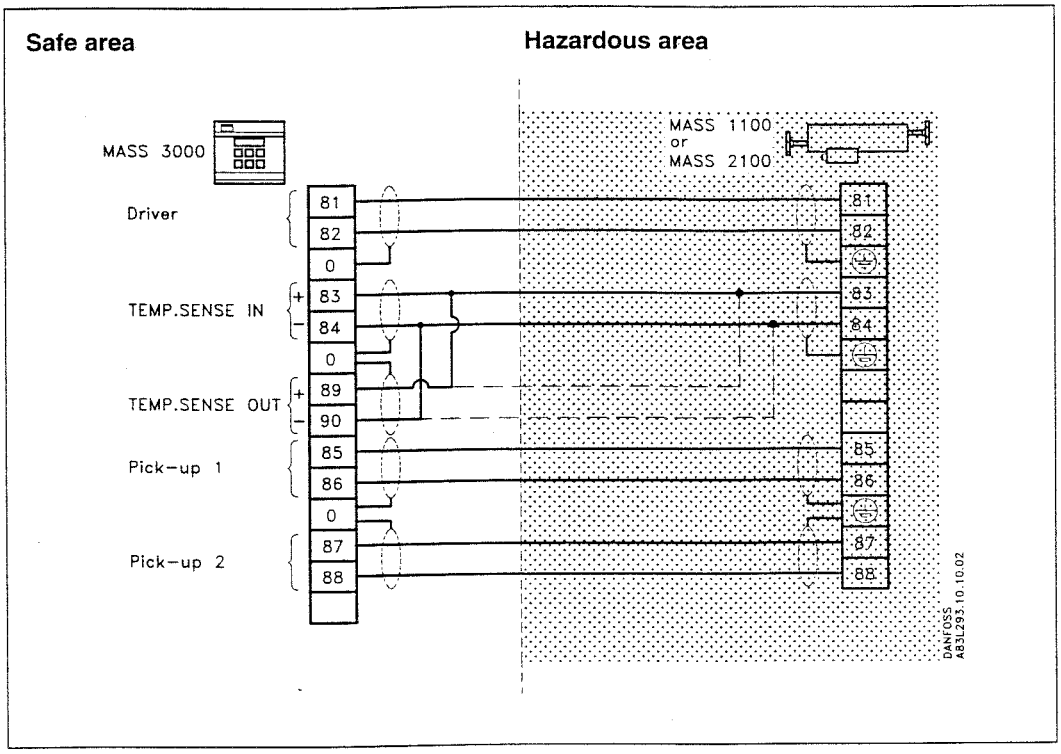
When starting up more systems at one time it is ALWAYS a good idea to check the SENSORPROM™ identity under the menu SENSOR CHARACTERISTICS with the identity of the sensor, see section "Starting up".

Electrical connection in a hazardous area

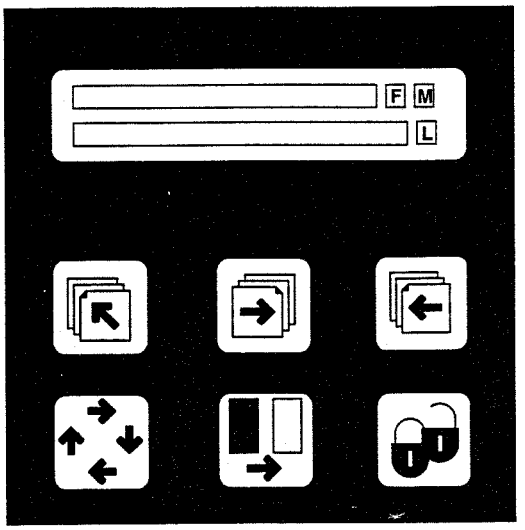
MASS 3000 in Ex-version is used with MASS 1100/2100 sensor in Ex-version when the sensor is to be mounted in a hazardous area. MASS 3000 **must** be mounted in the safe area, see below figure. Standard cable is used. As the type of protection is intrinsically safe the use of blue cable is recommended as it indicates the protection type 'intrinsically safe'.

Description of MASS 3000 Ex-version

The Ex-protection in MASS 3000 is achieved through the use of a galvanic, intrinsically safe power supply to which MASS 1100/2100 is connected. Thereby neither zener barriers between electronics and sensor nor an Ex-earth connection are required. This ensures that wrong wiring never causes any risk of explosion. The type of protection used is thus superior to others.



Keypad and display layout



Keypad

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

Top up - this key always returns the menu display to the basic menu: OPERATOR MENU, irrespective of where you are in the menu structure.

These two keys can be used to page backwards or forwards through the menus.

This key changes the settings or numerical values.

This key indicates the numerical values to be changed.

Lock/unlock - the key unlocks access to setting changes, locks new settings, or gives access to submenus.

Settings are stored automatically in both signal converter and SENSORPROM™. The values remain stored in the case of power failure and when a signal converter is replaced.

Operation of any key illuminates the display background. It switches off automatically after 10 minutes of final key operation.

ɜplay

The display is alpha-numeric. It is used to read selected operating values and flowmeter settings.
The three fields F, M and L are reserved for the following symbols:

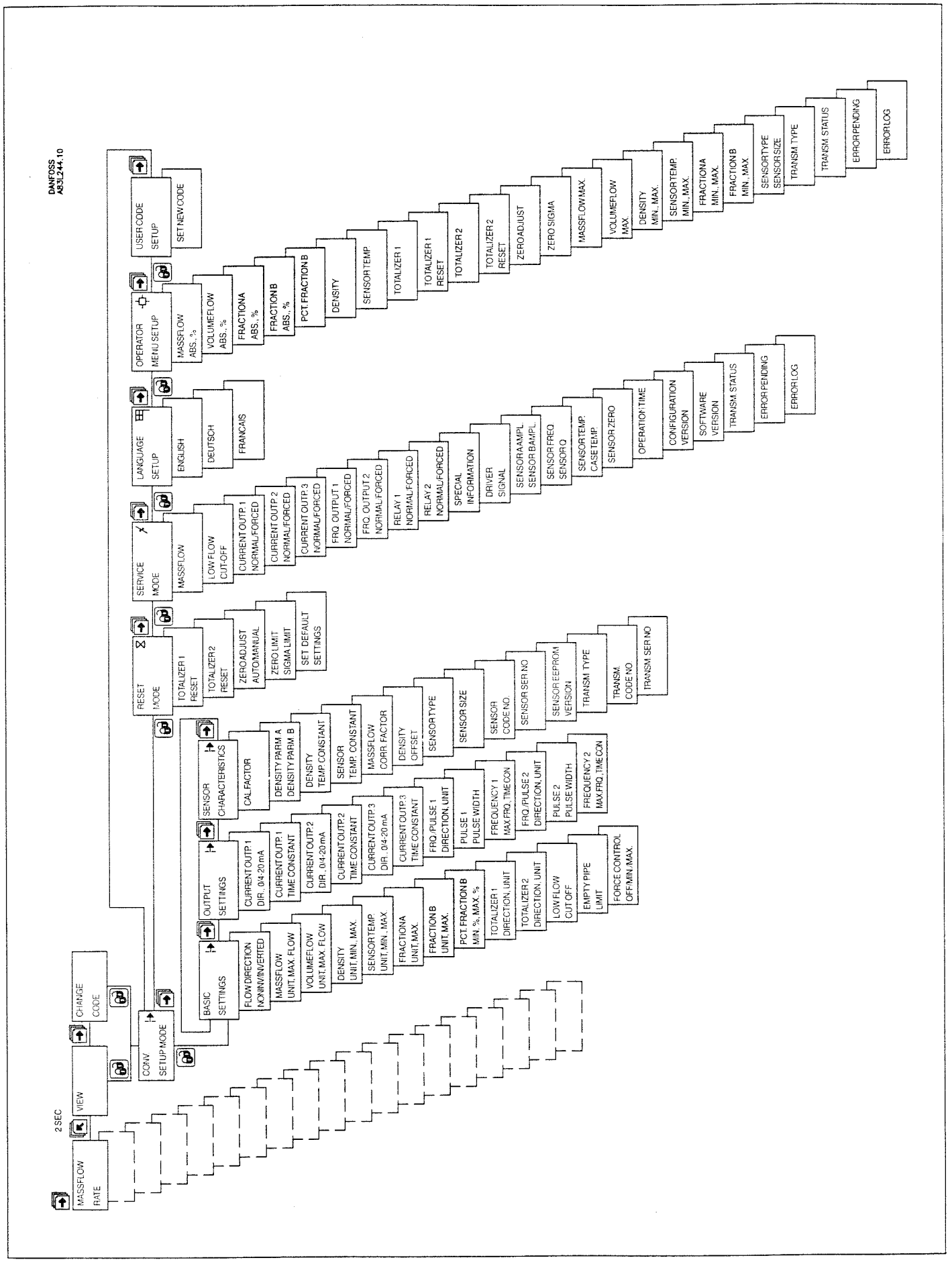
F: If a fault develops, two flashing triangles appear ◪ .

M: Shows with a symbol the actual main menu represented by the following symbols:

⧖	RESET MENU
✕	SERVICE MODE
🌐	LANGUAGE SETUP
⊹	OPERATOR MENU SETUP
⊢	CONVERTER SETUP

L: Shows the function of the [🔒] key using the following symbols:

🔒	Ready for change
🔒	Value locked
⊤	Access to submenu
⚲	RESET MODE: Zero setting of totalizers and own settings.


DANFOSS
A83.244.10
MASSFLOW RATE
2 SEC
VIEW
CHANGE CODE
CONV SETUP MODE
BASIC SETTINGS
FLOW DIRECTION NORM/INVERTED
MASSFLOW UNIT, MAX. FLOW
VOLUMEFLOW UNIT, MAX. FLOW
DENSITY UNIT, MIN., MAX.
SENSOR TEMP. UNIT, MIN., MAX.
FRACTION A UNIT, MAX.
FRACTION B UNIT, MAX.
PCT. FRACTION B MIN. %, MAX. %
TOTALIZER 1 DIRECTION, UNIT
TOTALIZER 2 DIRECTION, UNIT
LOW FLOW CUT OFF
EMPTY PIPE LIMIT
FORCE CONTROL OFF/MIN./MAX.
OUTPUT SETTINGS
CURRENT OUTP. 1 DIR., 0/4-20 mA
CURRENT OUTP. 1 TIME CONSTANT
CURRENT OUTP. 2 DIR., 0/4-20 mA
CURRENT OUTP. 2 TIME CONSTANT
CURRENT OUTP. 3 DIR., 0/4-20 mA
CURRENT OUTP. 3 TIME CONSTANT
FRQ./PULSE 1 DIRECTION, UNIT
PULSE 1 PULSE WIDTH
FREQUENCY 1 MAX.FRQ., TIMECON
FRQ./PULSE 2 DIRECTION, UNIT
PULSE 2 PULSE WIDTH
FREQUENCY 2 MAX.FRQ., TIMECON
SENSOR CHARACTERISTICS
CAL.FACTOR
DENSITY PARM A
DENSITY PARM B
DENSITY TEMP. CONSTANT
SENSOR TEMP. CONSTANT
MASSFLOW CORR. FACTOR
DENSITY OFFSET
SENSOR TYPE
SENSOR SIZE
SENSOR CODE NO.
SENSOR SER. NO.
SENSOR EEPROM VERSION
TRANSM. TYPE
TRANSM. CODE NO.
TRANSM. SER. NO.
RESET MODE
TOTALIZER 1 RESET
TOTALIZER 2 RESET
ZEROADJUST AUTO/MANUAL
ZERO LIMIT SIGMA LIMIT
SET DEFAULT SETTINGS
SERVICE MODE
MASSFLOW
LOW FLOW CUT-OFF
CURRENT OUTP. 1 NORMAL/FORCED
CURRENT OUTP. 2 NORMAL/FORCED
CURRENT OUTP. 3 NORMAL/FORCED
FRQ. OUTPUT 1 NORMAL/FORCED
FRQ. OUTPUT 2 NORMAL/FORCED
RELAY 1 NORMAL/FORCED
RELAY 2 NORMAL/FORCED
SPECIAL INFORMATION
DRIVER SIGNAL
SENSOR A AMPL.
SENSOR B AMPL.
SENSOR FREQ
SENSOR Q
SENSOR TEMP.
CASE TEMP.
SENSOR ZERO
OPERATION TIME
CONFIGURATION VERSION
SOFTWARE VERSION
TRANSM. STATUS
ERROR PENDING
ERROR LOG
LANGUAGE SETUP
ENGLISH
DEUTSCH
FRANCAIS
OPERATOR MENU SETUP
MASSFLOW ABS., %
VOLUMEFLOW ABS., %
FRACTION A ABS., %
FRACTION B ABS., %
PCT. FRACTION B
DENSITY
SENSOR TEMP.
TOTALIZER 1
TOTALIZER 1 RESET
TOTALIZER 2
TOTALIZER 2 RESET
ZEROADJUST
ZERO SIGMA
MASSFLOW MAX.
VOLUMEFLOW MAX.
DENSITY MIN., MAX.
SENSOR TEMP. MIN., MAX.
FRACTION A MIN., MAX.
FRACTION B MIN., MAX.
SENSOR TYPE
SENSOR SIZE
TRANSM. TYPE
TRANSM. STATUS
ERROR PENDING
ERROR LOG
USER CODE SETUP
SET NEW CODE

ME' ' BUILD-UP

The menu structure of the MASS 3000 signal converter is shown by an overview menu and subsequent detail of the build-up of each submenu.

The submenus marked with ▨ , i.e. Fraction A, Fraction B, Pct Fraction B are only accessible when the associated SENSORPROM™ has a data set for this facility.

OPERATOR MENU

The signal converter always starts in the basic menu OPERATOR MENU by showing the massflow.
Pressing the key pages through the menus under OPERATOR MENU.
OPERATOR MENU is envisaged as being for the daily use of operating personnel, etc. who will be able to read off massflow, temperature, density, etc.

VIEW

If the wish is just to display the flowmeter settings, VIEW can be used to move through the menu structure.
Hold the key down for 2 seconds to bring the display from OPERATOR MENU to VIEW.

CONVERTER SETUP

If the settings are to be changed, enter a user code to move via CHANGE to CONVERTER SETUP. The user code is factory-set at 1000.
Enter the code using and .
The code can be changed only via the USER CODE SETUP. This prevents unauthorised persons from changing settings.

[illegible] SETTINGS

Here, the direction of flow, measuring range, units, totalizing units, low flow cut-off, and empty pipe cut-off can be selected. The force control of outputs can also be set up.

OUTPUT SETUP

The required output signals can be selected in OUTPUT SETUP.

SENSOR CHARACTERISTICS

SENSOR CHARACTERISTICS contain information about the sensor. The information is read in automatically from the SENSORPROM™. If the unit is started up without SENSORPROM™, this menu is used to enter calibration data for the sensor.

RESET MODE

In RESET MODE it is possible to reset the totalizers, zero-point-adjust the massflow meter, and return the menus to the factory setting.

SERVICE MODE

SERVICE MODE can be used when starting up and for trouble shooting, including force control of all outputs and relays. In addition, error indications can be read under ERROR LOG.
Leaving SERVICE MODE disables all settings made when in this mode.

LANGUAGE MODE

The menu language can be selected here.

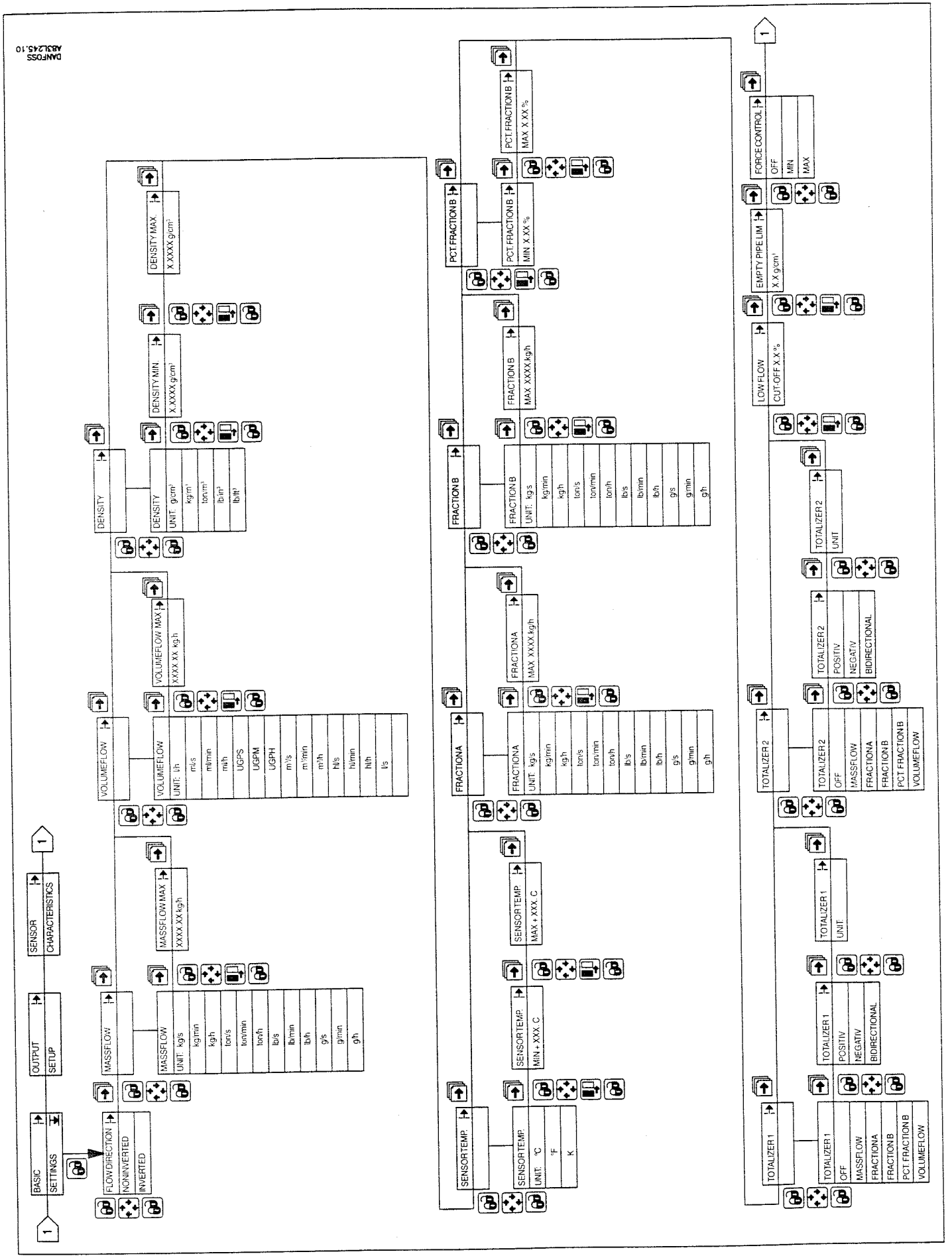
OPERATOR MENU SETUP

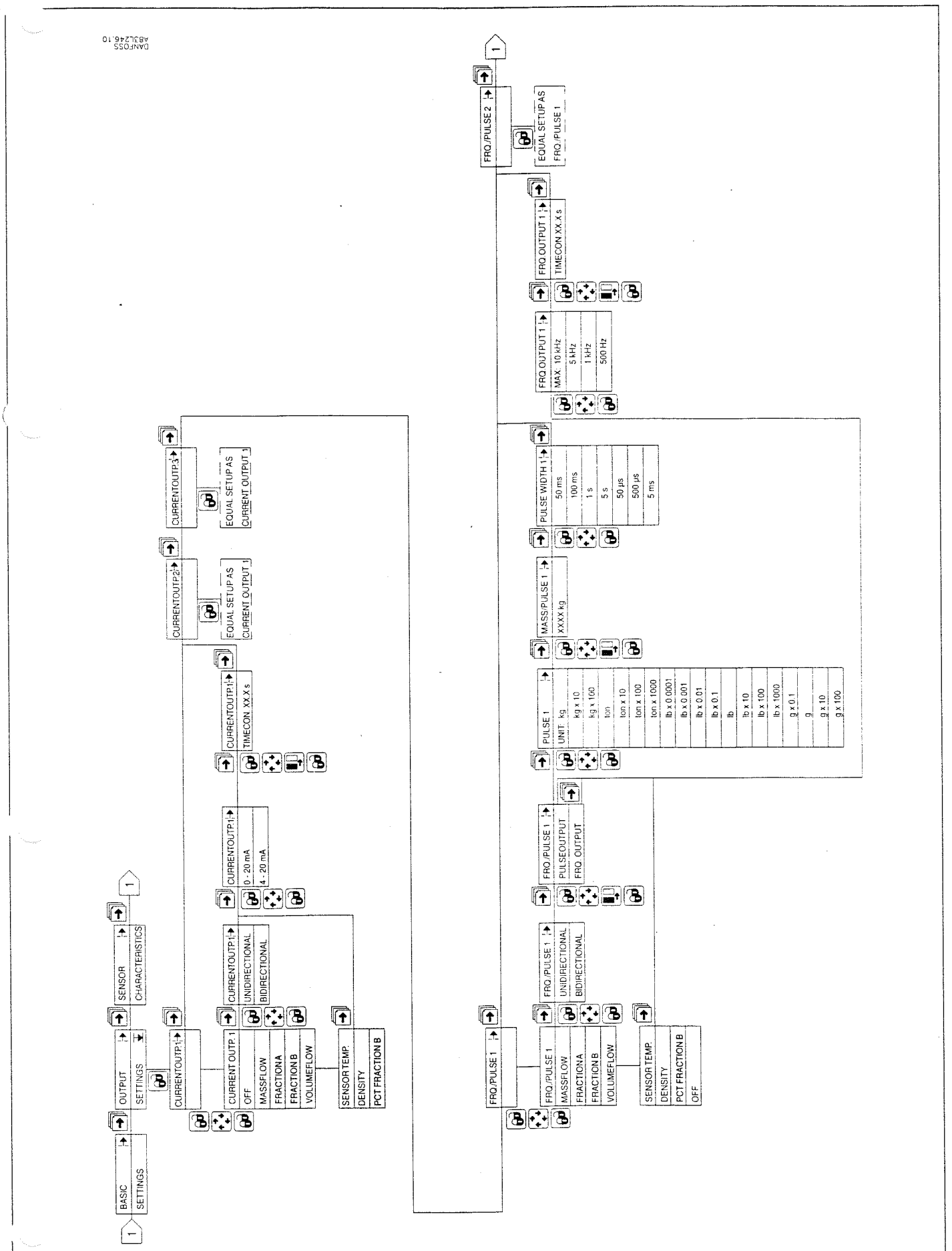
Information that must be accessible in OPERATOR MENU can be selected here.

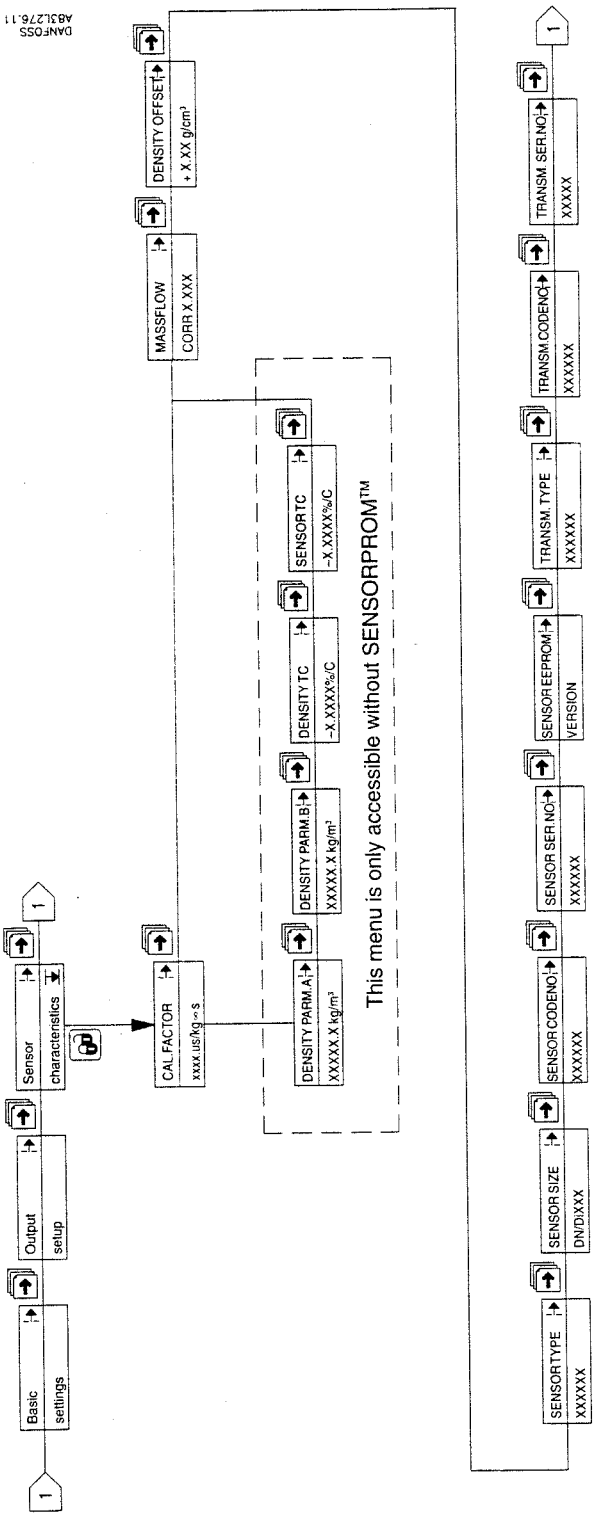
USER CODE SETUP

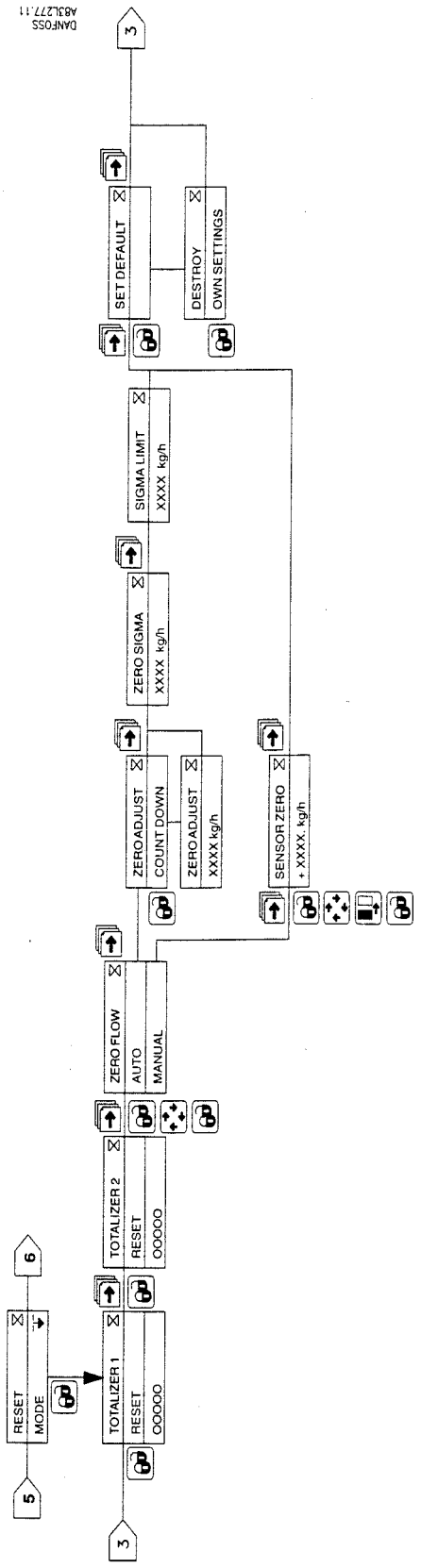
The user code can be changed in USER CODE SETUP. The user code is factory-set at 1000.
If the user code is forgotten, the factory setting can be recovered in the following way:
Switch off the power supply, hold the key down and switch the power supply on again.
When the ROM and RAM test is finished, release the key. The user code will now be 1000.

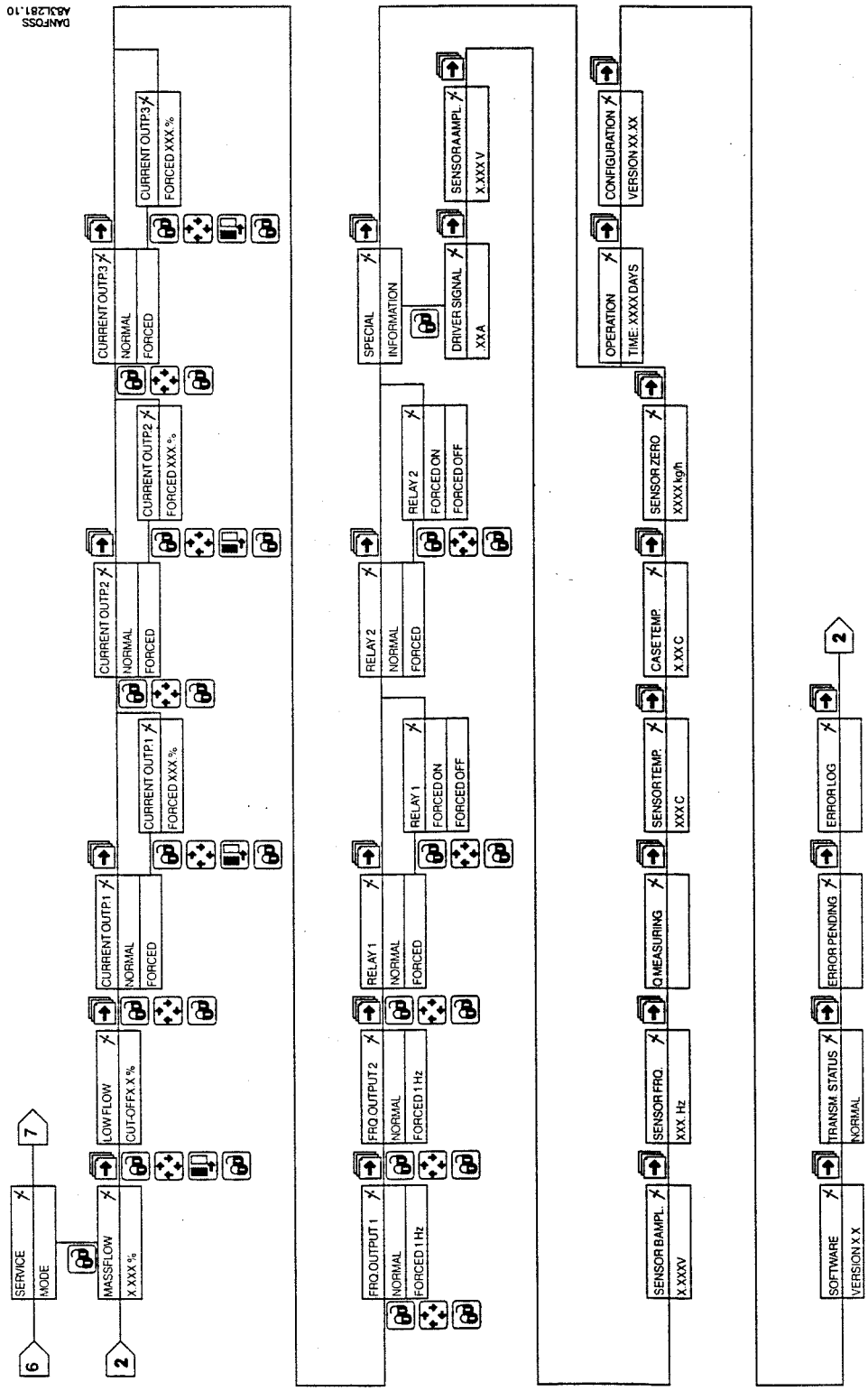
If the signal converter is left in CONVERTER SETUP for more than 10 minutes, it automatically switches over to OPERATOR MENU.

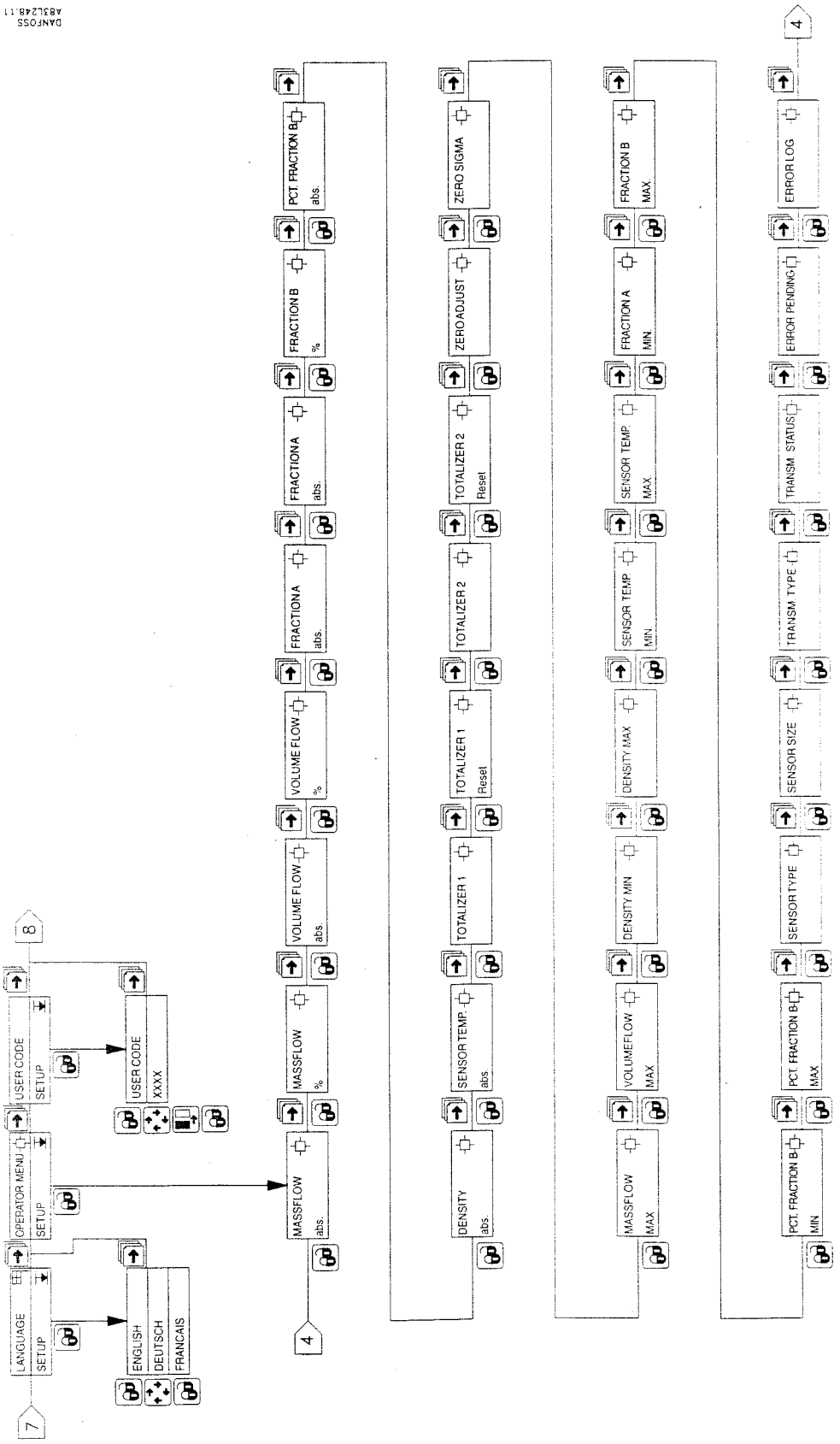

DANFOSS
AB3L245.10
BASIC
SETTINGS
OUTPUT
SETUP
SENSOR
CHARACTERISTICS
FLOWDIRECTION
NONINVERTED
INVERTED
MASSFLOW
MASSFLOW
UNIT: kg/s
kg/min
kg/h
ton/s
ton/min
ton/h
lb/s
lb/min
lb/h
g/s
g/min
g/h
MASSFLOW MAX
XXXX.XX kg/h
VOLUMEFLOW
VOLUMEFLOW
UNIT: l/h
ml/s
ml/min
ml/h
UGPS
UGPM
UGPH
m³/s
m³/min
m³/h
hl/s
hl/min
hl/h
l/s
VOLUMEFLOW MAX
XXXX.XX kg/h
DENSITY
DENSITY
UNIT: g/cm³
kg/m³
ton/m³
lb/in³
lb/ft³
DENSITY MIN
X.XXXX g/cm³
DENSITY MAX
X.XXXX g/cm³
SENSORTEMP
SENSORTEMP
UNIT: °C
°F
K
SENSORTEMP
MIN ÷ XXX. C
SENSORTEMP
MAX ÷ XXX. C
FRACTION A
FRACTION A
UNIT: kg/s
kg/min
kg/h
ton/s
ton/min
ton/h
lb/s
lb/min
lb/h
g/s
g/min
g/h
FRACTION A
MAX XXXX kg/h
FRACTION B
FRACTION B
UNIT: kg/s
kg/min
kg/h
ton/s
ton/min
ton/h
lb/s
lb/min
lb/h
g/s
g/min
g/h
FRACTION B
MAX XXXX kg/h
PCT. FRACTION B
PCT. FRACTION B
MIN X.XX %
PCT. FRACTION B
MAX X.XX %
TOTALIZER 1
TOTALIZER 1
OFF
MASSFLOW
FRACTION A
FRACTION B
PCT. FRACTION B
VOLUMEFLOW
TOTALIZER 1
UNIT
TOTALIZER 1
POSITIV
NEGATIV
BIDIRECTIONAL
TOTALIZER 2
TOTALIZER 2
OFF
MASSFLOW
FRACTION A
FRACTION B
PCT. FRACTION B
VOLUMEFLOW
TOTALIZER 2
UNIT
TOTALIZER 2
POSITIV
NEGATIV
BIDIRECTIONAL
LOW FLOW
CUT-OFF X.X %
EMPTY PIPE LIM
X.X g/cm³
FORCE CONTROL
OFF
MIN
MAX


DANFOSS
AB3LZ46.10
BASIC
SETTINGS
OUTPUT
SETTINGS
SENSOR
CHARACTERISTICS
CURRENTOUTP1
CURRENTOUTP2
CURRENTOUTP3
CURRENT OUTP. 1
OFF
MASSFLOW
FRACTION A
FRACTION B
VOLUMEFLOW
CURRENTOUTP1
0 - 20 mA
4 - 20 mA
CURRENTOUTP1
UNIDIRECTIONAL
BIDIRECTIONAL
CURRENTOUTP1
TIMECON XX.X s
EQUAL SETUP AS
CURRENT OUTPUT 1
EQUAL SETUP AS
CURRENT OUTPUT 1
SENSOR TEMP.
DENSITY
PCT FRACTION B
FRQ./PULSE 1
FRQ./PULSE 2
EQUAL SETUP AS
FRQ./PULSE 1
FRQ. OUTPUT 1
TIMECON XX.X s
FRQ. OUTPUT 1
MAX 10 kHz
5 kHz
1 kHz
500 Hz
PULSE WIDTH 1
50 ms
100 ms
1 s
5 s
50 µs
500 µs
5 ms
MASS/PULSE 1
XXXX kg
PULSE 1
UNIT kg
kg x 10
kg x 100
ton
ton x 10
ton x 100
ton x 1000
lb x 0.0001
lb x 0.001
lb x 0.01
lb x 0.1
lb
lb x 10
lb x 100
lb x 1000
g x 0.1
g
g x 10
g x 100
FRQ./PULSE 1
PULSEOUTPUT
FRQ. OUTPUT
FRQ./PULSE 1
UNIDIRECTIONAL
BIDIRECTIONAL
FRQ./PULSE 1
FRQ./PULSE 1
MASSFLOW
FRACTION A
FRACTION B
VOLUMEFLOW
SENSOR TEMP.
DENSITY
PCT FRACTION B
OFF


DANFOSS
AB3L276.11
Basic settings
Output setup
Sensor characteristics
CAL.FACTOR
xxxx.us/kg*s
DENSITY PARM.A
XXXXX.X kg/m³
DENSITY PARM.B
XXXXX.X kg/m³
DENSITY TC
-X.XXXX%/C
SENSOR TC
-X.XXXX%/C
MASSFLOW
CORR.X.XXX
DENSITY OFFSET
+X.XX g/cm³
This menu is only accessible without SENSORPROM™
SENSOR TYPE
XXXXXX
SENSOR SIZE
DN/DXXX
SENSOR CODENO
XXXXXX
SENSOR SER.NO
XXXXXX
SENSOR EEPROM
VERSION
TRANSM.TYPE
XXXXXX
TRANSM.CODENO
XXXXXX
TRANSM.SER.NO
XXXXX


DANFOSS
A83L277.11
3
SET DEFAULT
DESTROY
OWN SETTINGS
SIGMA LIMIT
XXXX kg/h
ZERO SIGMA
XXXX kg/h
ZEROADJUST
COUNT DOWN
ZEROADJUST
XXXX kg/h
SENSOR ZERO
+ XXXX. kg/h
ZERO FLOW
AUTO
MANUAL
TOTALIZER 2
RESET
OOOOO
6
RESET
MODE
TOTALIZER 1
RESET
OOOOO
5
3


DANFOSS
A83L281.10
SERVICE
MODE
MASSFLOW
X.XXX %
LOW FLOW
CUT-OFF X.X %
CURRENT OUTP1
NORMAL
FORCED
CURRENT OUTP1
FORCED XXX %
CURRENT OUTP2
NORMAL
FORCED
CURRENT OUTP2
FORCED XXX %
CURRENT OUTP3
NORMAL
FORCED
CURRENT OUTP3
FORCED XXX %
FRQ.OUTPUT 1
NORMAL
FORCED 1 Hz
FRQ.OUTPUT 2
NORMAL
FORCED 1 Hz
RELAY 1
NORMAL
FORCED
RELAY 1
FORCED ON
FORCED OFF
RELAY 2
NORMAL
FORCED
RELAY 2
FORCED ON
FORCED OFF
SPECIAL
INFORMATION
DRIVER SIGNAL
XXA
SENSORAAMPL.
X.XXX V
SENSOR BAMPL.
X.XXXV
SENSOR FRQ.
XXX. Hz
MEASURING
SENSOR TEMP.
XXX C
CASE TEMP.
X.XX C
SENSOR ZERO
XXXX kg/h
OPERATION
TIME: XXXX DAYS
CONFIGURATION
VERSION XX.XX
SOFTWARE
VERSION X.X
TRANSM. STATUS
NORMAL
ERROR PENDING
ERROR LOG
6
7
2
2


DANFOSS
A8SL248.11
LANGUAGE
SETUP
ENGLISH
DEUTSCH
FRANCAIS
OPERATOR MENU
SETUP
MASSFLOW
abs.
USER CODE
SETUP
USER CODE
XXXX
VOLUME FLOW
abs.
MASSFLOW
%
VOLUME FLOW
%
FRACTION A
abs.
FRACTION B
%
PCT. FRACTION B
abs.
DENSITY
abs.
SENSOR TEMP.
abs
TOTALIZER 1
TOTALIZER 1
Reset
TOTALIZER 2
TOTALIZER 2
Reset
ZERO ADJUST
ZERO SIGMA
MASSFLOW
MAX
VOLUMEFLOW
MAX
DENSITY MIN
DENSITY MAX
SENSOR TEMP
MIN
SENSOR TEMP
MAX
FRACTION A
MIN
FRACTION B
MAX
PCT. FRACTION B
MIN
PCT. FRACTION B
MAX
SENSOR TYPE
SENSOR SIZE
TRANSM TYPE
TRANSM STATUS
ERROR PENDING
ERROR LOG
4
7
8

Factory setting

On start-up, the meter uses the factory setting automatically read in from the SENSORPROM™. The tables below give the factory-set values for the menus BASIC SETTINGS and OUTPUT SETUP. The possible range for each setting is given.

If the respective setting range is exceeded, the cursor moves to the first digit in the display. The cursor flashes to indicate that the setting is invalid and the selected setting cannot be locked with the key before a correct value is selected.

Since a number of factory-set values such as max. massflow, max. volume flow, etc. are dimension-dependent, these are given separately in the table "Dimension-dependent setting values".

Basic settings

BASIC SETTINGS	Factory setting	Setting possibilities
Direction def.	Non-inverted	Non-inverted, inverted
Massflow unit	kg/h	g/s, g/min, g/h, kg/s, kg/min, kg/h, ton/s, ton/min, ton/h, lb/s, lb/min, lb/h
Massflow max.	Dimension-dependent	See table 1
Volume flow unit	l/h	ml/s, ml/min, ml/h, l/s, l/min, l/h, hl/s, hl/min, hl/h, m^3/s,m^3/min, m^3/h, UGPS, UGPM, UGPH
Volume flow max.	Dimension-dependent	See table 1
Density unit	kg/m^3	g/cm^3, kg/m^3, ton/m^3, lb/in^3, lb/ft^3
Density min.	100 kg/m^3	100 - 2900 kg/m^3
Density max.	2000 kg/m^3	100 - 2900 kg/m^3
Sensor temp. unit	°C	°C, °F, K
Sensor temp. min.	0°C	–50 to +250°C
Sensor temp. max.	200°C	–50 to + 250°C
Fraction A unit	kg/h	g/s, g/min, g/h, kg/s, kg/min, kg/h, ton/s, ton/min, ton/h, lb/s, lb/min, lb/h
Fraction A max.	Dimension-dependent	See table 1
Fraction B unit	kg/h	g/s, g/min, g/h, kg/s, kg/min, kg/h, ton/s, ton/min, ton/h, lb/s, lb/min, lb/h
Fraction B max.	Dimension-dependent	See table 1
Pct Fraction B min.	0%	0% to 100%
Pct Fraction B max.	100%	0% to 100%
Totalizer 1	Massflow	Massflow, Fraction A, Fraction B, Volume flow, off
Totalizer 1, mode	Positive	Positive, Negative, Bidirectional
Totalizer 1 unit	-	The unit follows the possibilities given by the selected flow type
Totalizer 2	Positive	Massflow, Fraction A, Fraction B, Volume flow, off
Totalizer 2 mode	Massflow	Positive, Negative, Bidirectional
Totalizer 2 unit	-	The unit follows the possibilities given by the selected flow type
Low flow cut-off	1.5%	0 - 9.9%
Empty pipe ERR. Limit	500 kg/m^3	100 - 2900 kg/m^3
Force control	Off	Off, Min., Max.

Output Setup

OUTPUT SETUP	Factory setting	Setting possibilities
Curr. output 1	Off	Massflow, Fraction A, Fraction B, Volume flow, Sensor temp., Density, Pct. Fraction B, Off
Curr. output 1	Unidirectional	Unidirectional, Bidirectional
Curr. output 1	4 - 20 mA	0 - 20 mA, 4 - 20 mA
Curr. output 1,Timecon.	5 s	0.1 - 30 s
Curr. output 2	Off	Massflow, Fraction A, Fraction B, Volume flow, Sensor temp., Density, Pct. Fraction B, Off
Curr. output 2	Unidirectional	Unidirectional, Bidirectional
Curr. output 2	4 - 20 mA	0 - 20 mA, 4 - 20 mA
Curr. output 2,Timecon.	5 s	0.6 -30 s
Curr. output 3	Off	Massflow, Fraction A, Fraction B, Volume flow, Sensor temp., Density, Pct. Fraction B, Off
Curr. output 3	Unidirectional	Unidirectional, Bidirectional
Curr. output 3	4 - 20 mA	0 - 20 mA, 4 - 20 mA
Curr. output 3,Timecon.	5 s	0.6 - 30 s
Frq./Pulse 1	Massflow	Massflow, Fraction A, Fraction B, Volume flow, Sensor temp., Density, Pct. Fraction B, Off
Frq./Pulse 1	Unidirectional	Unidirectional, Bidirectional
Pulse output unit	See table 1	kg, kg×10, kg×100, ton, lb×0.0001, lb×0.001,lbx0.01, lb×0.1, lb, lb×10, lb×100, lb×1000, g, g×10, g×100
Mass/pulse or Volume/pulse	See table 1	
Pulse width	50 ms	50 µs, 500 µs, 5 ms, 50 ms, 100 ms, 1 s, 5 s
Frq. output 1 max. frequency	10 kHz	500 Hz, 1 kHz, 5 kHz, 10 kHz
Frq. output 1,Timecon.	5 s	0.1 - 30 s
Frq./Pulse 2	Off	Massflow, Fraction A, Fraction B, Volume flow, Sensor temp., Density, Pct. Fraction B, Off
Frq./Pulse 2	Unidirectional	Unidirectional, Bidirectional
Pulse output 2 unit	See table 1	kg, kg×10, kg×100, ton, lb×0.0001, lb×0.001,lbx0.01 lb×0.1, lb, lb×10, lb×100, lb×1000, g, g×10, g×100
Mass/pulse or Volume/pulse	See table 1	
Pulse width	50 ms	50 µs, 500 µs, 5 ms, 50 ms, 100 ms, 1 s, 5 s
Frq. output 2 max. frequency	10 kHz	500 kHz, 1 kHz, 5 kHz, 10 kHz
Frq. output 2,Timecon.	5 s	0.1 - 30 s

Dimension-dependent setting values

Table 1

Sensor type	Massflow			Volume flow			Pulse output					
							Factory settings					
	Factory setting kg/h	Min.	Max.	Factory setting l/h	Min.	Max.	Mass per pulse	Pulse unit	Totalizer unit pulse	Volume per unit	Pulse unit	Totalizer unit pulse
DI 3	75	-	250	75	-	250	1	g	g	1	ml	ml
DI 6	300	-	1000	300	-	1000	10	g	g	10	ml	ml
DI 15	1500	-	5600	1500	-	5600	1	kg	kg	1	l	l
DI 25	7500	-	25000	7500	-	25000	1	kg	kg	1	l	l
DI 40	25000	-	52000	25000	-	52000	10	kg	kg	10	l	l
DN 10	1500	-	4400	1500	-	4400	1	kg	kg	1	l	l
DN 25	7500	-	20800	7500	-	20800	1	kg	kg	1	l	l
DN 50	25000	-	80000	25000	-	80000	10	kg	kg	10	l	l

.arting procedure

1. Switch on the signal converter MASS 3000, the meter will then automatically run through a self-test routine which is informed via the display with the text: **RAM TEST, ROM TEST, INITIALIZATION**, and subsequently the measuring will start.

2. Check that the error symbol is not switched on in the display. If that is the case, go to the chapter regarding trouble shooting.

3. Let the signal converter and the sensor heat up for approx. 20-30 minutes before making the zero point adjustment.

4. Pump liquid at maximum flow through the sensor for approx. 2 minutes so that the sensor is heated to the same temperature as the liquid, and to ensure that collections of air are washed away, as non-homogenous mixtures of air can make the 0-point unstable and thus cause measuring errors.

5. **0-point adjustment** is made by stopping the flow by shutting off the valve in front/at the back of the sensor so that the sensor is filled up with liquid.
The sensor must be under pressure from pump or level of flow, otherwise there is a risk that collections of air will be separated from the liquid.

6. Wait for approx. 1 minute until the liquid has stabilized.

7. Go via the keyboard (or activate REMOTE ZERO POINT ADJ., if this is connected) to the menu **RESET MODE**, and step to the menu point **ZERO ADJUST**. The 0-point adjustment will now be made by activating the locking key.

8. The zero point adjustment will last approx. 30 sec., which is shown on the display in the form of a countdown from 350 to 0, with the title **BUSY**.

9. When the countdown has finished the display will show the actual 0-point error directly in g/s.
The standard deviation on the 0-point will be shown in the succeeding menu point **ZERO SIGMA**.
As a correct 0-point is of decisive importance to an optimum measuring function Danfoss has installed an automatic routine in MASS 3000 which compares the standard deviation on the 0-point **(ZERO SIGMA)** with a reference value **(SIGMA LIMIT)**. If the value is within the reference value MASS 3000 accepts the value found in the 0-point adjustment, and the flow measuring can continue. If the value is not within the reference value (can be due to a leaky valve, incorrect installation or non-homogeneously separated air in the liquid), the 0-point adjustment routine must be repeated - points 4-9.
If the routine is not repeated MASS 3000 will maintain the original result.

   The reference value depends on the pipe dimension, and therefore it is automatically read by the SENSORPROM™ of the measuring pipe.

10. The meter is now ready for flow measurement and will measure with the settings automatically read in from the SENSORPROM™. See pages 37 and 38 for factory-setting values.

Manual adjustment of the 0-point

If you want to enter the 0-point value manually, this can be done under the menu point **ZERO FLOW**, by chosing **MANUAL**.
Please note that the evaluation of the quality of the 0-point by means of the **SIGMA LIMIT** function will be disabled.

St ng up without SENSORPROM™

When started up without SENSORPROM™ the meter automatically reads in some predetermined values corresponding to the tabel below.
When the meter is started up without SENSORPROM™ the specific calibration constants valid for the actual sensor must be manually entered. This is made via the menu **SENSOR CHARACTERISTICS**.
From the calibration report or the plate on the side of the sensor in question the following data is read and set in MASS 3000:

Calibration	Setting parameter	Factory setting
Sensor without density calibration	CAL. FACTOR	100.00 µsec / (kg x sec)
	SENSOR TC.	– 0.05% / °C
Sensor with density calibration	CAL. FACTOR	100.00 µsec / (kg x sec)
	DENSITY PARM A.	– 1000.0 kg/m^3
	DENSITY PARM. B	100.0000 kg/m^3 x sec^2
	DENSITY TC	– 0.0500% / °C
	SENSOR TC	– 0.0500% / °C

The meter will then operate normally with the following precautions:
Dimension-dependent factory settings, shown in table 1, must be entered manually.

When the meter is used for fraction flow measurement (e.g. °brix) this can **only** be done with SENSORPROM™ installed, as SENSORPROM™ contains all fraction data and the fraction menu. This data cannot be entered manually as the quantity of data is too comprehensive.
In this case a new SENSORPROM™ is required.

SERVICE MODE	**SERVICE MODE** can be used when commissioning and thorough examination of fault owing to wrong wiring, fault in signal converter, fault in sensor or application errors. Practical tips for use of this menu are given under section "Fault location".
MASSFLOW	% massflow gives the actual mass flow in %, whilst tests are being conducted in SERVICE MODE.
LOW FLOW CUT OFF	Used when commissioning to experiment with suppression of fluctuating flow transients.
CURRENT OUTPUT FORCED	CURRENT OUTPUT FORCED simulates a given flow, temperature or density signal etc. This enables checking and calibration of connected equipment before the system is operated. If 3 current outputs are used the function can also be used for identification of the individual outputs by activating these in turns one by one.
FRQ. OUTPUT FORCED 1 Hz.	FRQ. OUTPUT FORCED is used to test counters, data collection equipment, etc. If 2 frequency/pulse outputs are used the function can be used for identification of the individual outputs by activating these by turns one by one.
RELAY FORCED	RELAY FORCED is used when commissioning to test connected indicators, contactors, etc. If both ERROR and DIRECTION RELAY are connected the function can also be used for identification of these by activating the relays one by one.
SPECIAL INFORMATION	SPECIAL INFORMATION is used for making a diagnosis of the sensor function under the present operating conditions. This makes is possible to reveal errors caused by errors in the sensor or errors due to application conditions disturbing the sensor function.
DRIVER SIGNAL	DRIVER SIGNAL gives the current induced to the sensor driver.
SENSOR A AMPL./ SENSOR B AMPL.	SENSOR A AMPL./SENSOR B AMPL. gives the signal level in [Vrms] from pick-up A and pick-up B, respectively, mounted in the sensor. Power supply to the driver is regulated so that the output voltage from pick-up A/B is always 0.106 Vrms ±0.10%. The function can be used to check missing/wrong connection of the sensor cables. Errors due to a too large quantity of air in the liquid can be detected as the driver voltage will saturate and PICKUP AMPL. will go considerably below 0.106 Vrms ±0.10%.
SENSOR FRQ.	SENSOR FRQ. gives the resonant frequency of the sensor in Hz. The frequency is dependent on dimension as well as the density of the liquid measured, see table below.

DI 3	110 Hz
DI 6	135 Hz
DI 15	165 Hz
DI 25	125 Hz
DI 40	125 Hz

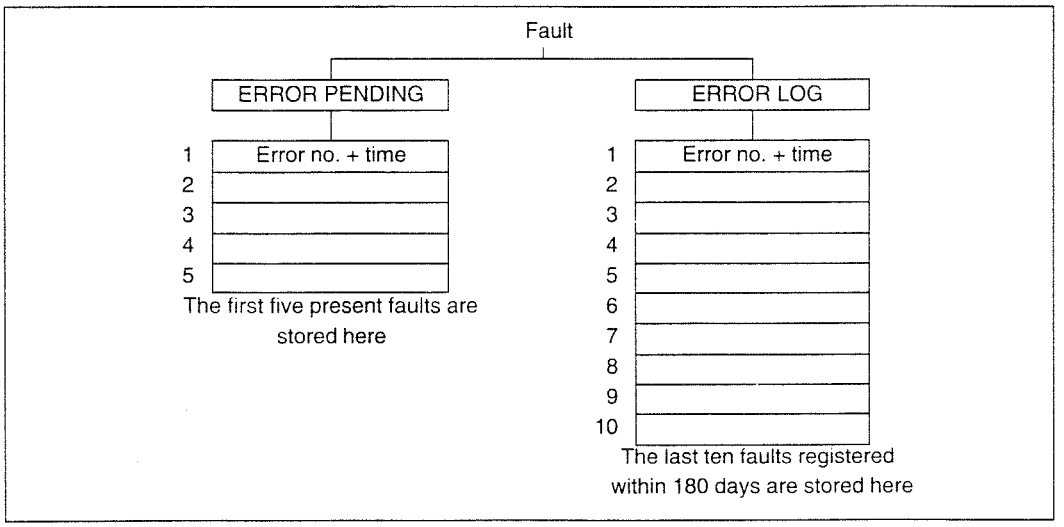
Q asuring	Q Measuring gives by a dimensionless figure the ability of the sensor to oscillate at the required resonant frequency. Q Measuring is used to check that the sensor operates in the optimum way in the application concerned. With optimum operation the Q will be high. A low Q means that the sensor emits some unwanted harmonic oscillations around the resonant frequency which may disturb measurement and consequently measuring accuracy. These disturbances may be due to excessively high air content in the liquid, multiphase flow, heavy mechanical vibrations, etc.
SENSOR TEMP	SENSOR TEMP gives the actual temperature of the sensor. The function can be used to see whether possible errors occur because the sensor is exposed to an excessively high temperature. Furthermore, errors due to missing/wrong connection of the temperature transmitter between sensor and signal converter can be detected.
CASE TEMP	CASE TEMP shows the internal electronics temperature in MASS 3000. The function can be used to check that the signal converter is installed under correct thermic conditions. If the maximum electronics temperature of 55°C is exceeded an alarm is given, the alarm relay, however, is not activated.
SENSOR ZERO	Via the service menu the zero point adjustment function of the meter can be activated, also described in section "Starting procedure". During service in can be of use to see the size and stability of the zero point.
OPERATING TIME	OPERATING TIME states how many days the signal converter has been in operation.
CONFIGURATION	CONFIGURATION VERSION gives the software configuration version.
SOFTWARE VERSION	SOFTWARE VERSION gives the software version.
ERROR PENDING	ERROR PENDING gives actual errors, see section "Fault location".
ERROR LOG	ERROR LOG gives the last 10 errors registered within 180 days, see section "Fault location".

Fault location

MASS 3000 is self-monitoring and provided with an advanced fault location routine enabling detection of the following faults:

1) Internal faults in the MASS 3000 signal converter
2) Internal faults in the MASS 1100/2100 sensor
3) Operation and setting faults
4) Wrong connection of current outputs
5) Wrong connection between signal converter and sensor
6) Faults caused by application

These operational disturbances are displayed immediately in the form of two flashing triangles ◣.
The individual faults are stored in two memories. Present faults are stored in **ERROR PENDING**, while present and past faults are stored in **ERROR LOG**. The faults are stored in the form of an error code, with indication of time elapsed since error registration.



In MASS 3000, errors can also be registered via the relay. As not all errors are of the same importance, errors which do not affect basic measurement and accuracy will only be displayed without activating the relay.

In the "Fault location guide" the errors activating the relay are shown.

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

Fault location guide

Symptom	Output signals	ERROR relay	Error code	Cause	Remedy
Empty display	Minimum	ON	None	1. Supply voltage 2. MASS 3000 is defective	1. Check supply voltage and voltage selector 2. Replace MASS 3000
No flow signal	Minimum	OFF	None	1. Current output deselected 2. Frequency/pulse output deselected	1. Run through output setup menu 2. Run through output setup menu
	Minimum	OFF	None	Reverse flow direction	Select direction definition in Basic Settings
	Minimum	ON	60	1. No load on current output 1 2. MASS 3000 is defective	1. Check cables and connections 2. Replace MASS 3000
	Minimum	ON	61	1. No load on current output 2 2. MASS 3000 is defective	1. Check cables and connections 2. Replace MASS 3000
	Minimum	ON	62	1. No load on current output 3 2. MASS 3000 is defective	1. Check cables and connections 2. Replace MASS 3000
	Minimum	ON	13	Phase error in sensor pick-up coils	Check cables and connections for polarization fault
	Minimum	ON	14	Phase error in driver magnet	Check cables and connections for polarization fault
	Minimum	ON	15	Error in temperature sensor	Check cables and connections
	Undefined	ON	16	MASS 3000 is defective	Replace MASS 3000
	Minimum	OFF	17	Electronics temperature too high	Locate MASS 3000 so the ambient temperature is below 55 °C
	Minimum	ON	18	Empty pipe	Check the application and ensure that the measuring pipe is full
	Maximum	ON	19	Massflow saturates	Ensure that the sensor is correctly sized
	Undefined	ON	20	Temperature in sensor too high	Check the application and ensure that the liquid temperature does not exceed 180 °C
	Minimum	ON	10	Hardware fault in MASS 3000	Replace MASS 3000
			11	Pick-up voltage in sensor too low	1. Check cables and connections 2. Check applicatation for damping, air, etc.
			12	Pick-up voltages unequal	Replace MASS 1100/2100
	Undefined	ON	33 34	Loss of internal data in MASS 3000	Replace MASS 3000
Measuring error	Maximum	ON	64 65 66	Current output 1 exceeds 120% Current output 2 exceeds 120% Current output 3 exceeds 120%	Ensure that the sensor is correctly sized and check max. settings under menu BASIC SETTINGS
	Undefined	ON	68 69 70	MASS 3000 is defective	Replace MASS 3000
	Maximum	ON	80 81	Frequency/pulse output 1 exceeds 120% Frequency/pulse output 2 exceeds 120%	1. Max. settings too low 2. Mass/pulse- or volume/pulse setting too low
	Maximum	ON	82 83	Pulse length of frequency/pulse output 1 exceeds 50% duty cycle. Pulse length of frequency/pulse output 2 exceeds 50% duty cycle.	Pulse width too long, select smaller pulse width
	Undefined	ON	84 85	MASS 3000 is defective	Replace MASS 3000
	Undefined	ON	120	Zero point adjustment exceeds limit	Carry out the activities described under section "Starting up"
	Undefined	ON	121 125 126	MASS 3000 is defective	Replace MASS 3000
	Undefined	ON	30 31 40	SENSORPROM™ fault Defective or deficient SENSORPROM™	1. Remove SENSORPROM™ and enter calibration data in menu SENSOR CHARACTERISTICS, cf. section "Starting up" 2. Replace SENSORPROM™ (Contact Danfoss Instrumentation)
	Undefined	ON	41	MASS 3000 is defective	Replace MASS 3000
	Undefined	OFF	42	Deficient SENSORPROM™	Mount SENSORPROM™ or enter calibration data in the menu "SENSOR CHARACTERISTICS", see section "Starting up"
OK	Minimum	OFF	100	"Power on" indication. Signal converter self-tests when switched on. This condition is not considered a fault.	
	Undefined	ON	110 111	MASS 3000 is defective	Replace MASS 3000

Check for air in the sensor

In case of large air collections non-homogeneously distributed in the sensor, the air in the liquid can disturb the flowmeter and lead to incorrect measurement, whereas homogeneously distributed air and solids will not disturb measurement.

Symptoms of air bubbles in the liquid are:
1) 0-point unstable, or exceeding limit (SIGMA LIMIT) ?
2) Measurement with MASSFLO® incorrect?
3) Output signal stable?
4) Error symbol on?

If one or more of the above symptoms is observed, the cause can be that there is air in the liquid. This can be checked through the following tests:

1. **Use of SERVICE MODE**
   Select SERVICE MODE and read the values under the menu DRIVE SIGNAL. If the current to the driver is higher than specified it might be because there are air bubbles in the liquid.

DI 3	7 mA
DI 6	15 mA
DI 15	15 mA
DI 25	10 mA
DI 40	12 mA
DN 10	7 mA
DN 25	5 mA
DN 50	20 mA

2. **Increase of pump pressure**
   Close the valve, if any, after the sensor. Start the pump and consequently increase the pump pressure. If the 0-point becomes more stable there are non-homogeneously distributed air bubbles in the liquid.

3. **Connection in parallel of pick-up signals.**
   The fault can also be found by connecting pick-up A and pick-up B in parallel. Move the lead on terminal 85 to terminal 87 in MASS 1100/2100, or remove lead 85 and connect from 85-87 in MASS 3000. This will send the same sensor signal into both channels in the signal converter.

If the 0-point is stable or within the limit (SIGMA LIMIT) after the 0-point adjustment MASS 3000 is in order and there is non-homogeneously distributed air in the liquid.

Check for air in the sensor

If the above check shows that there is air in the liquid, this can be due to the following causes:

1) Suction pressure ahead of pump too low (pump cavitates)
2) Blocked filter or other obstruction ahead of sensor. This can produce cavitation and air formation
3) Volatile liquid producing air bubbles at low pressure
4) Pressure in sensor too low because of too low a pressure drop in the piping after the sensor
5) Incorrect location of sensor, see section "Sensor mounting".

Cleaning of sensor

The sensor is designed to withstand steam cleaning, hot-water cleaning, or chemical cleaning (CIP).

0-point adjustment after cleaning is recommended before final measurement is commenced.

Replacement of sensor

When the sensor is replaced make sure to install the SENSORPROM™ belonging to the new sensor. Check identity in the menu SENSOR CHARACTERISTICS with the identity of the sensor when starting up.

For safety's reasons, the used sensor must **not** be returned to Danfoss unless agreed otherwise.

Return of sensor

1. **Before returning the sensor, contact the distributor, giving the following information:**

- Date of purchase
- Description of fault
- Measurements made on (liquid), poisonous/**non**-poisonous
  Trade designation } (food)
  Chemical designation }
  Chemical formula } other
- Concentration }
- Temperature
- Pressure
- Code no. on sensor
- Serial no. on sensor
- Size, mm

Normally, sensors cannot be repaired

2. **If the sensor is to be returned by arrangement, Danfoss will forward a return document which is to be carefully completed**

The sensor must be:

- Accompanied by a carefully completed "Return document"
- Cleaned both internally and externally
- Thoroughly flushed out with water
- Packed properly, in original packing (can be ordered from Danfoss)

Replacement of signal converter

Replacement of signal converter is straight forward, as no programming is required due to the SENSORPROM™ facility.
Just switch the power off and exchange the signal converter, turn on the power again and the measurement can continue.

Returning signal converter

The signal converter can be repaired. When returning, please supply the following information:

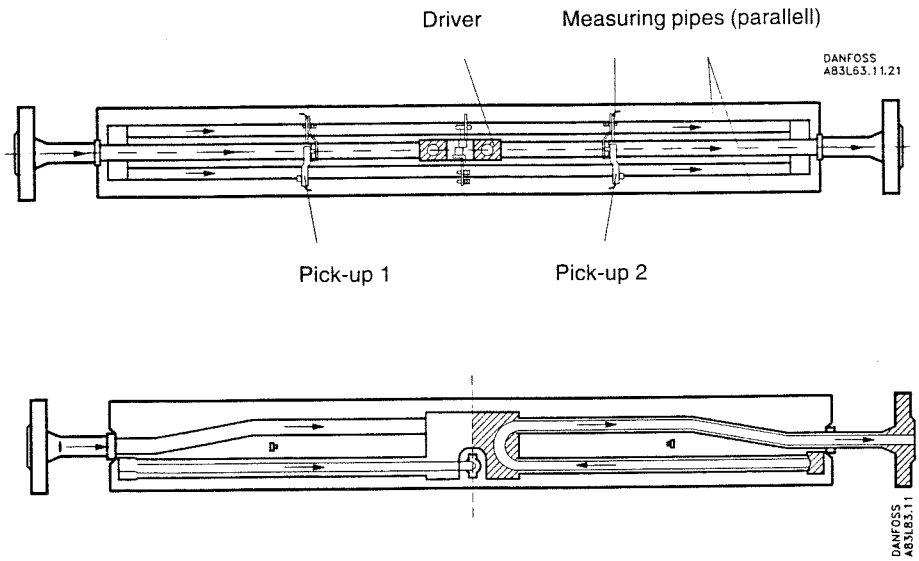
- Company's name
- Address
- Person contacted about return (at supplier's)
- Fault observed, as accurately described as possible
- Code number
- Serial number

Pack the signal converter properly, preferably in original packing.

onstruction

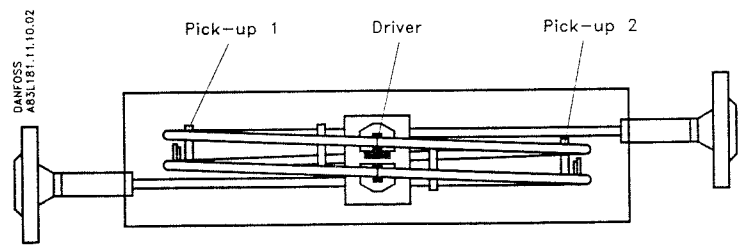
MASS 1100

Sectional drawing



MASS 2100

Sectional drawing

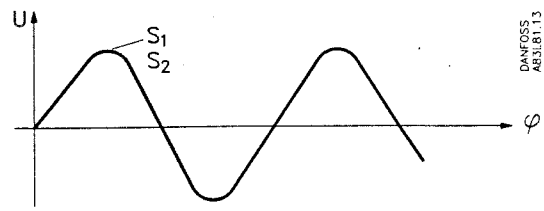


Mode of operation

The measuring principle is based on the Coriolis force [1])

Energised by the signal converter, driver D resonates on the measuring pipe so that it oscillates in phase opposition at its natural frequency. Two pick-ups, 1 and 2, are placed symmetrically either side of the driver D.
When the flow is 0, the signals on S_1 and S_2 will be in phase (see fig. 1).

MASS FLOW $q_m = 0$

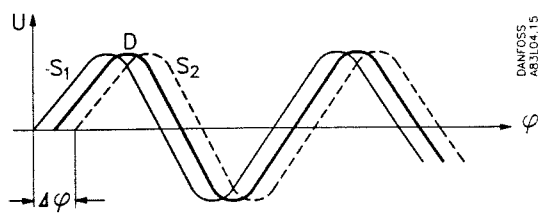


S_1 = Voltage signal from pick-up 1
S_2 = Voltage signal from pick-up 2
$\Delta\varphi$ = Phase difference between pick-ups 1 and 2, $\Delta\varphi = 0$ when $q_m = 0$

Fig. 1

When liquid flows through the meter, Coriolis force will act on the measuring pipe. The resultant pipe deflection causes a phase shift between the pick-up outputs.

MASS FLOW $q_m \neq 0$



S_1 = Voltage signal from pick-up 1
S_2 = Voltage signal from pick-up 2
$\Delta\varphi$ = Phase difference between pick-ups 1 and 2, $\Delta\varphi \neq 0$ when $q_m \neq 0$

Fig. 2

The phase difference is proportional to mass flow q_m.

Density is measured by monitoring the resonant frequency of the measuirng pipe. The resonant frequency falls with rising density.
In a signal converter with the fraction menu the fraction value is calculated from density and temperature.

[1]) A particle of mass **m** which is moved at velocity **v** in a coordinate system rotating at an angular velocity **ω** is subjected to Coriolis force the size of which is $\mathbf{F_c = 2 * m * v * \omega}$.

In the mass flowmeter, $\mathbf{m * v = q_m}$ (mass flow) and the Coriolis force becomes $\mathbf{F_c = 2 * q_m * \omega}$.

Physics tells us that a mass which is made to change velocity and/or direction will react with a force equal and opposite to the force which produced the change.

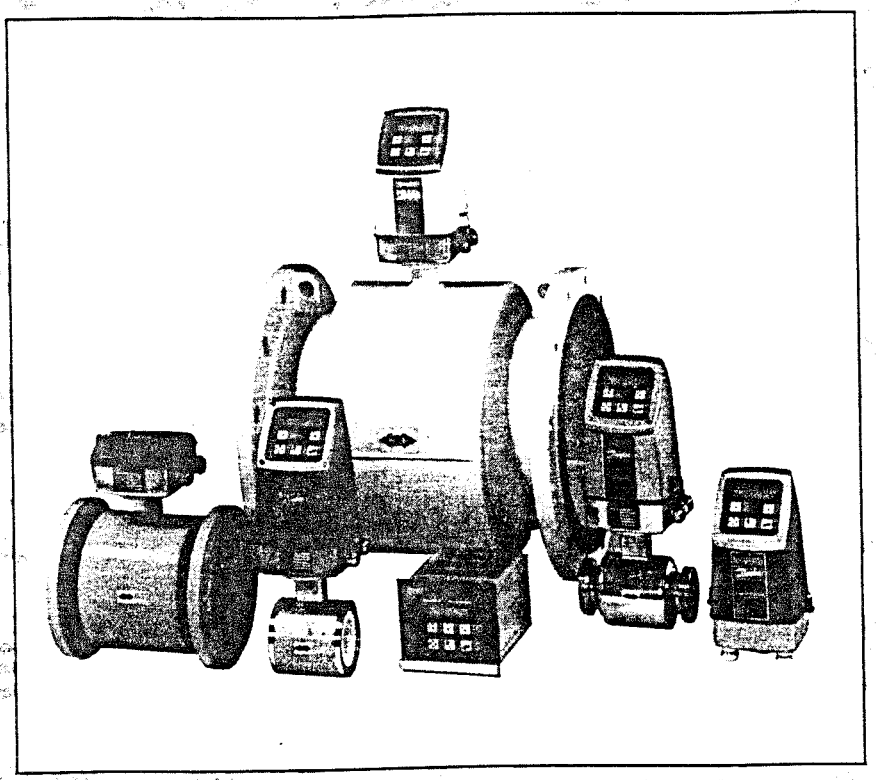
That is to say, when the measuring pipe oscillation produces a change in direction of liquid movement, the Coriolis force F_c from the liquid acts on the measuring pipe with a force equal and opposite to the force that caused the change.

Section 10
The Wincanton Standardiser Model TW-200/ TW-250

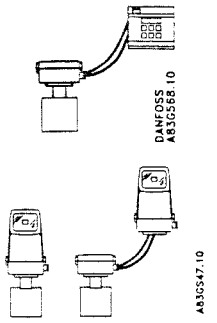
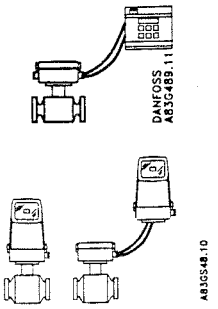
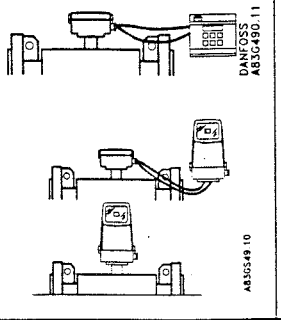
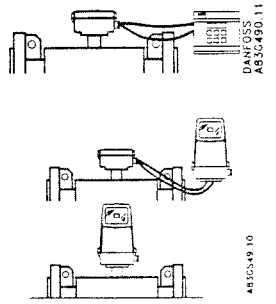
Magflo Data

MAGFLO®

Electromagnetic flowmeter
Sensor type MAG 1100, MAG 2100, MAG 3100
Signal converter type MAG 2500, MAG 3000

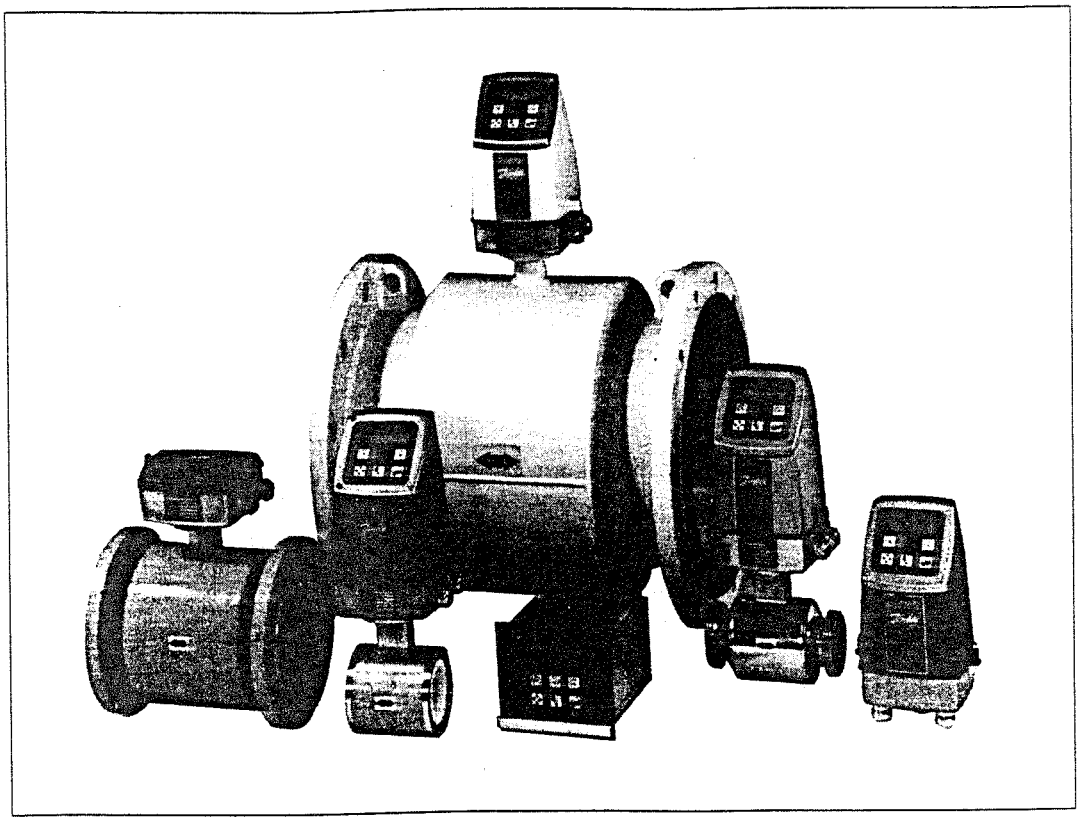


Range of electromagnetic flowmeters

MAGFLO® electromagnetic flowmeter	MAG 1100/3000	FOODMAG[a] MAG 2100/3000	MAG 3100/3000	MAG 3100/2500
				
Size [mm]	DN 6-100	DN 25-80	DN 15-2000	DN 15-1200
Connection	Flangeless (Sandwich)	Hygienic ISO 2852 clamp, DIN 11851 screwed fitting	Flange	Flange
Pressure [bar]	PN 40	PN 10	PN 16 (option to PN 350)	PN 16 (option to PN 350)
Temperature (°C)	-20 to 200	-30 to 100	-20 to 180	-20 to 180
Liner	Al_2O_3	FEP (Teflon)	Neoprene, EPD Ebonite, Teflon (PFTE) Natural rubber Polyurethane	Neoprene EPDM Ebonite, Teflon (PTFE) Natural rubber Polyurethane
Electrodes	Platinum	Platinum	AISI 316 Ti Hastelloy C, Platinum Monel, Titanium	AISI 316 Ti Hastelloy C, Platinum Monel, Titanium
Outputs	Current, frequency and pulse output Fault indication and flow direction relay	Current, frequency and pulse output Fault indication and flow direction relay	Current, frequency and pulse output Fault indication and flow direction relay	Current, frequency and pulse output
Display/counter	Alphanumeric: Flow, volume, fault, etc.	Alphanumeric: Flow, volume, fault, etc.	Alphanumeric: Flow, volume, fault, etc.	Alphanumeric: Flow, volume, fault, etc.
Enclosure	IP 67	IP 67/IP 68	IP 67/IP 68	IP 67/IP 68
Ex-version	-	-	-	-
Accuracy	±0.25%	±0.25%	±0.25%	±0.5%
Data sheet	LK.27.I2.02	LK.27.I2.02	LK.27.I2.02	LK.27.I2.02

Contents

ntents



MAGFLO® electromagnetic flowmeters use Faraday's law as the basis of measuring liquid flow.

The MAG 3000 measuring system consists of a sensor type MAG 1100, FOODMAG® type MAG 2100 or type MAG 3100, and a signal converter type MAG 3000.

The MAG 2500 measuring system consists of a sensor type MAG 1100, FOODMAG® type MAG 2100 or type MAG 3100 and a MAG 2500 signal converter.

The two signal converters are menu-driven and give a flow-proportional output signal 0-20/4-20 mA on the current output, 0-10 kHz on the frequency/pulse output. MAG 3000 also contains a fault/directional relay.

MAG 3000 and MAG 2500 are available in two versions: an IP 67 version for mounting direct on the sensor or on a wall bracket and an IP 00 version for mounting in a 19" rack system, on a wall, or in a panel.

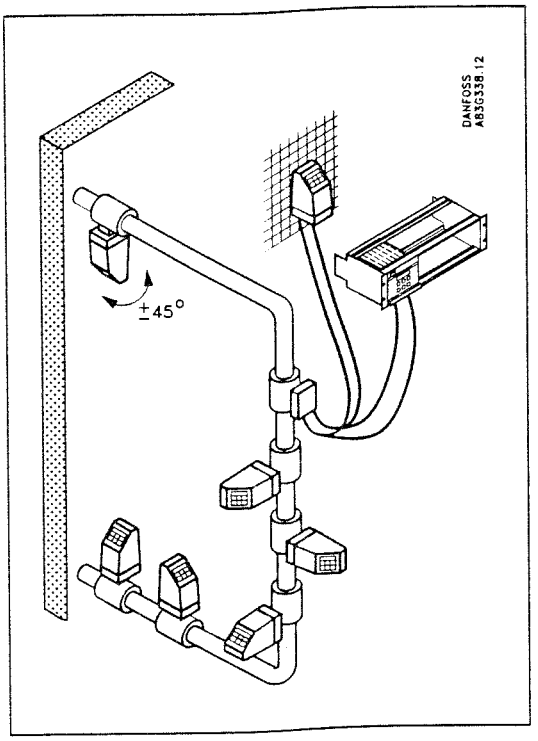
1.1 Application range

MAGFLO® electromagnetic flowmeters can be used as standard units in many different applications. They offer significant advantages, especially in the chemical, food and water treatment sectors. The MAG 2500 measuring system is specially adapted to meet the demands of the water treatment sector.
Many good application possibilities can also be documented for the pulp and paper industry as well as district heating installations.

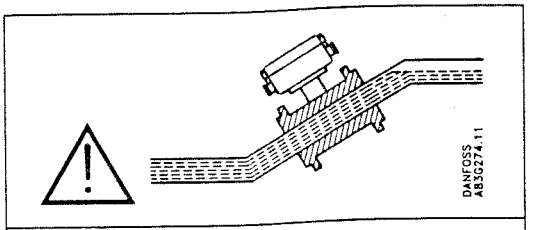
Application examples

- Flow integration
- Measurement of actual flow in connection with
  - control
  - input to monitoring systems
  - input to main process control
- Liquid blending (proportional control)
- Measurement of predetermined volume (batching)
- Filling liquid into packings, containers, etc.

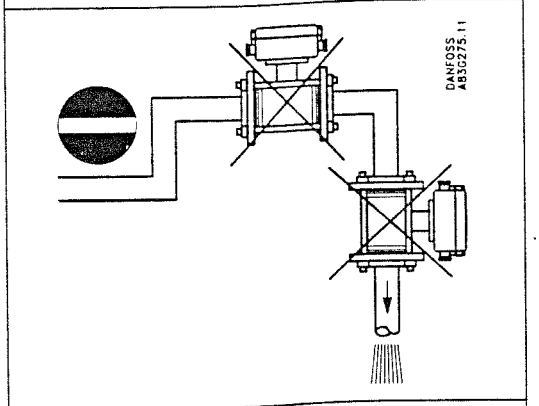
Sensor, general



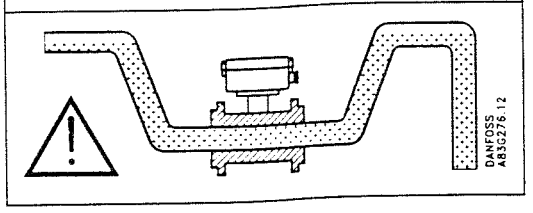
Reading and operating the flowmeters is possible under practically any installation conditions, in that the terminal box can be turned in relation to the sensor. The terminal box should be turned before final installation, see page 15.
To ensure optimum flow measurement, attention should be paid to the following:



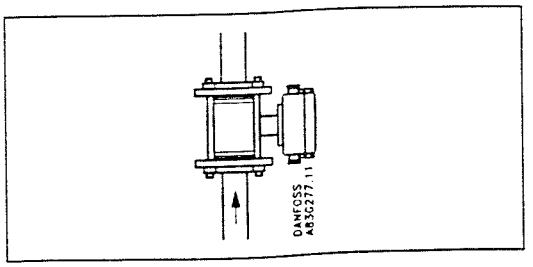
The sensor must always be completely full of liquid.



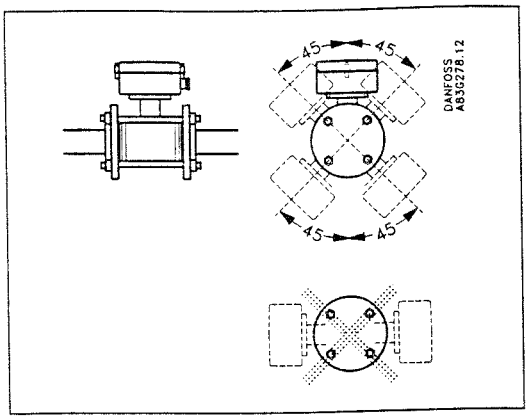
Therefore avoid:
- installation at the highest point in the system.
- installation in vertical pipes with free outlet.



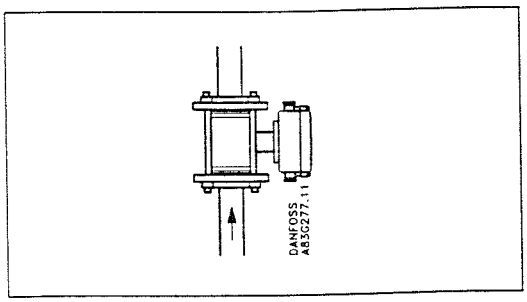
With partially full pipes or pipes with free outlet the flowmeter should be located in a U-tube.



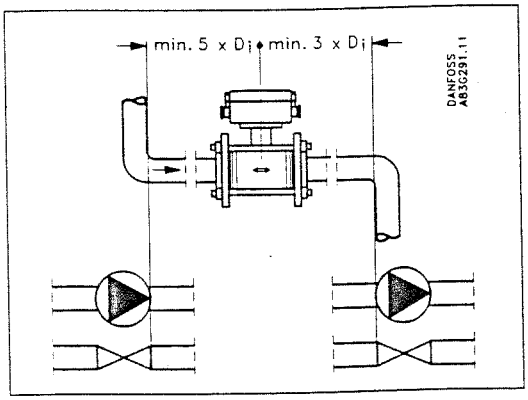
Installation in vertical pipes
Recommended direction of flow: upwards.
This minimizes the effect gas/air bubbles in the liquid have on the measurement.



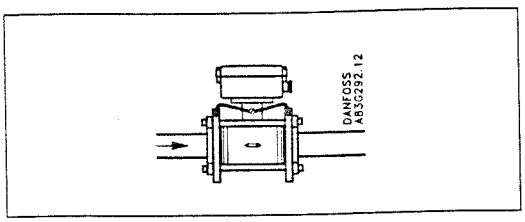
Installation in horizontal pipes
The flowmeter and terminal box must be mounted as shown in the top figure. In respect of electrode location, the meter must not be mounted as shown in the bottom figure.



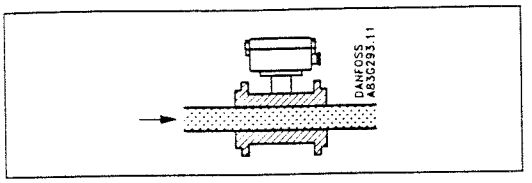
Measuring abrasive liquids and liquids containing particles
To minimise wear and deposits, the recommendation is installation in a vertical/inclined pipe.



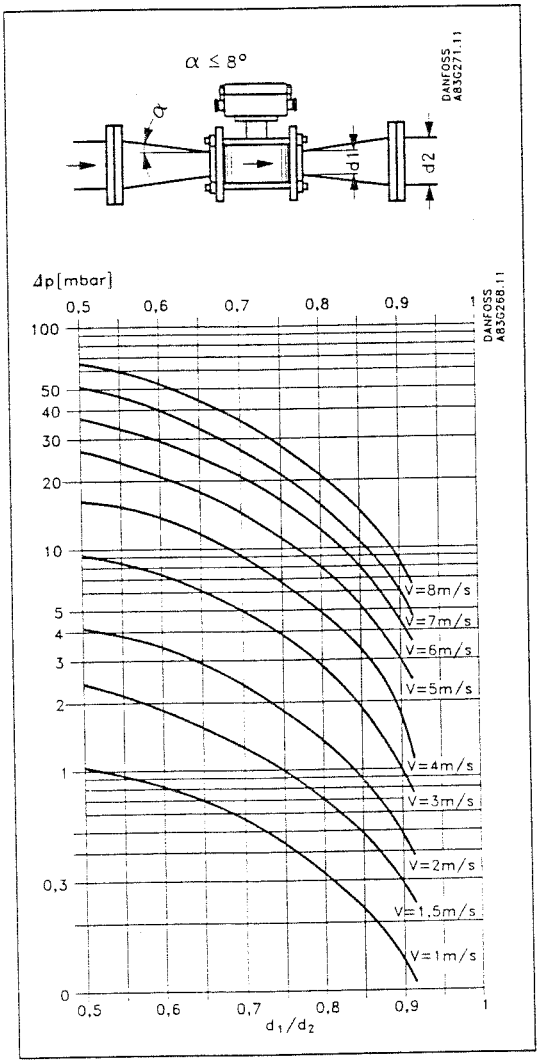
Inlet and outlet conditions
To obtain accurate flow measurement it is necessary to have straight lengths of inlet and outlet pipes, and a certain distance between meter, pump and valves.
It is also important to centre the flowmeter in relation to pipe flanges and gaskets.



Potential equalization
The electrical potential of the liquid must **always** be equal to the electrical potential of the sensor. This can be ensured in different ways, depending on the application. See "Installation".

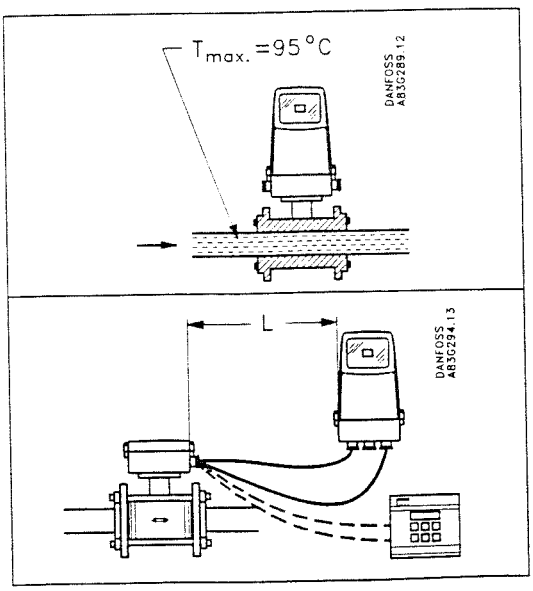


Vacuum
Avoid vacuum in the measuring pipe as this can damage certain types of liners. See "Technical data", section 9.



Installation in large pipes
The flowmeter may also be installed between two reducers (e.g. DIN 28545), assuming that $\alpha \leq 8°$ applies to the pressure drop graph below. The graph applies to water.

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



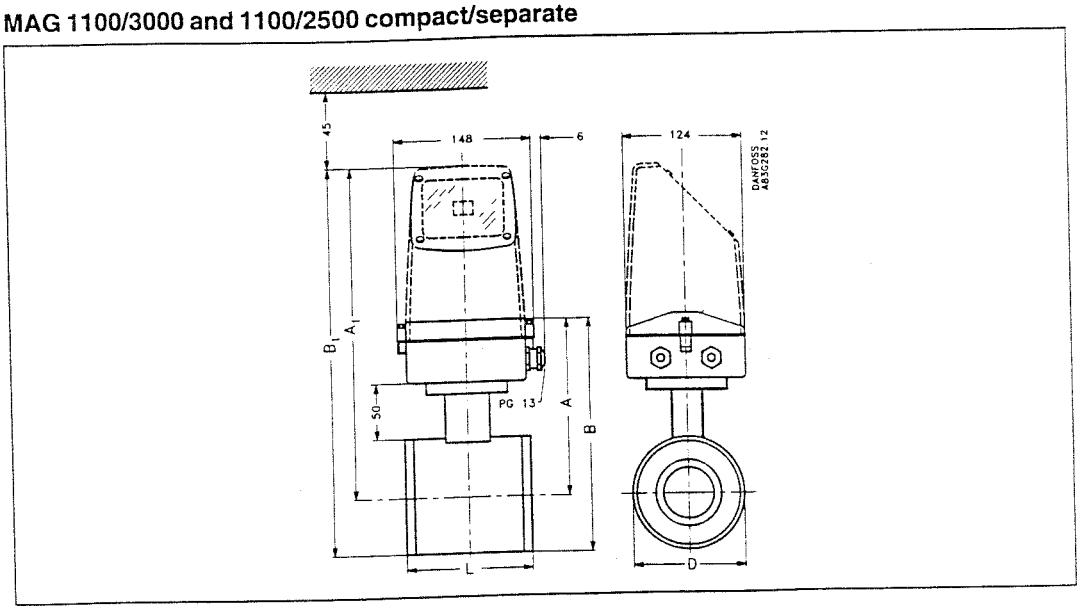
Compact/separate installation
The sensor and signal converter can be installed either compact or separate.

With **compact** installation, the temperature of the medium must be limited to max. 95 °C.

With **separate** installation, the cable length and type described under "Technical data" sensor, section 9 must be used.

1
mensions and weights,
AG 1100

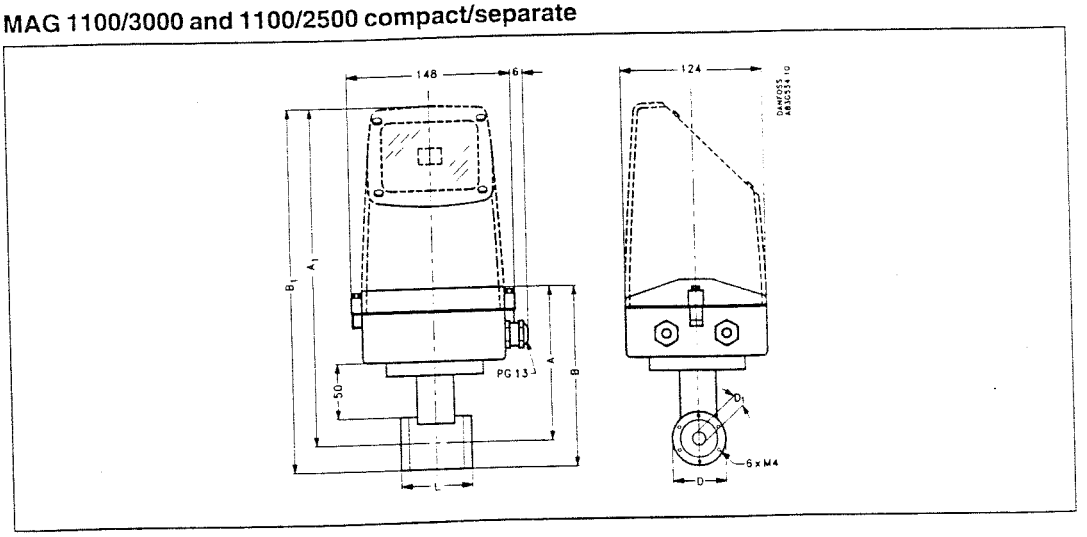
MAG 1100/3000 and 1100/2500 compact/separate



DN	L [1] [mm]	A [mm]	B [mm]	A_1 [mm]	B_1 [mm]	D [mm]	Weight [2] [kg]
15	66	143	167	299	323	49	2.2
25	81	151	183	307	339	64	2.7
40	96	161	203	317	359	84	3.4
50	106	170	221	326	377	102	4.2
80	156	186	252	342	408	133	7.0
100	186	199	278	355	434	159	10.0

[1]) Inclusive of 3 mm graphite gasket. Teflon gaskets further increase the installation length by 2 × 2 mm. Earthing flanges increase the length by 7 mm.
[2]) With MAG 3000 signal converter mounted: Weight is increased by 2 kg.

MAG 1100/3000 and 1100/2500 compact/separate



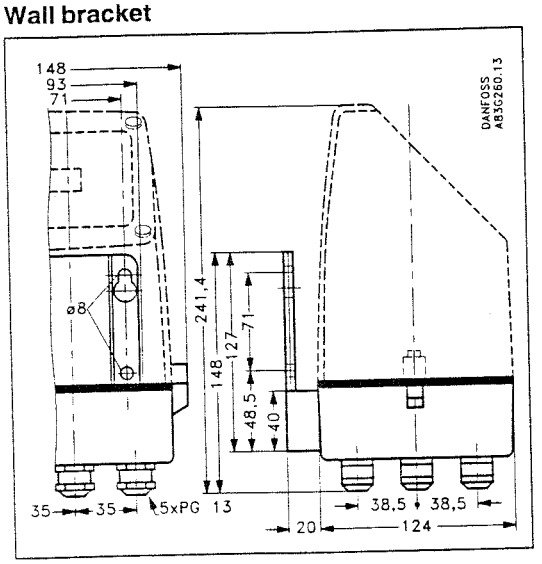
DN	Di [mm]	A [mm]	B [mm]	A_1 [mm]	B_1 [mm]	D [mm]	Weight [kg]
6	6	143	167	299	323	49	2.1
10	10	143	167	299	323	49	2.1

The total built-in length depends on the gasket selected:

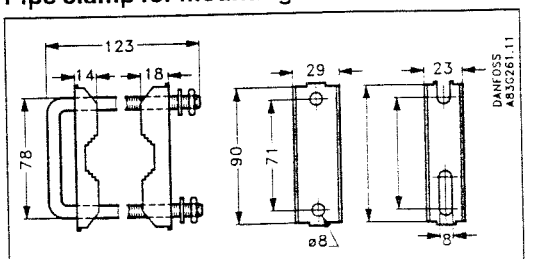
	GRAFITE	EPDM	PTFE	Without gasket	Earthing ring
L [mm]	66	64	70	64	77

The MAG 1100 sensor can also be used with the MAG 2500/3000 signal converter compact-installed (shown by the dashed line on the dimensional sketch).

Wall bracket

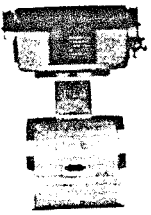


Pipe clamp for mounting wall bracket

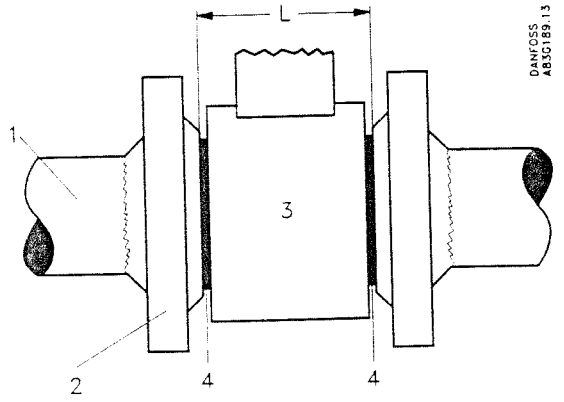


For pipe diameters 24 to 60 mm

3.2 Installation, MAG 1100



Sensor MAG 1100 must be mounted between two flanges. The surface of the flanges must be parallel to and in line with each other. For installation dimensions, see section 3.1.

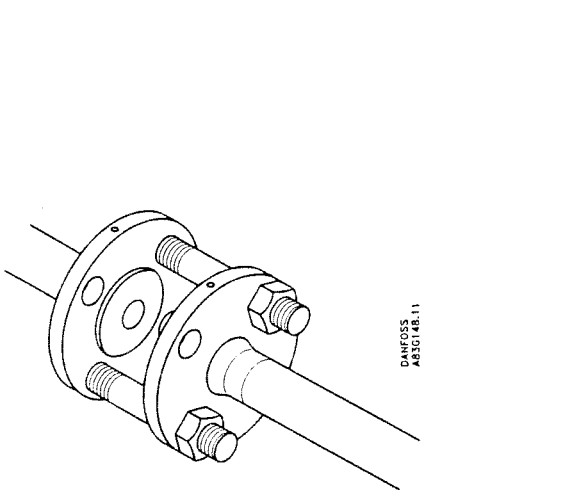


1. Existing pipe
2. Flange
3. Sensor
4. Gaskets

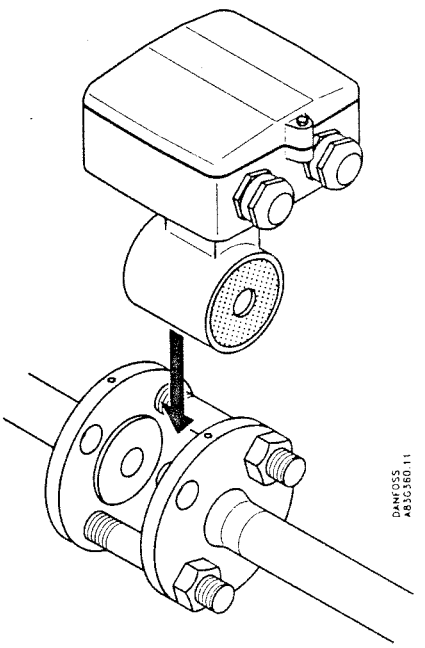
L. Sensor length incl. gaskets (3 mm)

The design of the MAG 1100 sensor allows for bi-directional flow.

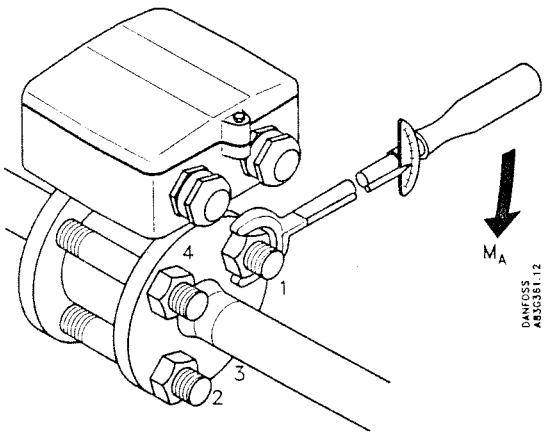
Length L is given in the tables, section 3.1. L is calculated taking into account standard 3 mm gaskets. If an earthing ring is built in, the dimension becomes L +10 mm.
Insert staybolts (as many as necessary for location purposes) and tighten gently, see **a.**. Make sure that gaskets fit exactly into their recess in each end of the sensor, see **b.**
The remaining staybolts can now be inserted and tightened gently using about 25% of the actual tightening torque. Cross-tighten the bolts with a torque wrench, in the order given at **c.**



a



b



c

d

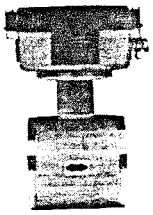
Dimension	M_A [Nm]
DN 15	16
DN 25	30
DN 40	65
DN 50	90
DN 80	90
DN 100	115

10 Nm ≈ 1 kpm

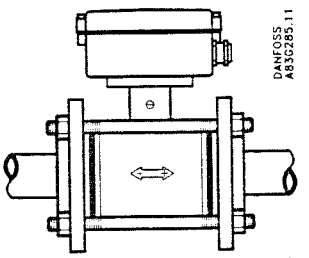
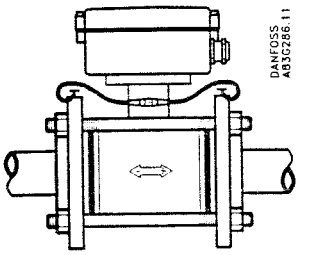
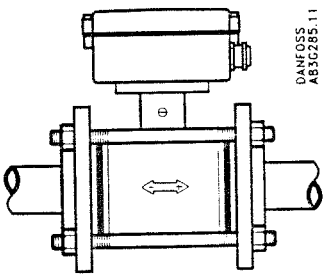
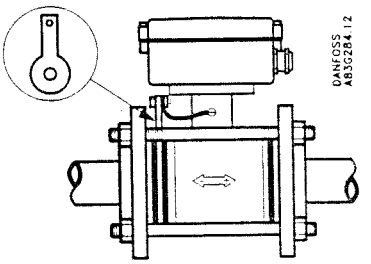
Tighten the bolts, first using up to 50% of max. tightening torque for the pipe dimension concerned. The max. tightening torques for different pipe sizes are given in table **d.** Now cross-tighten the bolts up to 75% torque, still in the sequence shown at **c.** Finally, tighten the bolts using 100% torque.

Note! To obtain optimum accuracy, it is important that the centrelines of sensor gaskets and flanges are aligned and that connecting flanges are perpendicular to the pipe.

Potential equalization, MAG 1100



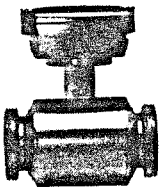
MAG 1100 is supplied with graphite gaskets.
PTFE gaskets are available as accessories, for use in the food industry for example.
To obtain optimum results from the measuring system, the sensor chassis point/housing must have the same electrical potential as the liquid being measured.
Depending on the type of gaskets selected (graphite or PTFE) and application, potential can be equalized as follows:

	Graphite gaskets	PTFE gaskets
Electrically conductive piping	 **A** Potential equalization with electrically conductive graphite gaskets	 **B** Potential equalization with cable supplied
Electrically non-conductive piping	 **C** Potential equalization with electrically conductive graphite gaskets	 **D** Potential equalization with separat earthing ring

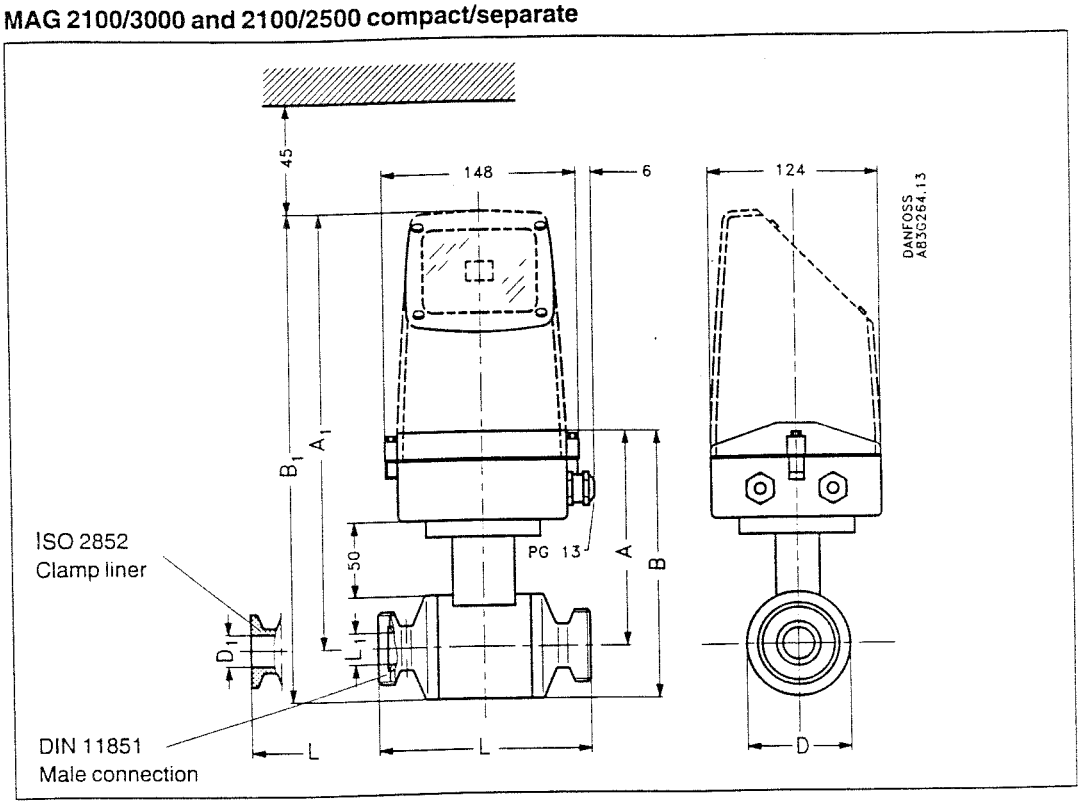
For earthing and gaskets (fig. D) see "Accessories".

Note! Special attention must be given to piping systems having cathodic protection. Please contact Danfoss.

Dimensions and weights, MAG 2100



MAG 2100/3000 and 2100/2500 compact/separate

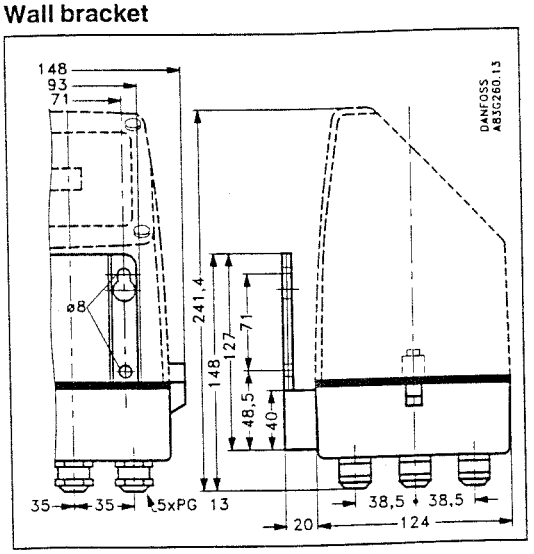


DN	DIN 11851		ISO 2852		A	B	A_1	B_1	D	Weight *)
	D_1 [mm]	L [mm]	D_1 [mm]	L [mm]	[mm]	[mm]	[mm]	[mm]		[kg]
25	26	130.4	22.6	108.4	157	195	314	352	76	3.0
40	38	150.6	35.6	131.3	161	203	318	360	84	3.0
50	50	162.9	48.6	145.7	170	221	327	378	102	3.5
65	66	191.7	60.3	175.3	179	239	336	396	120	5.0
80	81	225.7	72.9	196.3	186	252	343	409	133	6.0

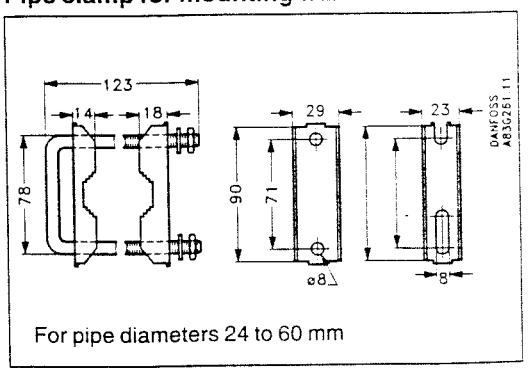
Standard ISO/DIN gaskets are used.

*) When MAG 3000 signal converter is used: Weight increases by 2 kg

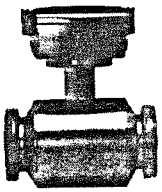
Wall bracket



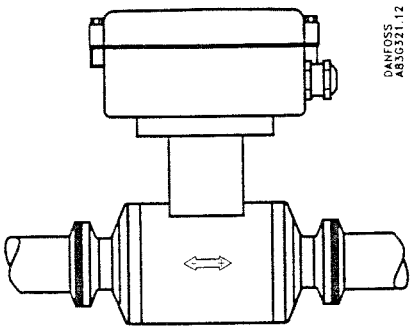
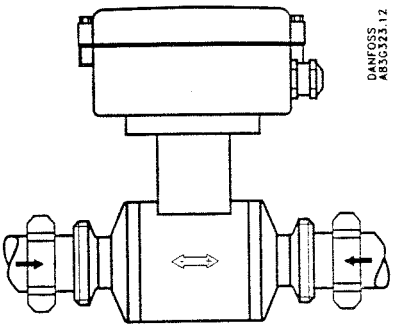
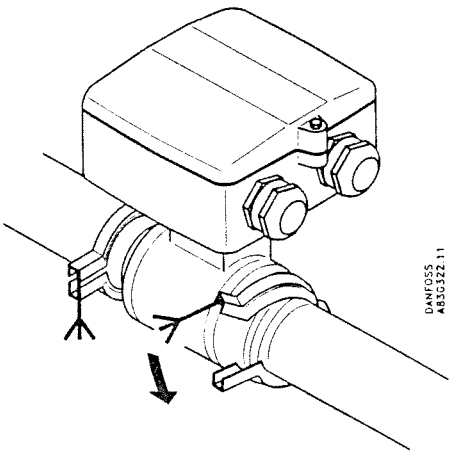
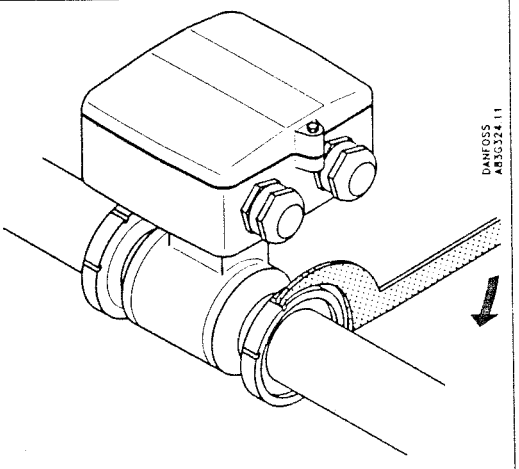
Pipe clamp for mounting wall bracket



Installation, MAG 2100

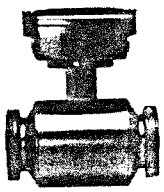


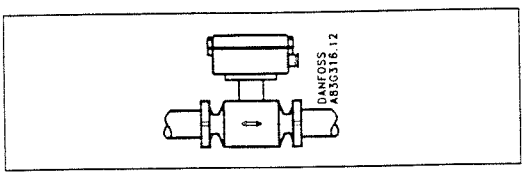
Sensor MAG 2100 must be mounted between standard ISO clamp 2852 or DIN 11851 hygienic couplings.
Standard gaskets in accordance with ISO clamps or DIN 11851 coupling standards must be used.

ISO 2852 clamp	DIN 11851 hygienic coupling
 Mounting	 Mountning
 The clamping rings must be located, closed and tightened.	 Hygienic couplings must be tightened using a special spanner.

Note! To obtain optimum accuracy and hygienic conditions, it is important that sensor and pipe centrelines are correctly aligned and that connecting fittings are perpendicular to the pipe.

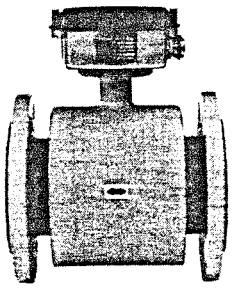
4.3 Potential equalization, MAG 2100



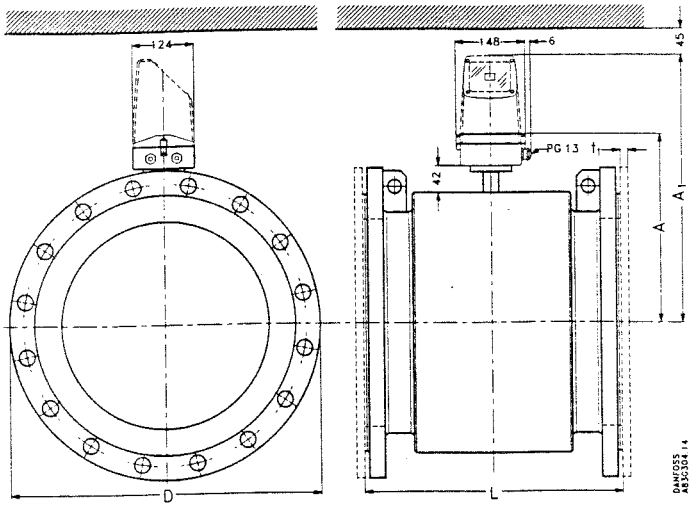


The sensor must be installed between two fittings/clamps.
Potential equalization with the liquid occurs automatically via these connections.

Dimensions and weights, MAG 3100



MAG 3100/3000 and 3100/2500 compact/separate



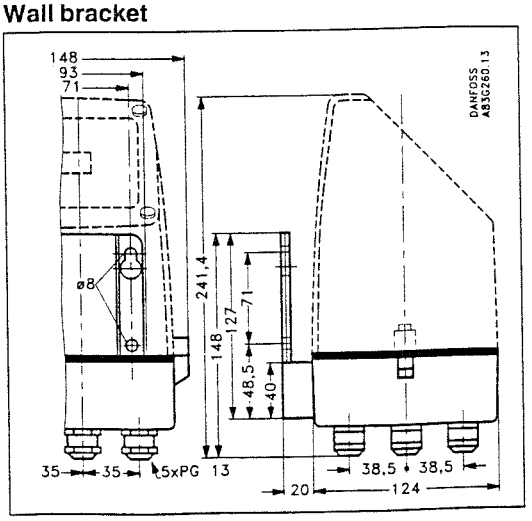
For liquid temperature > 120 °C (PTFE liner) the sensor is supplied with type E protection flanges.
L is thus increased by $2 \times t_1$.
For type E see fig. under "Ordering, Earthing/protection flanges" in the data sheet.

DN	DIN 2501				ANSI				Witout MAG 3000/2500	With MAG 3000/2500	Weight [1]
	PN 16		PN 40		150 lb		300 lb		A	A_1	
[mm]	L [2]	D	L [2]	D	L [2]	D	L [1]	D	[mm]	[mm]	[kg]
15			200	95	200	89	200	95	162	319	5
25			200	115	200	108	200	124	162	319	6
40			200	150	200	127	200	155	172	329	8
50			200	165	200	152	200	165	172	329	13
65	200	185	200	185	200	178	272	191	180	337	14
80	200	200	272	200	272	191	272	210	185	342	15
100	250	220	280	235	280	229	310	254	203	360	20
125	275	250	300	270	300	254	335	279	223	380	25
150	300	285	325	300	325	279	370	318	238	395	30
200	350	340	350	375	350	343	410	381	263	420	50
250	450	405	450	450	450	406	500	445	297	454	70
300	500	460	500	515	500	483	550	521	314	471	80
350	500	520	550	580	550	533	590	584	334	491	110
400	500	580	550	660	550	597	590	648	358	515	125
450	560	640	600	685	600	635	640	711	389	546	175
500	625	715	680	755	680	699	730	775	414	571	200
600	750	840	750	890	820	813	860	914	464	621	300
700	875	910							561	718	350
800	1000	1025							612	769	475
900	1125	1125							662	819	560
1000	1250	1255							713	870	700
1200	1500	1485							814	971	1250

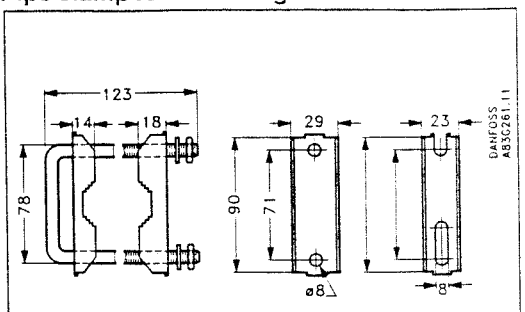
All flange dimensions to DIN 2501 or ANSI B16.5

[1]) With MAG 3000/2500 signal converter mounted: Weight is increased by 2 kg.
[2]) If earthing flanges are used, the thickness of the earthing flange and gasket must be added to the length.

Wall bracket

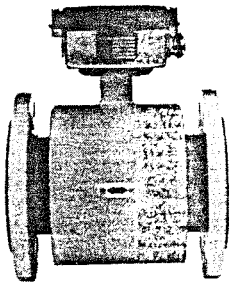


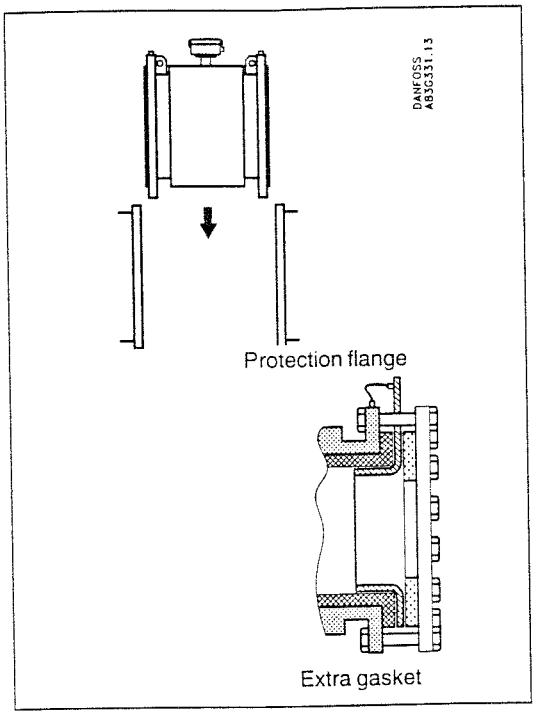
Pipe clamp for mounting wall bracket



For pipe diameters 24 to 60 mm

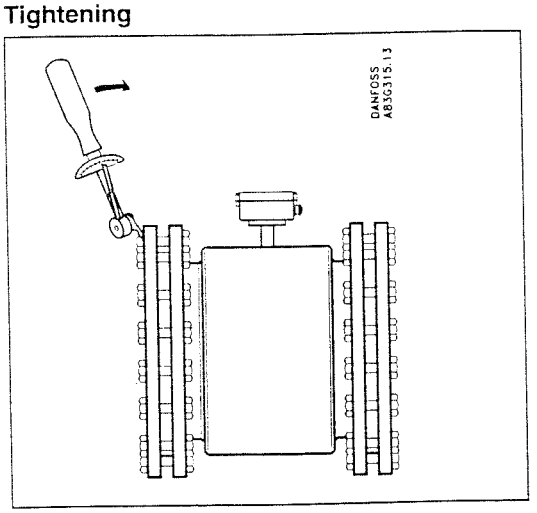
Installation, MAG 3100





The sensor must be mounted between two flanges. Gaskets are only necessary when the flowmeter is ordered with earthing/protection flanges, i.e. the liner is normally used in place of gaskets.

Tightening

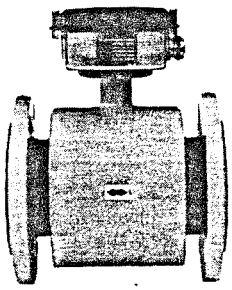


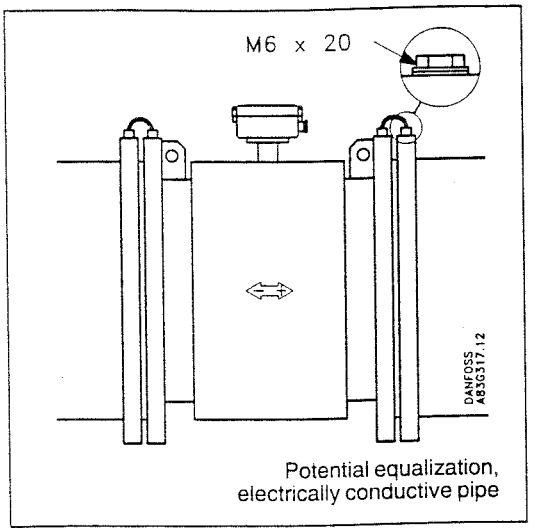
Standard bolts must be well lubricated and tightened evenly around the gasket. Leakage/damage to the flowmeter or piping can occur if bolts are over-tightened.

Nominal size	Tightening torque M_A [Nm]	
	PN 16	
	PTFE liner	Other liners
50	40	
65	40	30
80	40	30
100	40	30
125	60	40
150	70	50
200	70	55
250	100	80
300	145	110
350	160	125
400	180	140
450	190	150
500	195	150
600	250	180
700		180
800		190
900		190
1000		200
1200		200

Note! To ensure optimum accuracy it is important that the sensor and pipe centrelines are correctly aligned and that flanges are perpendicular to the pipe.

5.3 Earthing and potential equalization, MAG 3100

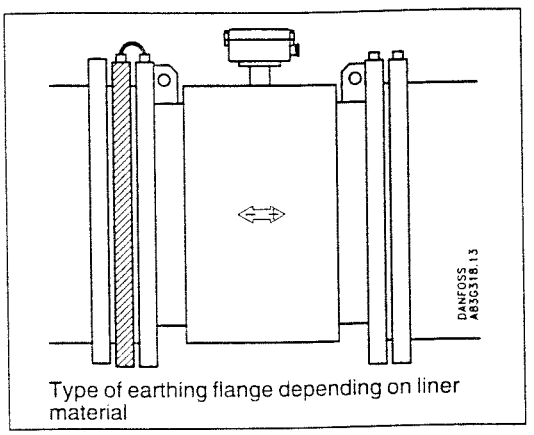




Potential equalization, electrically conductive pipe

To obtain optimum results from the measuring system, the chassis point/housing must have the same electrical potential as the liquid being measured. The method depends on the individual application:

1. Electrically conductive piping
The set of potential equalising cables supplied can be used as shown.



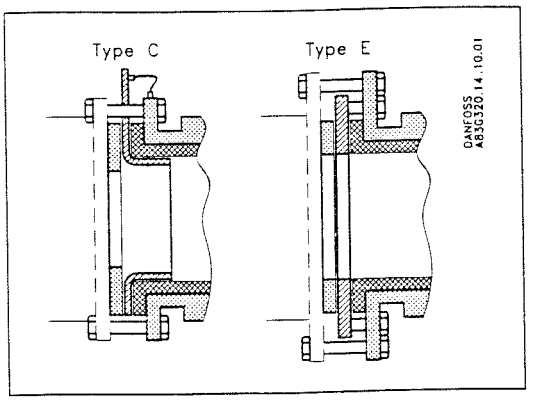
Type of earthing flange depending on liner material

2. Non-conductive piping
The earthing flange can be placed between flowmeter and pipe flanges. The selection of earthing flange will depend on the medium, liner material and application, see figure.

Liner material	Suitable earthing flanges
All, except PTFE PTFE and PU	Type C
PTFE and PU	Type E

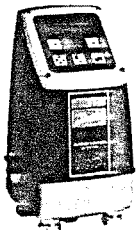
3. Cathodic protected piping
Special attention must be given to systems with cathodic protection. Please contact Danfoss.

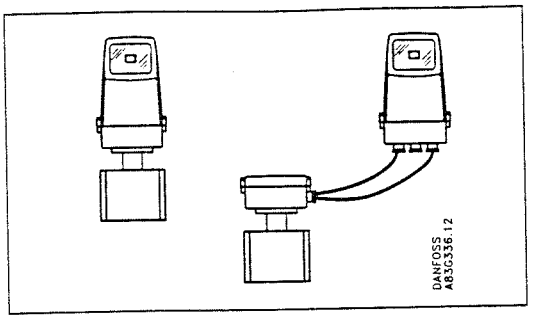
5.4 Inlet protection, MAG 3100



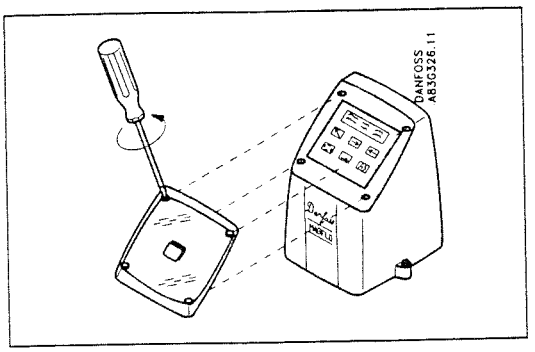
With abrasive liquids the use of flowmeter inlet protection may be necessary. Here, type C and E earthing flanges are used.
Type C must be clamped between flanges.
Type E must be screwed on the flowmeter.

Signal converter IP 67 version

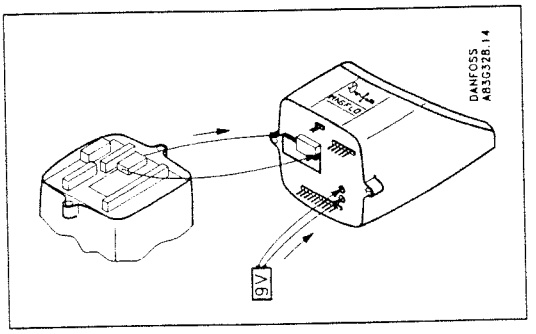




The IP 67 version signal converter can be installed indoors or outdoors.
The ambient temperature must lie between –20 and 50 °C. The signal converter must not be exposed to direct sunlight. Use a shield if necessary.

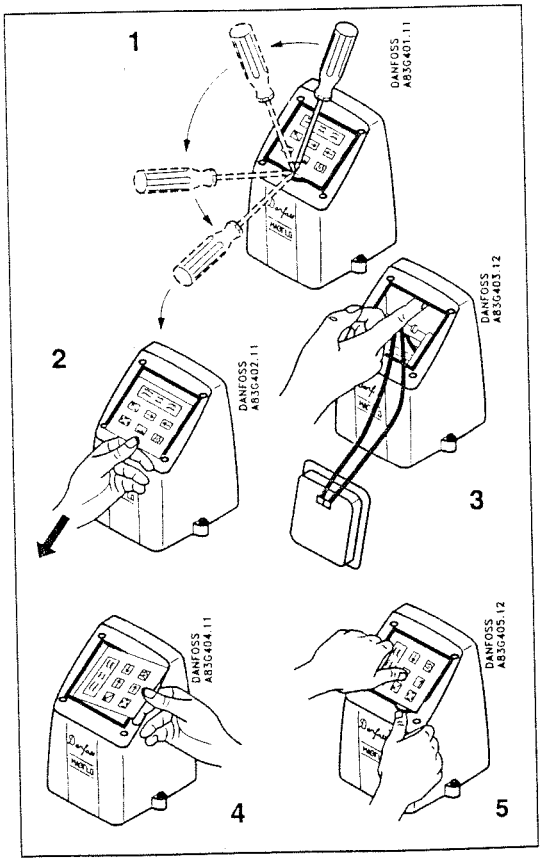


Removal of display window
All signal converter measuring rates can be read by pressing the rubber button on the display window. When setting the converter or turning the control panel the display window must be removed.



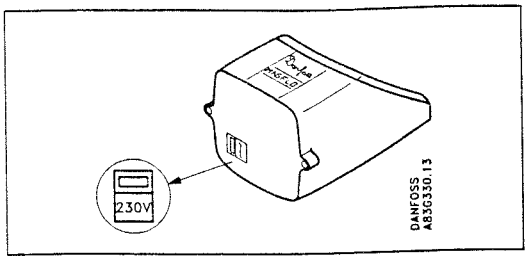
Setting prior to installation
By using a 9 V alkaline battery the flowmeter can be set before final installation. This is especially advantageous if the flowmeter is to be installed before the system is put into operation.

1. Place the SENSORPROM™ from the terminal box under the signal converter as shown.
2. To protect the pins, place the signal converter in the packaging base supplied.
3. Set the signal converter as described under "Commissioning" section 8. SENSORPROM™ is now programmed with the required settings.
4. Remove the battery and replace SENSORPROM™ in the terminal box. The flowmeter is now ready for operation.



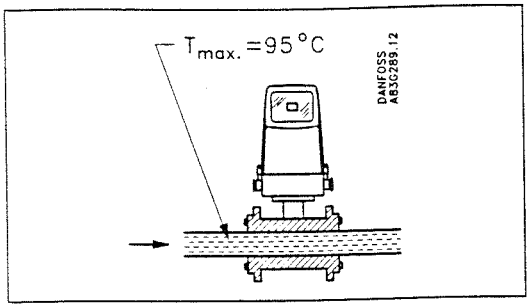
Turning the control pad

1. Insert a screwdriver under the lower edge of the control pad.
2. Withdraw the control pad.
3. Check to ensure that the gasket is seated correctly.
4. Turn the control pad. The top edge must always be inserted first. Press the pad well down into the gasket recess.
5. Now, with thumb pressure, ease the gasket edge over the control pad while pressing lightly on the centre of the pad.

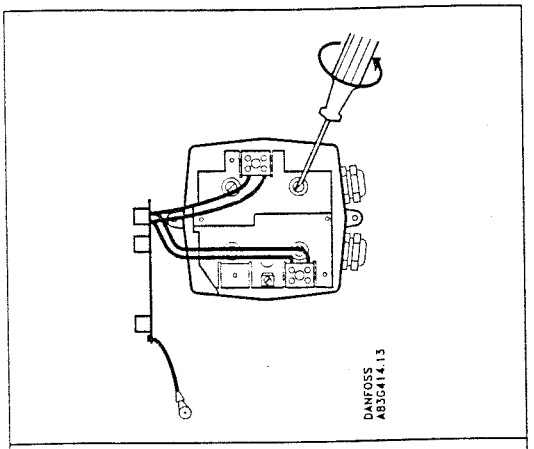


Setting the supply voltage
The mains voltage switch 115/230 V a.c. is located in the base of the signal converter.

6.1.1 Compact installation



With **compact** installation the temperature of the medium must not exceed 95 °C.



1. Remove and discard terminal box lid.

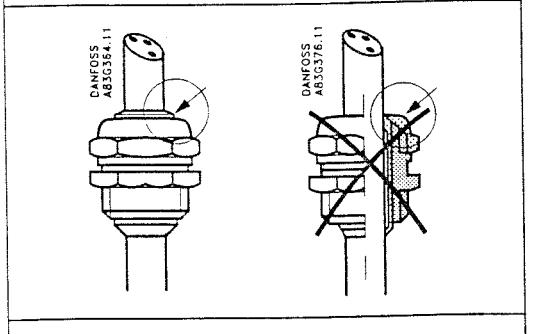
2. Turning the terminal box.
   Lift the plate with terminal boards to one side to give access to the screws. Remove the two diametrically opposed screws and loosen the remaining two. Turn the terminal box to the required position and retighten the screws.

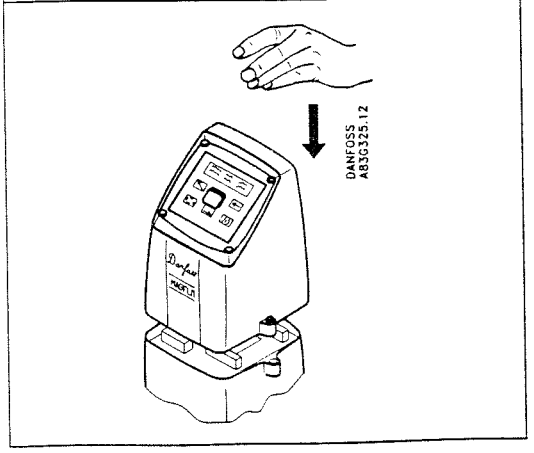
   Warning: If all four screws are removed at the same time there is a risk of damaging the leads to the sensor.

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

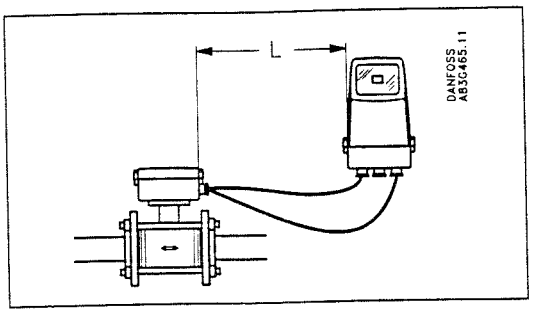
4. Tighten the screwed cable entries to obtain optimum sealing. The gaskets must swell out along the cable.

5. Mount the signal converter on the terminal box.



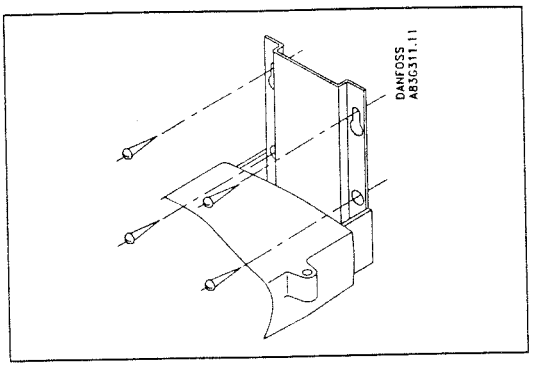


6.2 Separate installation

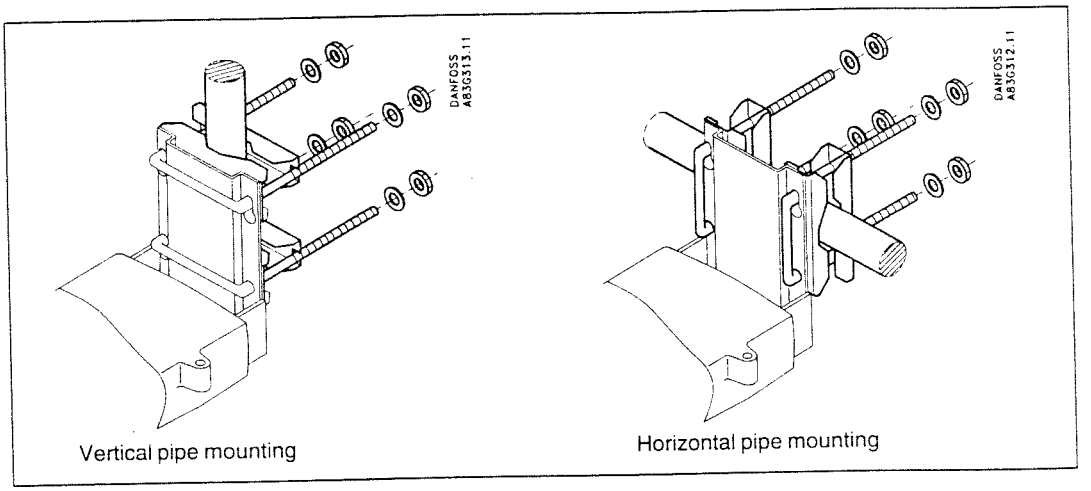


With **separate** installation, the distance between sensor and signal converter must not exceed the length specified under "Technical data", sensor, section 9.

Applicable to MAG 3000 only:
If the flowmeter must be able to detect "empty pipe", the cable supplied cannot be used. A special cable must be used instead.

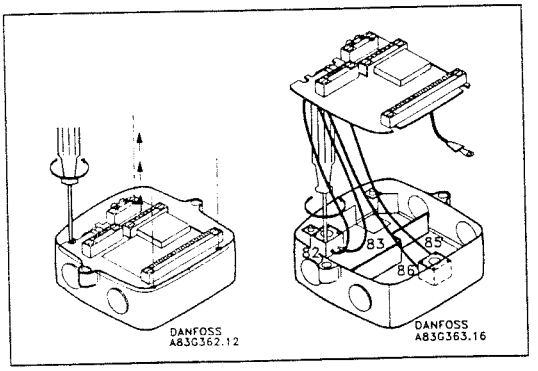


1. Mount wall bracket.

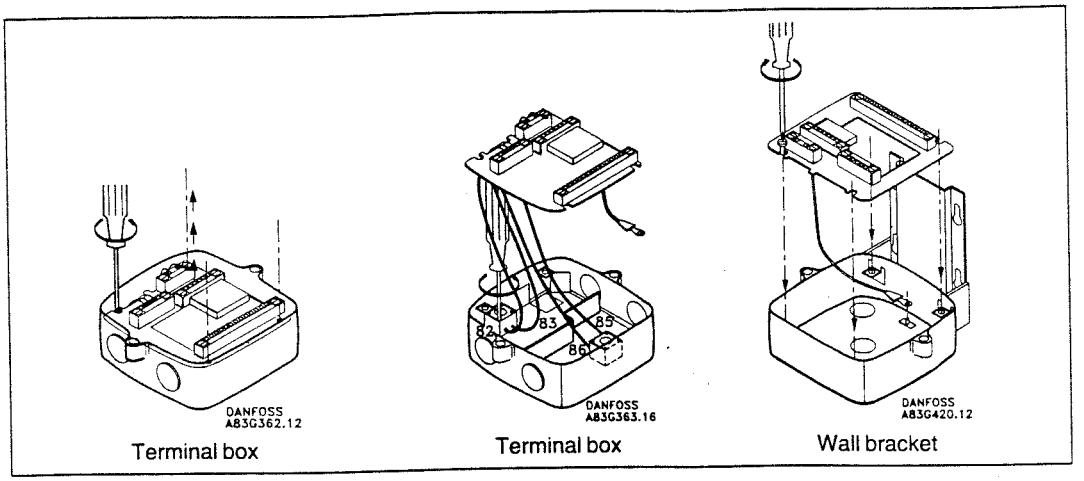


Vertical pipe mounting

Horizontal pipe mounting

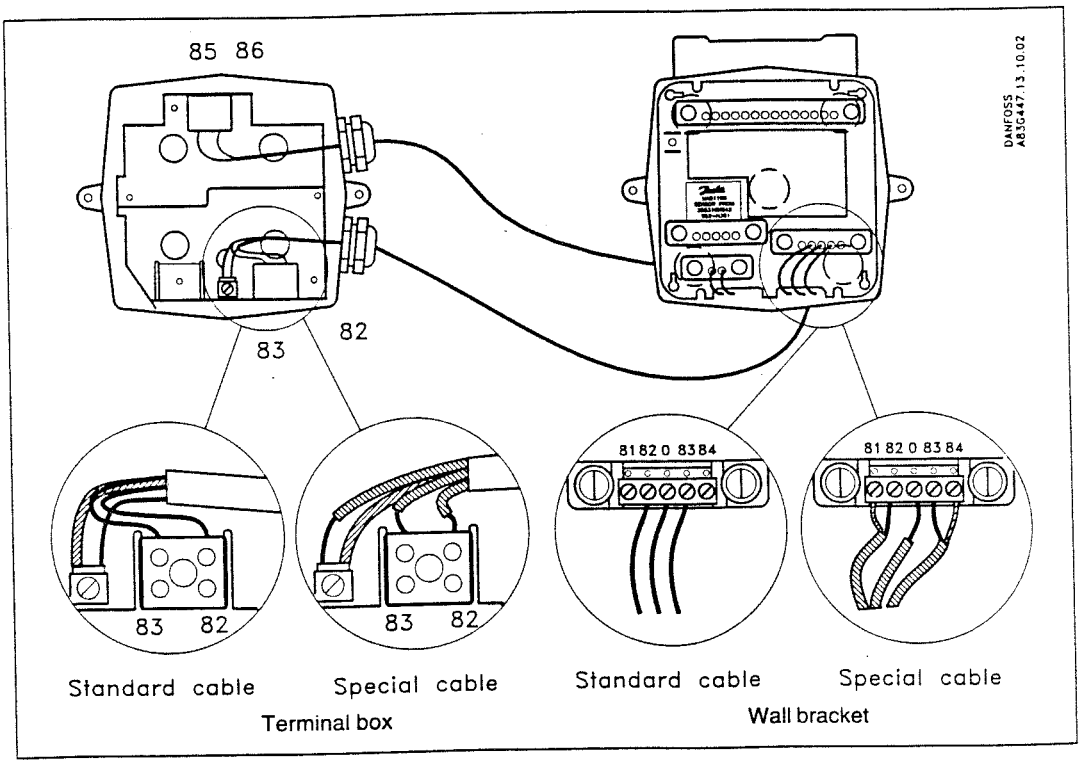


Move the plate with terminal boards to the wall bracket. Remove and discard the leads to the sensor itself. Earth leads are reused in the wall bracket.



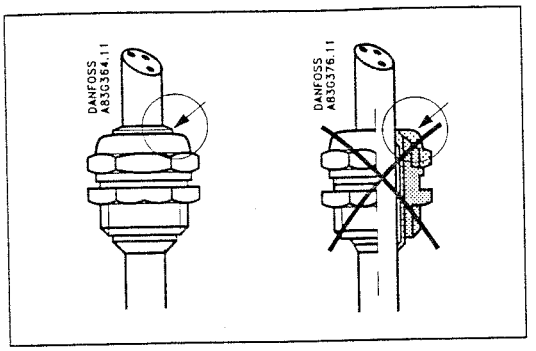
Terminal box Terminal box Wall bracket

2. Release the earth lead from the bottom of the terminal box.
   Remove and discard the other leads connecting the terminal box to the plate carrying the terminal boards.
   Move the plate to the wall bracket and fit the each lead in the base of the wall bracket.

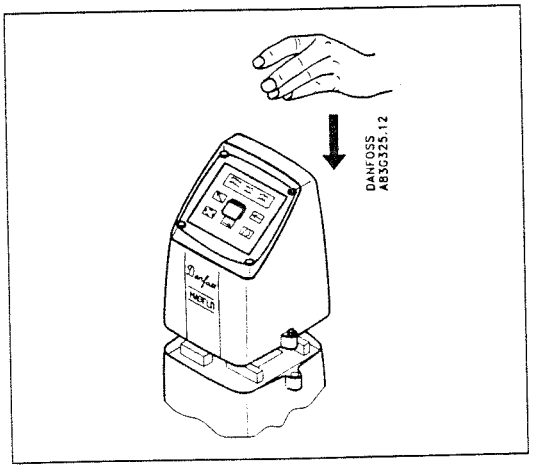


3. **Terminal box:** Place the cables in the screening duct as shown. To prevent noise problems, cables must not protrude over the edge of the duct. Unscreened cable ends must be as short as possible.
   Wall bracket: Always use the cable entry nearest the associated terminal so that unscreened lead ends from one cable do not cross those from the other cable.

   Normally the outer screen of the electrode cable remains unconnected, but in installations with strong electrical noise fields the noise immunity of the flowmeter can be further improved by connecting a capacitor of 1.5 µF between the cable screen and the each screw on the plate with terminal boards.
   If special cable is used, connect the inner screens to terminals 81 and 84.

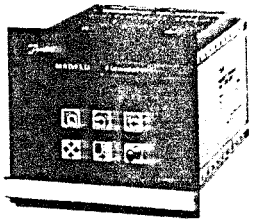


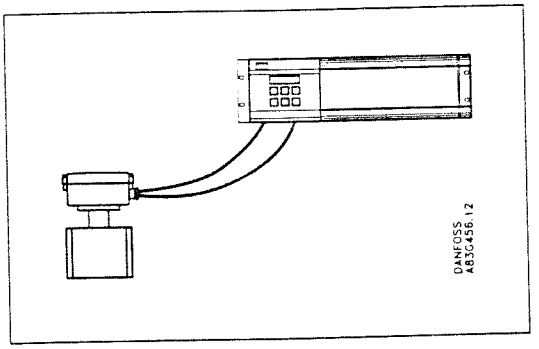
4. Tighten the cable entries to obtain optimum sealing. The gaskets must swell out along the cable.



5. Mount the signal converter on the wall bracket.

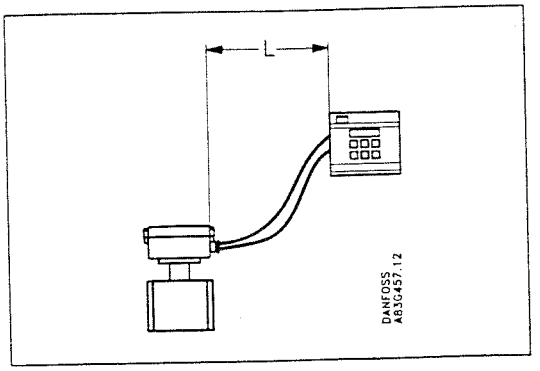
6.2 Signal convener IP 00 version





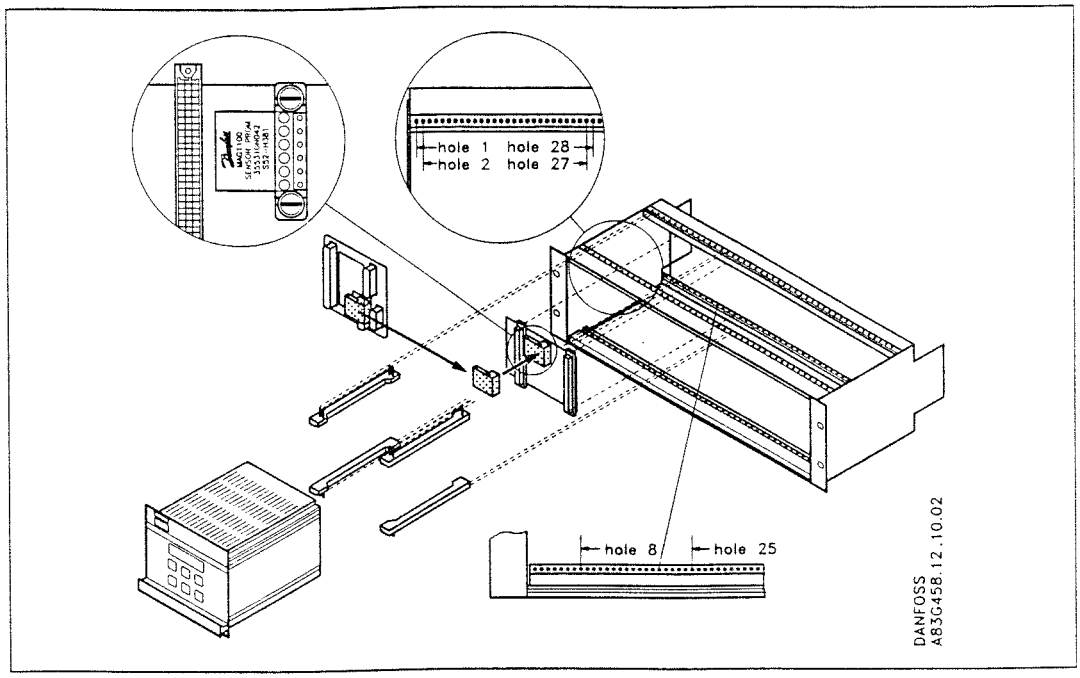
The signal converter is designed as a standard 19" insert for a 19" rack system, DIN 41494. The insert has a width of 28 TE (142 mm), a height of 3 HE (128 mm) and a module depth of 160 mm.

6.2.1 Installation

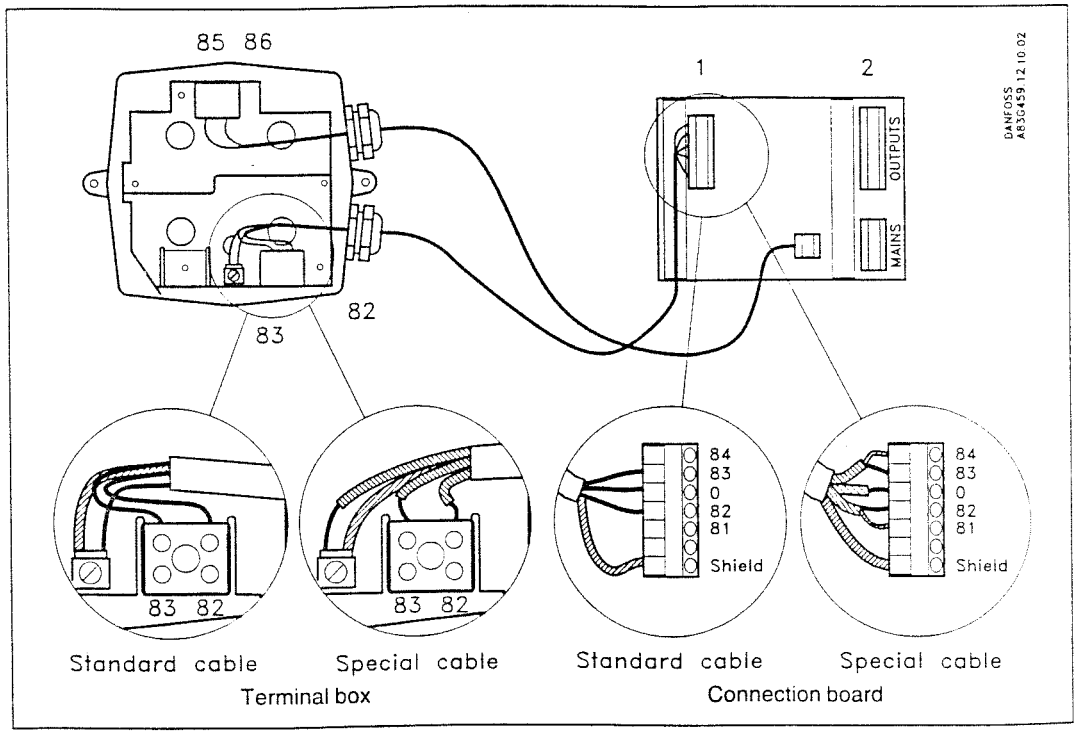


The distance between sensor and signal converter must not exceed the length specified under "Technical data", sensor, section 9.

Applicable to MAG 3000 only:
If the flowmeter must be able to detect "empty pipe", the cable supplied cannot be used. A special cable must be used instead. which is available as accessory.



1. Remove the SENSORPROM™ from the plate with terminal boards in the sensor and place it on the connection board supplied.
2. Mount the connection board and slide rails in the rack system as shown.
3. Insert the signal converter in the rack system.

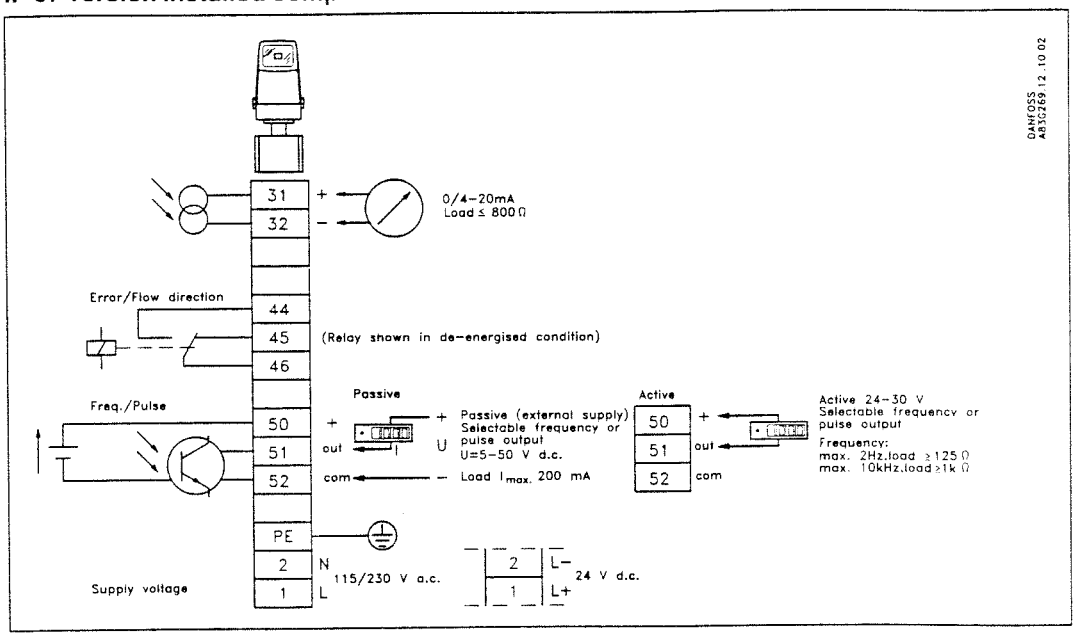


4. Connect the cables as shown under "Electrical connection", section 7.

Terminal box: Place the cables in the screening duct as shown. To prevent noise problems, cables must not protrude over the edge of the duct.
Unscreened cable ends must be as short as possible.
When special cable is used, the inner screens must remain unconnected.

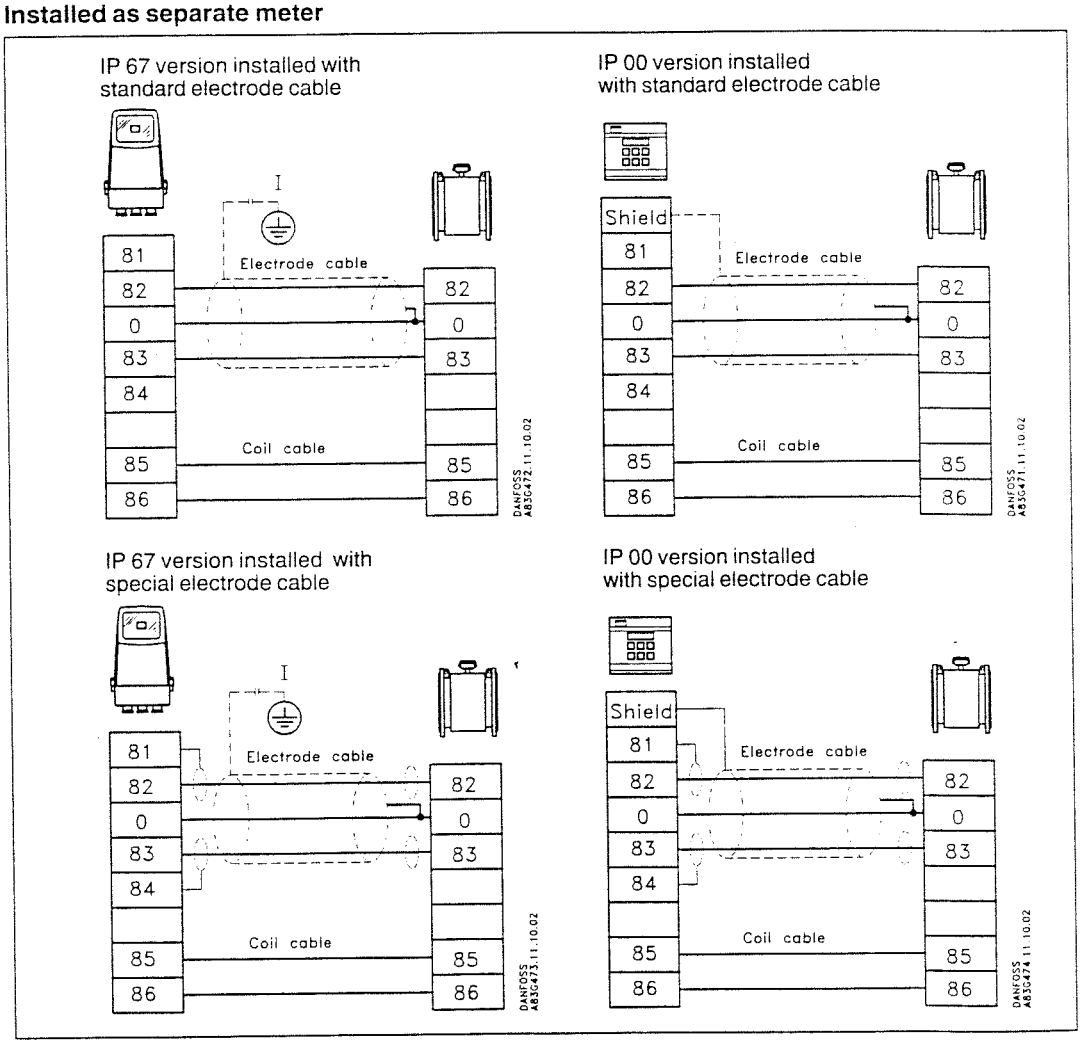
Connection board: Unscreened cable ends must be as short as possible and the two cables must be kept separate. Cables must be in one length and must not be taken to a distribution box or similar. The outer screen of the electrode cable must be connected to the terminal marked "Shield".
If special cable is used, connect the inner screens to terminals 81 and 84.

IP 67 version installed compact



Cable cross-section max. 1.5 mm²

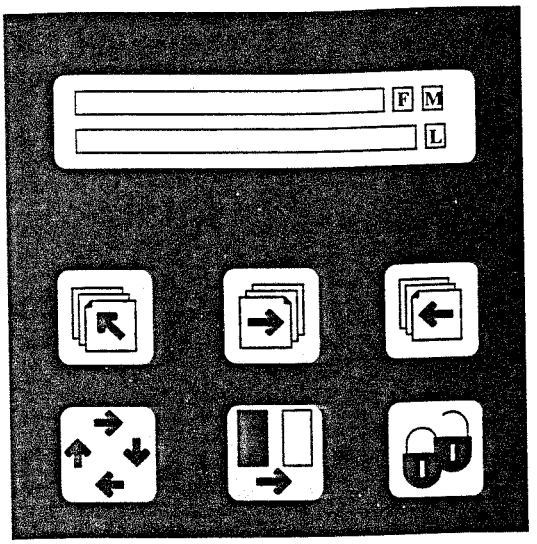
Installed as separate meter



I. 1.5 µF capacitor (code no. **612B2710**). Used only in areas with strong electrical noise fields.

All other connections as IP 67 version installed compact
For details of electrical data see "Technical data", section 9.

Keypad and display layout



Key functions:
returns **always** to the basic menu: **OPERATOR MENU**, irrespective of where you are in the menu structure

page backwards and forwards in menus

changes settings/figures

indicates the figure to be changed

unlocks for changing settings, locks new settings and gives access to submenus

The flowmeter is set via the control pad. Settings are stored both in the signal converter and SENSORPROM™.
The display is alphanumerical and indicates selected operating values and flowmeter settings.

Operation of any key illuminates the display background. It switches off automatically after 10 minutes of final key operation (MAG 3000 only).

Fields F, M, L are reserved for the following symbols:

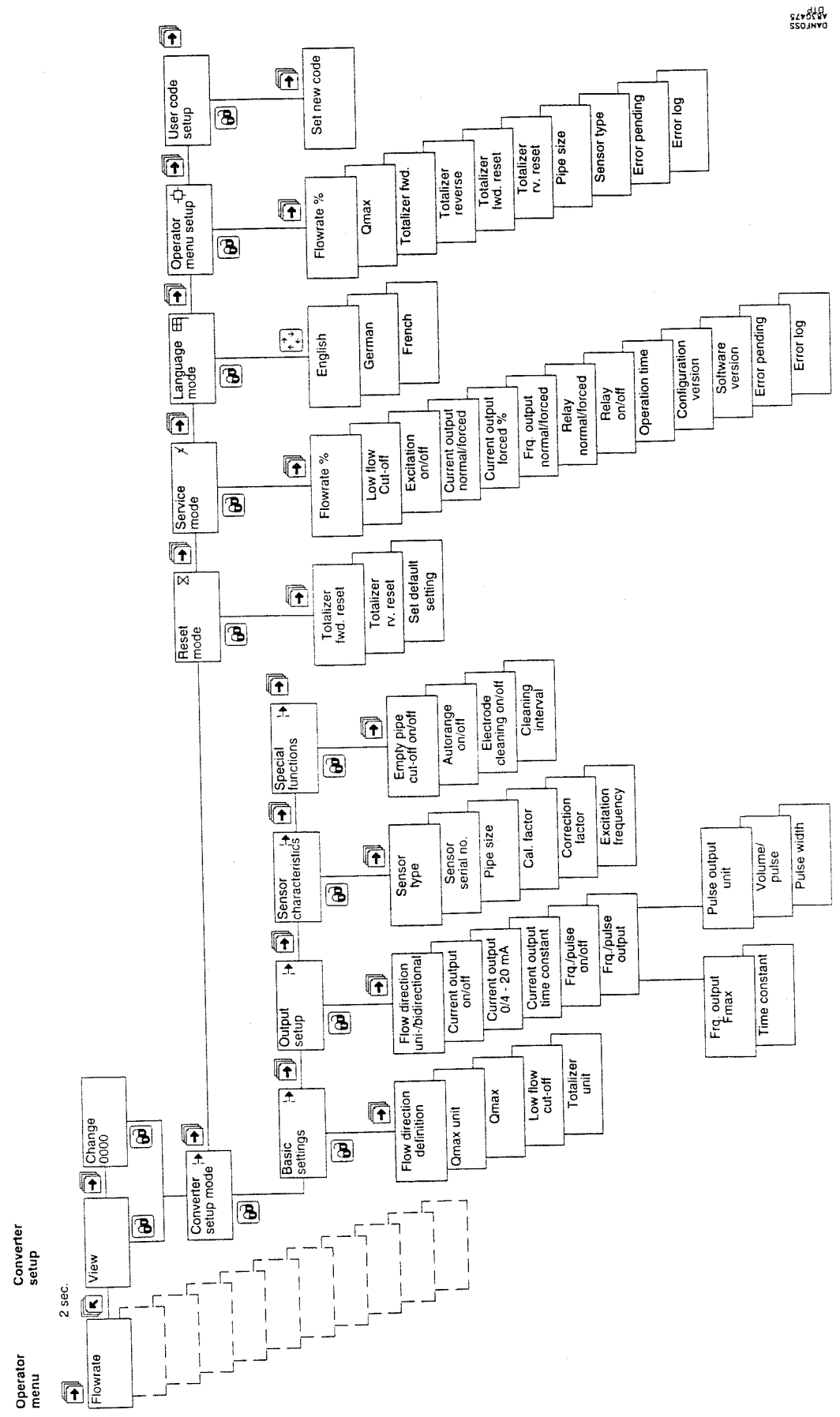
F: error indication by two flashing triangles

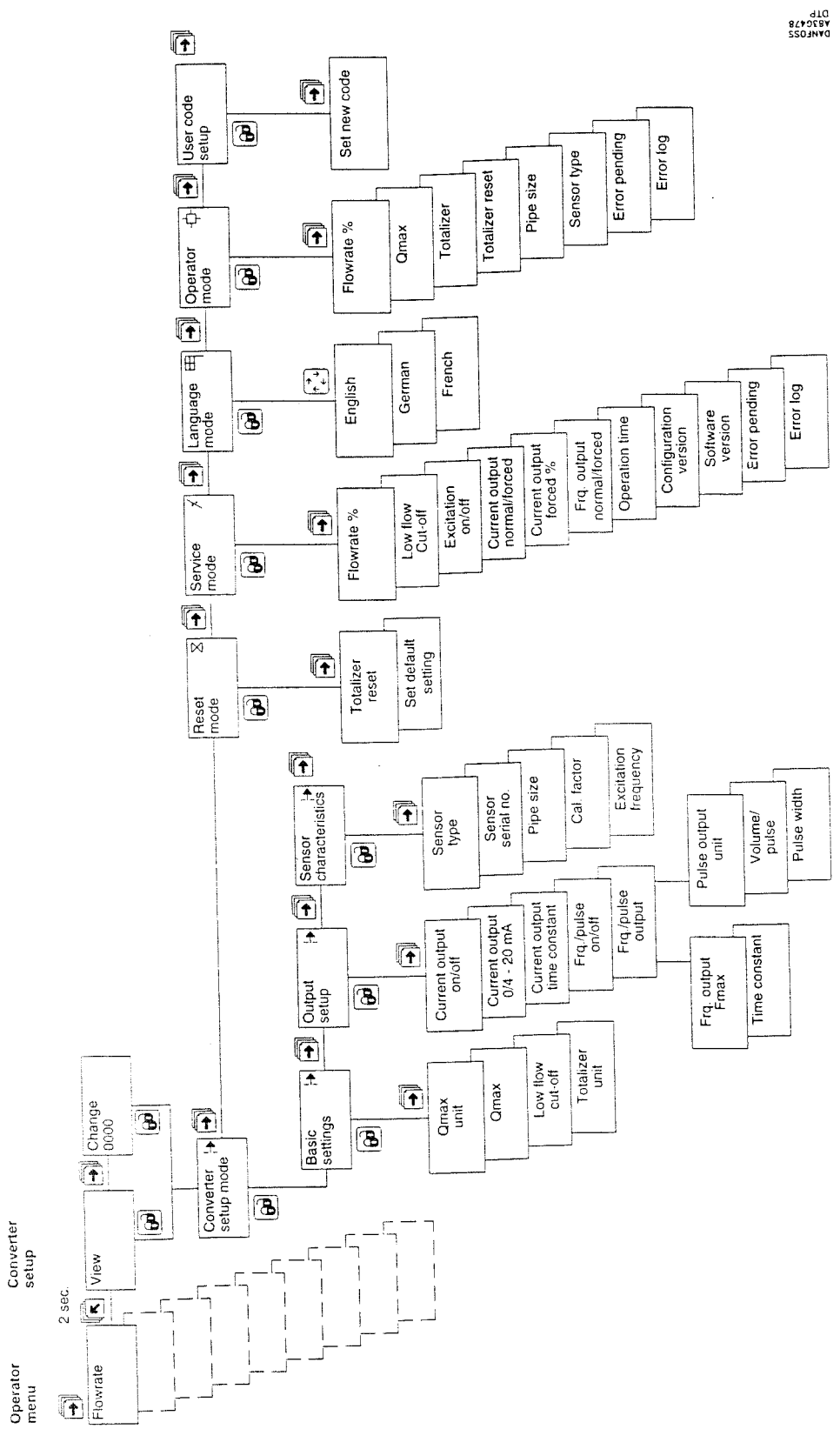
M:symbol to indicate actual main menu:

- RESET MENU
- SERVICE MODE
- LANGUAGE SETUP
- OPERATOR MENU SETUP

L. indicates key function by the following symbols:

- ready for change
- value locked
- access to submenu
- **RESET MODE:** Resetting of totalizer and own settings


MAG 3000
Operator menu
Converter setup
2 sec.
Flowrate
View
Change 0000
Converter setup mode
Basic settings
Flow direction definition
Qmax unit
Qmax
Low flow cut-off
Totalizer unit
Output setup
Flow direction uni-/bidirectional
Current output on/off
Current output 0/4 - 20 mA
Current output time constant
Frq./pulse on/off
Frq./pulse output
Pulse output unit
Volume/ pulse
Pulse width
Frq. output Fmax
Time constant
Sensor characteristics
Sensor type
Sensor serial no.
Pipe size
Cal. factor
Correction factor
Excitation frequency
Special functions
Empty pipe cut-off on/off
Autorange on/off
Electrode cleaning on/off
Cleaning interval
Reset mode
Totalizer fwd. reset
Totalizer rv. reset
Set default setting
Service mode
Flowrate %
Low flow Cut-off
Excitation on/off
Current output normal/forced
Current output forced %
Frq. output normal/forced
Relay normal/forced
Relay on/off
Operation time
Configuration version
Software version
Error pending
Error log
Language mode
English
German
French
Operator menu setup
Flowrate %
Qmax
Totalizer fwd.
Totalizer reverse
Totalizer fwd. reset
Totalizer rv. reset
Pipe size
Sensor type
Error pending
Error log
User code setup
Set new code
DANFOSS
AB.SC.475
DTP


MAG 2500
Operator menu
Converter setup
2 sec.
Flowrate
View
Change 0000
Converter setup mode
Basic settings
Qmax unit
Qmax
Low flow cut-off
Totalizer unit
Output setup
Current output on/off
Current output 0/4 - 20 mA
Current output time constant
Frq./pulse on/off
Frq./pulse output
Pulse output unit
Volume/ pulse
Pulse width
Frq. output Fmax
Time constant
Sensor characteristics
Sensor type
Sensor serial no
Pipe size
Cal. factor
Excitation frequency
Reset mode
Totalizer reset
Set default setting
Service mode
Flowrate %
Low flow Cut-off
Excitation on/off
Current output normal/forced
Current output forced %
Frq. output normal/forced
Operation time
Configuration version
Software version
Error pending
Error log
Language mode
English
German
French
Operator mode
Flowrate %
Qmax
Totalizer
Totalizer reset
Pipe size
Sensor type
Error pending
Error log
User code setup
Set new code
DANFOSS
A8304278
DTP

Me build-up

An overview of the menu structure is given on the two previous pages. The following pages contain more details information.

OPERATOR MENU

The signal converter always starts in the basic menu OPERATOR MENU at a certain FLOWRATE (actual flow).
The key can be used to page through menus under OPERATOR MENU.

VIEW

Only the preselected flowmeter settings can be scanned via VIEW.
Holding down the key for 2 seconds changes the display from OPERATOR MENU to VIEW.

CONVERTER SETUP

A user code (CODE) must be entered to change settings by moving forward from CHANGE to CONVERTER SETUP.
The user code is factory-set at 1000. The code can be entered using and . It can be changed via USER CODE SETUP.
This prevents settings being changed by unauthorised persons.

BASIC SETTINGS

Here, selection between direction of flow (MAG 3000 only), measuring range and totalizer unit can be made.

OUTPUT SETUP

The required output signals can be selected in OUTPUT SETUP.

SENSOR

SENSOR CHARACTERISTIC gives information on the sensor. This information is entered automatically from SENSORPROM™.

SPECIAL FUNCTIONS (MAG 3000 only)

Special functions can be selected here:

EMPTY PIPE CUT OFF:
The flowmeter shows zero when the measuring pipe is empty.

AUTORANGE:
The flowmeter contains automatic range changeover to ensure optimum dynamic range independent of selected measuring range.
To take account of reaction time, AUTORANGE should be deselected when measuring sequences are less than 0.8 seconds.

ELECTRODE CLEANING:
Control of electrochemical electrode cleaning unit.

RESET MODE

Totalizers can be reset in RESET MODE and menus can be reset on factory settings. When setting using a 9 V battery, totalizers do not become reset.

NOTE! USER CODE, CORRECTION FACTOR (MAG 3000) and LANGUAGE MODE do not return to the factory setting via RESET MODE.

VICE MODE

SERVICE MODE can be used when starting up or locating faults.
It provides the possibility of experimenting with settings and selecting forced outputs.
On leaving SERVICE MODE, all settings made in SERVICE MODE are cancelled.
See Chapter 8.7, Fault location.

LANGUAGE MODE

The menu language can be selected here.

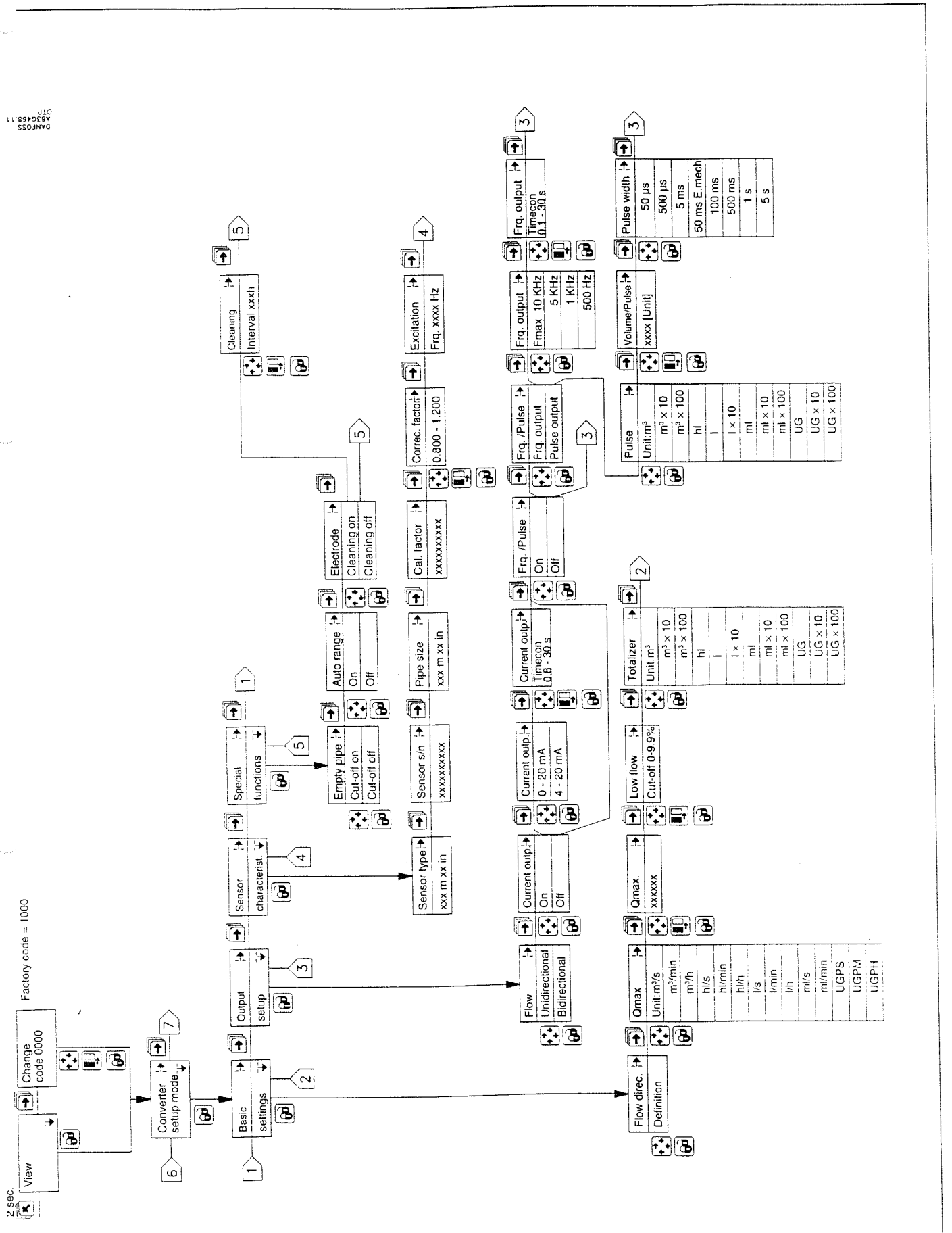
OPERATOR MENU SETUP

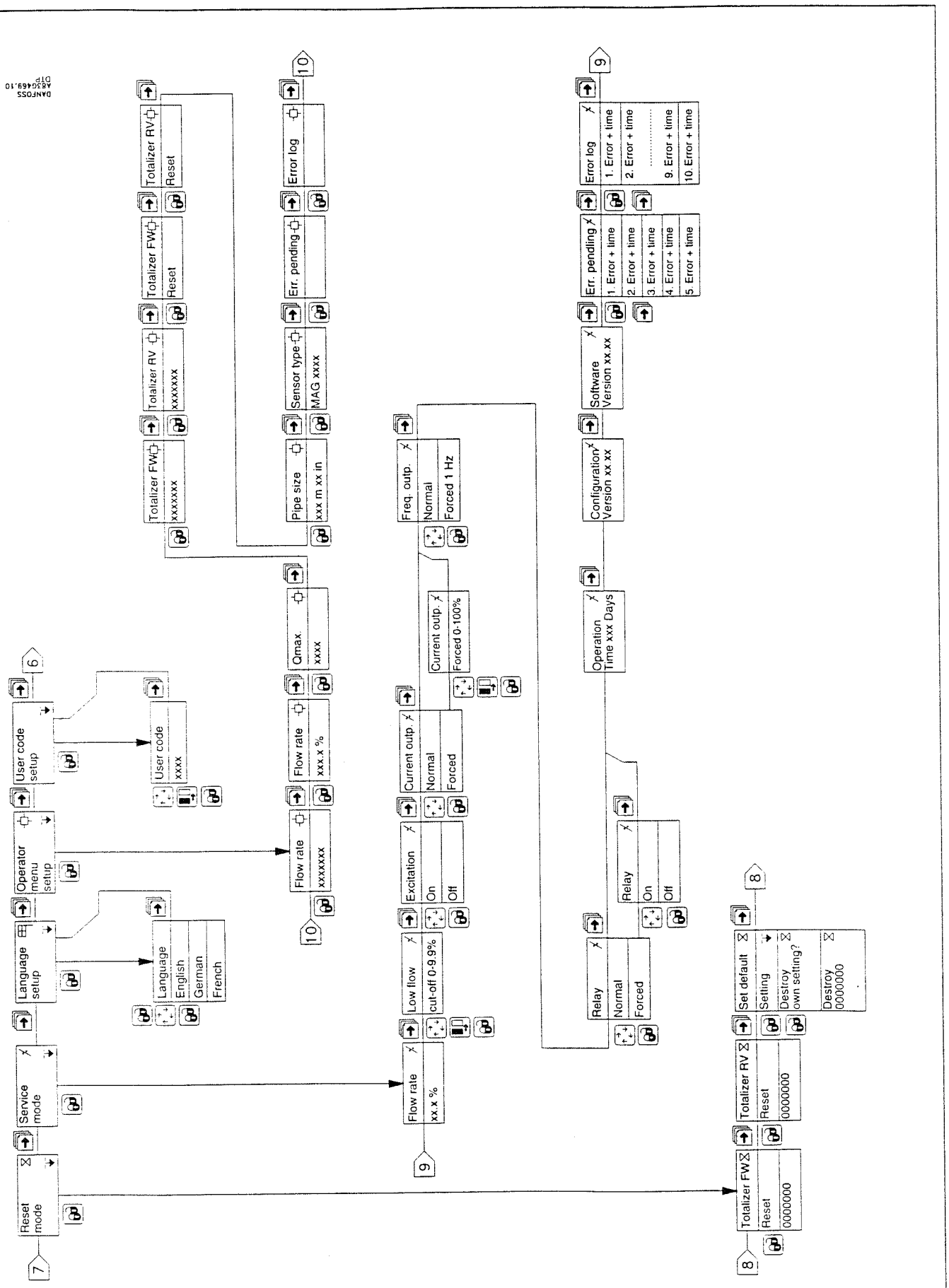
The information to be accessible in OPERATOR MENU can be selected here.

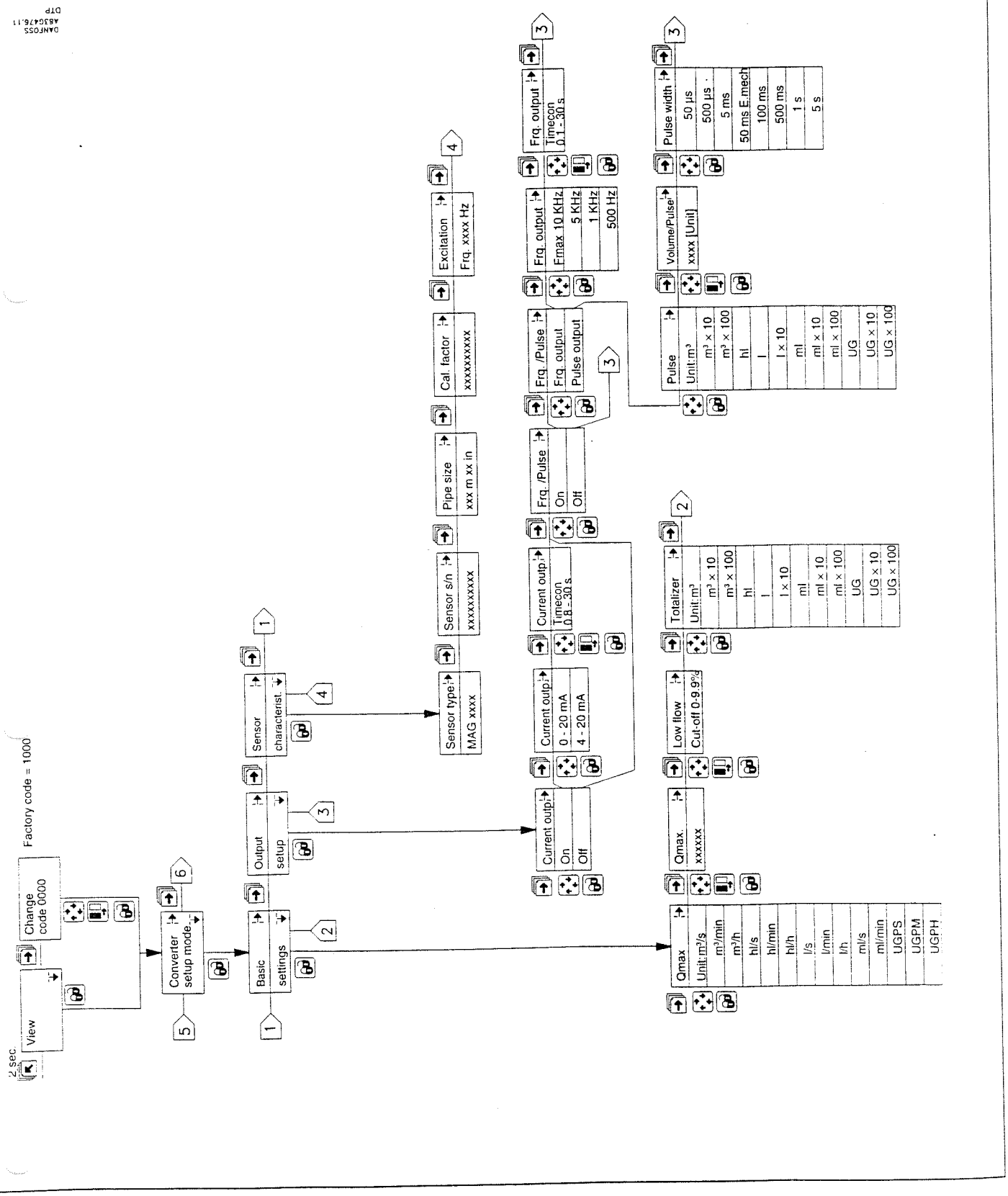
USER CODE SETUP

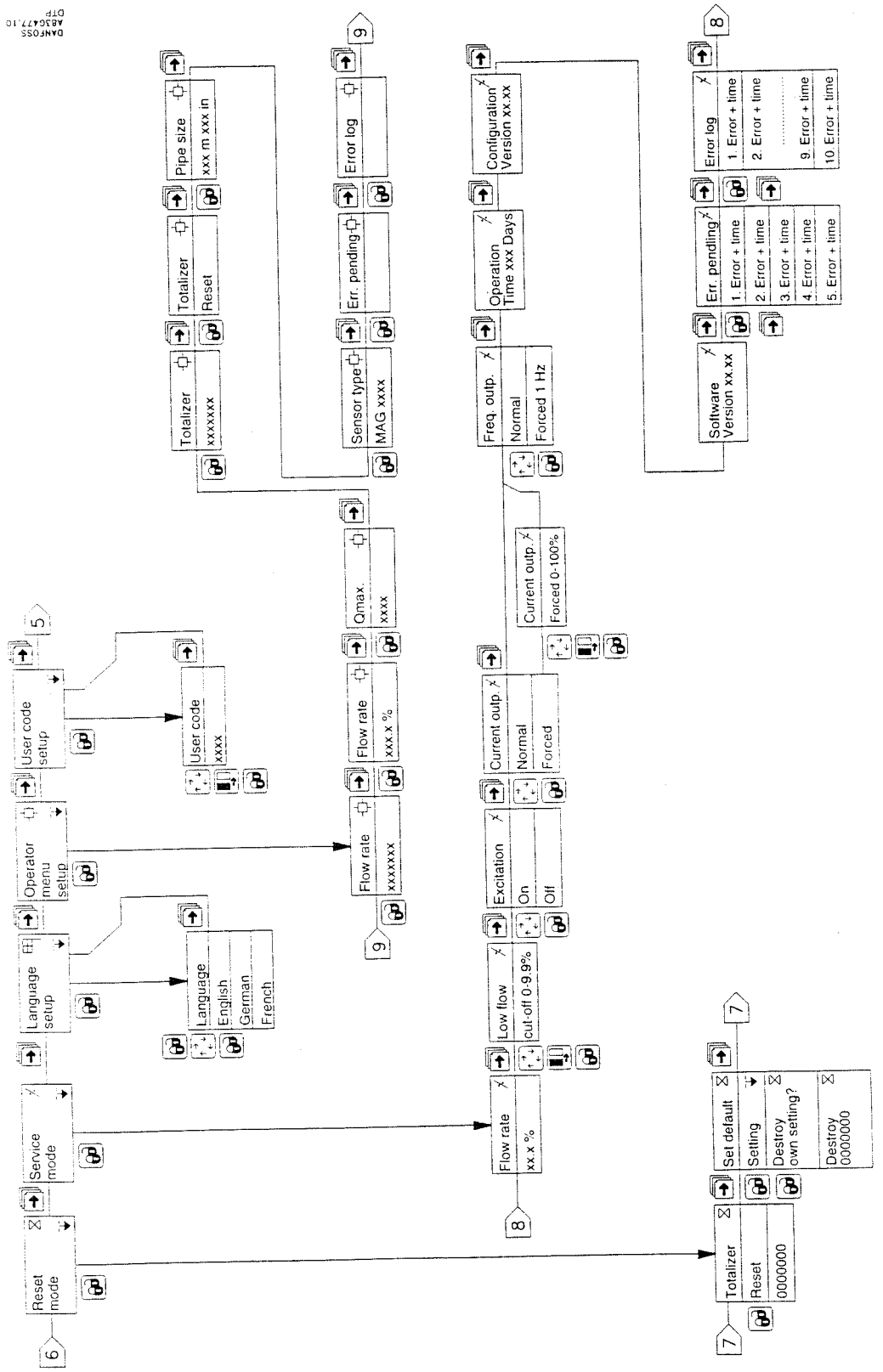
The user code can be changed in USER CODE SETUP. The code is factory-set at 1000. If the user code is forgotten, the factory setting can be re-established as follows: Switch off supply voltage, hold key down and switch on voltage again.
When the ROM and RAM tests have finished, release the key. The user code is now 1000 again.

If the signal converter is left in CONVERTER SETUP for more than 10 minutes, the converter automatically changes back to OPERATOR MENU and restarts measurement.


Factory code = 1000
2 sec.
View
Change code 0000
Converter setup mode
Basic settings
Output setup
Sensor characterist.
Special functions
Flow
Unidirectional
Bidirectional
Current outp.
On
Off
Current outp.
0 - 20 mA
4 - 20 mA
Current outp.
Timecon 0.1 - 30 s
Frq. /Pulse
On
Off
Frq. /Pulse
Frq. output
Pulse output
Frq. output
Timecon 0.1 - 30 s
Frq. output
Fmax 10 KHz
5 KHz
1 KHz
500 Hz
Pulse
Unit:m³
m³ × 10
m³ × 100
hl
l
l × 10
ml
ml × 10
ml × 100
UG
UG × 10
UG × 100
Volume/Pulse
xxxx [Unit]
Pulse width
50 µs
500 µs
5 ms
50 ms E.mech
100 ms
500 ms
1 s
5 s
Totalizer
Unit:m³
m³ × 10
m³ × 100
hl
l
l × 10
ml
ml × 10
ml × 100
UG
UG × 10
UG × 100
Low flow
Cut-off 0-9.9%
Qmax.
xxxxxx
Qmax
Unit:m³/s
m³/min
m³/h
hl/s
hl/min
hl/h
l/s
l/min
l/h
ml/s
ml/min
UGPS
UGPM
UGPH
Flow direc.
Definition
Sensor type
xxx m xx in
Sensor s/n
xxxxxxxxxx
Pipe size
xxx m xx in
Cal. factor
xxxxxxxxxx
Correc. factor
0.800 - 1.200
Excitation
Frq. xxxx Hz
Electrode
Cleaning on
Cleaning off
Auto range
On
Off
Empty pipe
Cut-off on
Cut-off off
Cleaning
Interval xxxh


DANFOSS
A8SC469.10
DTP
Totalizer RV
Reset
Totalizer FW
Reset
Totalizer RV
xxxxxxx
Totalizer FW
xxxxxxx
Error log
Err. pending
Sensor type
MAG xxxx
Pipe size
xxx m xx in
Qmax.
xxxx
Flow rate
xxx.x %
Flow rate
xxxxxxx
User code
setup
User code
xxxx
Operator
menu
setup
Language
setup
Language
English
German
French
Service
mode
Reset
mode
Freq. outp.
Normal
Forced 1 Hz
Current outp.
Forced 0-100%
Current outp.
Normal
Forced
Excitation
On
Off
Low flow
cut-off 0-9.9%
Flow rate
xx.x %
Relay
Normal
Forced
Relay
On
Off
Operation
Time xxx Days
Configuration
Version xx.xx
Software
Version xx.xx
Err. pendling
1. Error + time
2. Error + time
3. Error + time
4. Error + time
5. Error + time
Error log
1. Error + time
2. Error + time
9. Error + time
10. Error + time
Set default
Setting
Destroy
own setting?
Destroy
0000000
Totalizer RV
Reset
0000000
Totalizer FW
Reset
0000000
6
7
8
9
10


2 sec
View
Change code 0000
Factory code = 1000
Converter setup mode
Basic settings
Output setup
Sensor characterist.
Sensor type
MAG xxxx
Sensor s/n
xxxxxxxxxx
Pipe size
xxx m xx in
Cal. factor
xxxxxxxxxx
Excitation
Frq. xxxx Hz
Current outp.1
On
Off
Current outp.1
0 - 20 mA
4 - 20 mA
Current outp.1
Timecon
0.0 - 30 s
Frq. /Pulse
On
Off
Frq. /Pulse
Frq. output
Pulse output
Frq. output
Fmax 10 KHz
5 KHz
1 KHz
500 Hz
Frq. output
Timecon
0.1 - 30 s
Pulse
Unit: m³
m³ × 10
m³ × 100
hl
l
l × 10
ml
ml × 10
ml × 100
UG
UG × 10
UG × 100
Volume/Pulse
xxxx [Unit]
Pulse width
50 µs
500 µs
5 ms
50 ms E.mech
100 ms
500 ms
1 s
5 s
Totalizer
Unit: m³
m³ × 10
m³ × 100
hl
l
l × 10
ml
ml × 10
ml × 100
UG
UG × 10
UG × 100
Low flow
Cut-off 0-9.9%
Qmax
xxxxxx
Qmax
Unit: m³/s
m³/min
m³/h
hl/s
hl/min
hl/h
l/s
l/min
l/h
ml/s
ml/min
UGPS
UGPM
UGPH


DANFOSS
AB3C477.10
DTP
Pipe size
xxx m xxx in
Totalizer
Reset
Totalizer
xxxxxxx
Error log
Err. pending
Sensor type
MAG xxxx
Configuration
Version xx.xx
Operation
Time xxx Days
Freq. outp.
Normal
Forced 1 Hz
Current outp.
Forced 0-100%
Error log
1. Error + time
2. Error + time
9. Error + time
10 Error + time
Err. pendling
1. Error + time
2. Error + time
3. Error + time
4. Error + time
5. Error + time
Software
Version xx.xx
Qmax.
xxxx
Flow rate
xxx.x %
Flow rate
xxxxxxx
User code
setup
User code
xxxx
Operator
menu
setup
Language
setup
Language
English
German
French
Service
mode
Reset
mode
Current outp.
Normal
Forced
Excitation
On
Off
Low flow
cut-off 0-9.9%
Flow rate
xx.x %
Set default
Setting
Destroy
own setting?
Destroy
0000000
Totalizer
Reset
0000000
5
6
7
8
9

Setti.. available,
MAG 3000

	Factory-setting	Settings available
BASIC SETTINGS		
(Flow direction definition)		
Flow direction definition	Positive	Positive, negative
$Q_{max.}$ unit	Dimension-dependent	See page 32
$Q_{max.}$	Dimension-dependent	See page 32
Low flow cut-off	1.5%	0-9.9%
Totalizer units	See page 30	ml, ml × 10, ml × 100,1,1 × 10, hl, m^3, m^3 × 10 m^3 × 100, USgal, USgal × 10, USgal × 100
OUTPUT SETUP		
Uni-, bidirectional	Unidirectional	Unidirectional or bidirectional
Current output (on/off)	Off	On or off
Current output (0-20/4-20 mA)	4-20 mA	0-20 mA, 4-20 mA
Current output, time constant	5 s	0.8-30 s
Frq./pulse on/off	On	On or off
Frq./pulse output	Pulse	Frequency or pulse
$F_{max.}$	10 kHz	500 Hz, 1 kHz, 5 kHz, 10 kHz
Frq. output time constant (frq.output, time constant)	5 s	01-30 s
Pulse unit	Dimension-dependent	ml, ml × 10, ml × 100,1,1 × 10, hl, m^3, m^3 × 10 m^3 × 100, USgal, USgal × 10, USgal × 100
Volume/Pulse	Dimension-dependent	1 ml-100 m^3
Pulse width	50 ms e. mech.	50 µs, 500 µs, 5 ms, 50 ms e. mech., 100 ms, 500 ms, 1s, 5 s
SENSOR CHARACTERISTIC		
Correction factor	1.000	0.8000-1.2000
SPECIAL FUNCTIONS		
Empty pipe cut-off, on/off	Off	On or off
Autorange on/off	On	On or off
Electrode cleaning on/off	Off	On or off (to be introduced in 1993)
Cleaning interval	24 H	1-24 hours
OPERATOR MENU SETUP	Flowrate	(Permanent - cannot be deselected)
	Totalizer	Flowrate %
	Error pending	$Q_{max.}$
		Totalizer-FW
		Totalizer-RV
		Totalizer-FW Reset
		Totalizer-RV Reset
		Pipe size
		Sensor type
		Error pending
		Error log
USER CODE SETUP	1000	1000-9999

tings available
M . 2500

	Factory-settings	Settings available
BASIC SETTINGS		
$Q_{max.}$ unit	Dimension-dependent	See page 32
$Q_{max.}$	Dimension-dependent	See page 32
Low flow cut-off	1.5%	0-9.9%
Totalizer units	See page 30	ml, ml × 10, ml × 100, l, l × 10, hl, m^3, m^3 × 10 m^3 × 100, USgal, USgal × 10, USgal × 100
OUTPUT SETUP		
Current output (on/off)	Off	On or off
Current output (0-20/4-20)	4-20 mA	0-20 mA, 4-20 mA
Current output, time constant	5 s	0.8-30 s
Frq./pulse on/off	On	On or off
Frq./pulse output	Pulse	Frequency or pulse function
$F_{max.}$	10 kHz	500 Hz, 1 kHz, 5 kHz, 10 kHz
Frq. output time constant	5 s	0.1-30 s
(Frq.output time constant)		
Pulse unit	Dimension-dependent	ml, ml × 10, ml × 100,1,1 × 10, hl, m^3, m^3 × 10 m^3 × 100, USgal, USgal × 10, USgal × 100
Volume/Pulse	Dimension-dependent	1 ml-100 m^3
Pulse width	50 ms e. mech.	50 µs, 500 µs, 5 ms, 50 ms e. mech., 100 ms, 500 ms, 1s, 5 s
OPERATOR MENU SETUP	Flowrate	(Permanent - cannot be deselected)
	Totalizer Error pending	Flowrate % $Q_{max.}$ Totalizer Totalizer Reset Pipe size Sensor type Error pending Error log
USER CODE SETUP	1000	1000-9999

Dimension-dependent factory settings

DN		$Q_{max.}$				Volume/	Pulse	Totalizer
mm	[inches]	fac.set.	min.	max	unit	pulse	unit	unit
15	1/2		2000	159.0	6362	l/h	1	l l
25	1	5000	442.0	17671	l/h	10	l	l
40	1 1/2	12	1.1	45	m^3/h	10	l	l
50	2	20	1.8	71	m^3/h	10	l	l
65	2 1/2	30	3.0	119	m^3/h	100	l	l
80	3	50	4.5	181	m^3/h	100	l	l
100	4	120	7.1	283	m^3/h	100	l	l
125	5	180	11.0	442	m^3/h	100	l	m^3
150	6	250	15.9	636	m^3/h	100	l	m^3
200	8	400	28.3	1131	m^3/h	1	m^3	m^3
250	10	700	44.2	1767	m^3/h	1	m^3	m^3
300	12	1000	63.6	2545	m^3/h	1	m^3	m^3
350	14	1200	86.6	3464	m^3/h	1	m^3	m^3
400	16	1800	113.1	4524	m^3/h	1	m^3	m^3
450	18	2000	143.1	5726	m^3/h	1	m^3	m^3
500	20	3000	176.7	7069	m^3/h	1	m^3	m^3
600	24	4000	254.0	10179	m^3/h	10	m^3	m^3
700	28	5000	346.0	13854	m^3/h	10	m^3	m^3
800	32	7000	452.0	18096	m^3/h	10	m^3	m^3
900	36	9000	573.0	22902	m^3/h	10	m^3	m^3
1000	40	12000	707.0	28274	m^3/h	10	m^3	$m^3 \times 10$
1200	48	15000	1018.0	40715	m^3/h	10	m^3	$m^3 \times 10$

Service mode

SERVICE MODE can be used when commissioning and trouble shooting.

FLOWRATE xx.x%

FLOWRATE indicates flowrate in %, whilst test are being conducted in SERVICE MODE.

LOW FLOW CUT-OFF x.x%

Used when commissioning, to experiment with LOW FLOW CUT-OFF.
This function is useful when measurements are to be taken on noisy media.

EXCITATION ON/OFF

EXCITATION ON/OFF can be used when locating faults. When EXCITATION OFF is selected (coil current off) the flowmeter must show FLOWRATE 0% in SERVICE MODE.
Possible fault sources: incorrect electrical connections, electrical interference, noisy media, empty measuring pipe.

CURRENT OUTPUT FORCED

CURRENT OUTPUT FORCED simulates a given flow signal when commissioning. This enables checking and calibration of connected equipment before the system is operated.

FRQ OUTPUT FORCED 1HZ

FRQ OUTPUT FORCED 1 HZ is used when commissioning to test connected counters, data collection, etc.

(MAG 3000 only)

RELAY FORCED

RELAY FORCED is used when commissioning to test indicators, contactors, etc.

OPERATION TIME: xxx days

OPERATION TIME gives the total number of days the signal converter has been in operation.

CONFIGURATION VERSION xx.xx

CONFIGURATION VERSION gives the software configuration version.

SOFTWARE VERSION xx.xx

SOFTWARE VERSION gives the software version.

ERROR PENDING

See Chapter 8.6, Trouble shooting

ERROR LOG

See Chapter 8.6, Trouble shooting

OPERATOR MENU can be returned to with the ⏎ key.
Irrespective of the settings made in SERVICE MODE, operation will continue with the settings made before SERVICE MODE was selected.

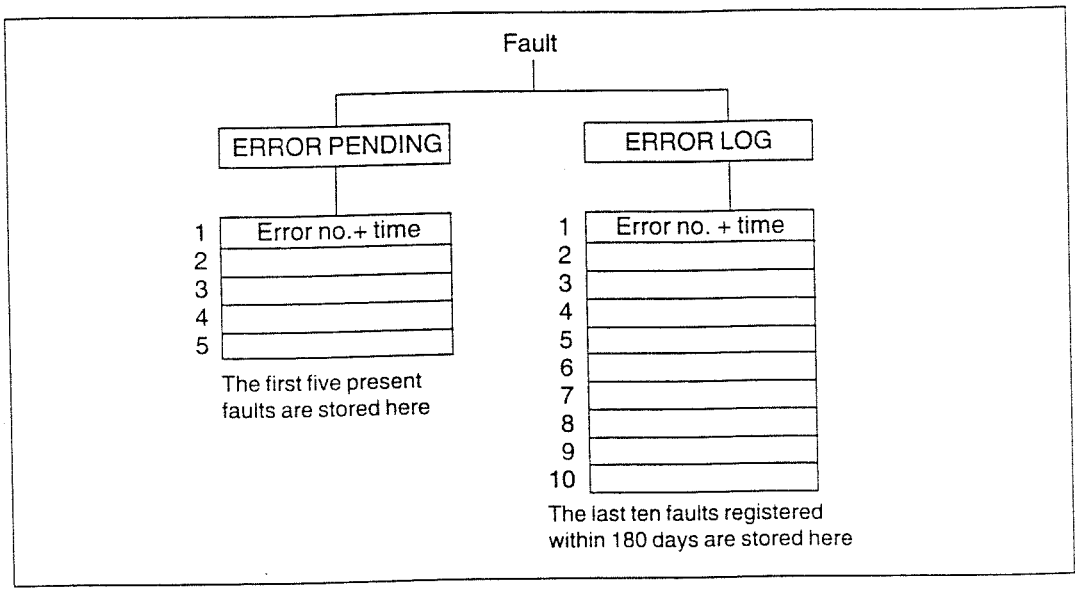
Trouble shooting

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

1. Cable fault on coil circuit and current output loop (MAG 3000 also contains the possibility of monitoring of electrode circuit).
2. Operation and setting faults.
3. Internal faults in signal converter.

These operational disturbances are displayed immediately in the forrn of two flashing triangles ◥◤.

The individual faults are stored in two memories. Present faults are stored in ERROR PENDING, while present and past faults are stored in ERROR LOG. The faults are stored in the form of an error code, with indication of time elapsed since error registration.



In MAG 3000, errors can also be registered via the relay, but conditional on the signal converter being set UNIDIRECTIONAL under the menu OUTPUT SETUP.
While the apparatus is being set (user code keyed in), error indication via relay is automatically blocked.

··ble shooting
M/ 3000

Symptom	Output signals	Error code	Cause	Remedy
Empty display	Minimum		1. Supply voltage 2. MAG 3000 defective	1. Check supply voltage and voltage selector 2. Replace MAG 3000
No flow signal	Minimum		1. Current output deselected 2. Frequency/pulse output deselected	Run through output setup menu Run through output setup menu
	Minimum		Reverse flow direction	Select direction definition. (Basic settings)
	Minimum	14	No coil current	Check cables and connections
	Undefined	60	1. No load on current output 2. MAG 3000 defective	1. Check cables and connections 2. Replace MAG 3000
	Undefined	41	Initializing error 5 s and switch on again	Switch off MAG 3000, wait
	Minimum	16	Measuring pipe empty Empty pipe cut-off is ON	Ensure that the measuring pipe is full
	Minimum	10 11 12	Hardware fault in MAG 3000	Replace MAG 3000
	Undefined	33 34 50	Loss of intemal data	Replace MAG 3000
Indicates flow with no flow in pipe	Undefined		Measuring pipe empty Empty pipe cut-off Is OFF	Select empty pipe cut-off (Special funtions) Ensure that the measuring pipe is full
			Electrode cable insufficiently screened	Ensure that electrode cable is sufficiently screened and connected as described in Chapter 7 "Electrical connection"
Unstable flow signal	Unstable		Pulsating flow	Increase time constant (Output setup)
			Conductivity of medium too low	Use special electrode cable. Contact Danfoss Instrumentation.
			Electrical noise potential between medium and sensor	Ensure sufficient potential equalization. See Chapter "Sensor installation".
			Air bubbles in medium	Ensure medium does not contain air bubbles
Measuring error			Incorrect installation	See Chapter "Sensor installation"
	Maximum	13 15	Signal overflow	Ensure sensor is correctly sized and check $Q_{max.}$ (Basic Settings)
	Maximum	64	Flow exceeds 120% of $Q_{max.}$ (current output)	
	Maximum	70	Flow exceeds 120% of $Q_{max.}$ (frequency output)	
	Maximum	72	Pulse error: 1. Volume/pulse too small 2. Pulse width too large	Run through output setup.
	Undefined	30 31 40 42*)	SENSORPROM™ fault. Defective or deficient SENSORPROM™	1. Remove SENSORPROM™ and key Cal-factor manually in sensor characteristics 2. Replace SENSORPROM™ (Contact Danfoss Instrumentation)
OK		100*)	"Power on" indication. Signal convener self-tests when switched on. This condition is not considered a fault.	

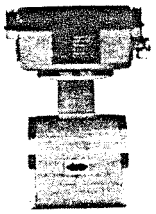
* These "errors" are not registered in the display or relay output, but only in ERROR LOG.

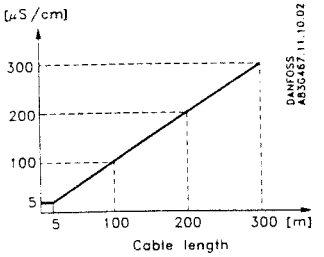
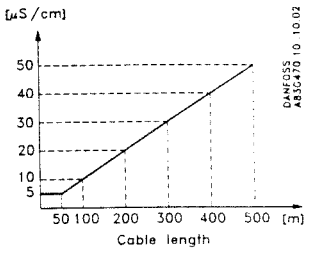
...ble shooting MAG 2500

Symptom	Output signals	Error code	Cause	Remedy
Empty display	Minimum		1. Supply voltage 2. MAG 2500 defective	1. Check supply voltage and voltage selector 2. Replace MAG 2500
No flow signal	Minimum		1. Current output deselected 2. Frequency/pulse output deselected	Run through output setup menu Run through output setup menu
	Minimum	14	No coil current	Check cables and connections
	Undefined	60	1. No load on current output 2. MAG 2500 defective	1. Check cables and connections 2. Replace MAG 2500
	Undefined	41	Initializing enor	Switch off MAG 2500, wait 5 s and switch on again
	Minimum	10 11 12	Hardware fault in MAG 2500	Replace MAG 2500
	Undefined	33 34 50	Loss of internal data	Replace MAG 2500
Indicates flow with no flow in pipe	Undefined		Measuring pipe empty	Ensure that the measuring pipe is full.
			Electrode cable insufficiently screened	Ensure that electrode cable is sufficiently screened and connected as described in Chapter 7" Electrical connection".
Unstable flow signal	Unstable		Pulsating flow	Increase time constant (Output setup)
			Conductivity of medium too low	Use special electrode cable. Contact Danfoss Instrumentation
			Electrical noise potential between medium and sensor	Ensure sufficient potential equalization. See Chapter "Sensor installation".
			Air bubbles in medium	Ensure medium does not contain air bubbles.
Measuring error			Incorrect installation	See Chapter "Sensor installation"
	Maximum	13 15	Signal overflow	Ensure sensor is correctly sized and check Q_{max} (Basic Settings)
	Maximum	64	Flow exceeds 120% of Q_{max} (current output)	
	Maximum	70	Flow exceeds 120% of Q_{max} (frequency output)	
	Maximum	72	Pulse error: 1. Volume/pulse too small 2. Pulse width too large	Run through output setup.
	Undefined	30 31 40 42*)	SENSORPROM™ fault Defective or deficient SENSORPROM™	1. Remove SENSORPROM™ and key Cal-factor manually in sensor characteristics 2. Replace SENSORPROM™ (Contact Danfoss Instrumentation)
OK		100*)	"Power on" indication. Signal converter self-tests when switched on. This condition is not considered a fault.	

*) These "errors" are not registered in the display, but only in ERROR LOG.

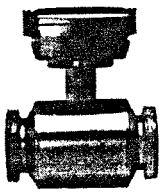
9.
Sensor MAG 1100

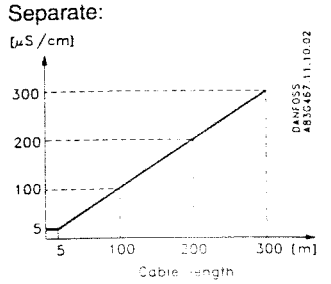
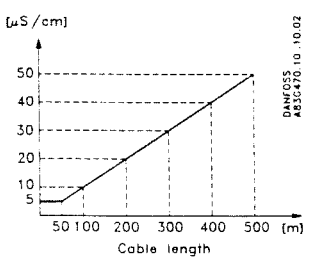


Type	Flangeless sensor
Nominal size	DN 6, 10, 15, 25, 40, 50, 65, 80, 100 mm
Measuring range	0-0.25 m/s to 0-10 m/s
Coil current	Pulsating d.c. with measuring frequency: $3^1/_8$ Hz, $6^1/_4$ Hz, or $12^1/_2$ Hz depending on sensor
Operating pressure	PN 40. Vacuum: 1×10^{-6} bar
Temperature of liquid	-20°C to +130 °C (200 °C) [1] At T > 95 °C install signal converter separately
Temperature shock	Temperature shock: Positive change $\Delta T_{max.} \leq 100$ °C/s Negative change $\Delta T_{max.} \leq 60$ °C/s With higher ΔT, heating or cooling time is necessary
Ambient temperature	Operation: –40 to 100 °C [2] Storage: –40 to 75 °C
Liner	Aluminium oxide Al_2O_3 (ceramic)
Electrodes	Platinum
Enclosure	Stainless steel AISI 316 (W.no. 1.4436)
Staybolt	Stainless steel AISI 304 (W.no. 1.4305). Number and size to DIN 2501
Flange	To DIN 2501. (PN 10-PN 40). Other flange types on request.
Gaskets	Graphite (max. 200 °C, PN 40). (Teflon PTFE (max. 130 °C, PN 25)) [3]
Cable entries	2-off. Pg 13.5
Enclosure rating	IP 67 (1 m w.g. for 30 min) to IEC 529 and DIN 40050
Mechanical load	3 g, 1-800 Hz sinusoidal in all directions, to IEC 68-2-6
Test pressure	80 bar (2 × PN)
Conductivity	Compact: Electrically conductive liquids with conductivity ≥ 5 µSiemens/cm With reduced accuracy: ≥ 1 µSiemens/cm
	Separate:  Standard cable  Special cable

[1]) Use high-temperature cable if temperature in terminal box exceeds 70 °C
[2]) –20 to +50 °C with signal converter mounted on sensor
[3]) Supplied as extra accessory

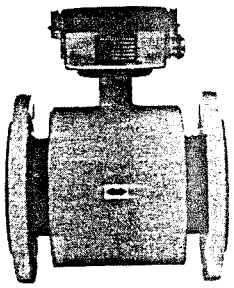
9.. Sensor MAG 2100



Type	Hygienic sensor with dairy fittings
Nominal size	DN 25, 40, 50, 65, 80 D_i to ISO 2037 or DIN 11850 depending on connection
Measuring range	Adjustable from 0-0.25 m/s to 0-10 m/s
Coil current	Pulsating d.c. with measuring frequency $12^1/_2$ Hz
Operating pressure	PN 10 Vacuum: 1×10^{-6} bar
Temperature of liquid	–30 °C to 100 °C [1]) not suitable for steam sterilization At T > 95 °C install signal converter separately
Ambient temperature	Operation: –30 to 100 °C [2]) Storage: –40 to 75 °C
Liner	FEP (Perfluoroethylenepropylene) FDA-approved
Electrodes	Platinum
Enclosure	Stainless steel AISI 316 (W.no. 1.4436)
Pipe connection	Hygienic fitting DIN 11851; Clamp ISO 2852
Cable entries	2-off, Pg 13.5
Enclosure rating	IP 67 (1m w.g. for 30 min.) to IEC 529 and DIN 40050
Mechanical load	3 g,1-800 Hz sinusoidal in all directions, to IEC 68-2-6
Test pressure	20 bar (2 × PN)
Conductivity	Compact: Electrically conductive liquids with conductivity ≥ 5 µSiemens/cm With reduced accuracy: ≥ 1 µSiemens/cm
	Separate:  Standard cable  Special cable

[1]) Use high-temperature cable if temperature in terminal box exceeds 70 °C
[2]) –20 to +50 °C with signal converter mounted on sensor

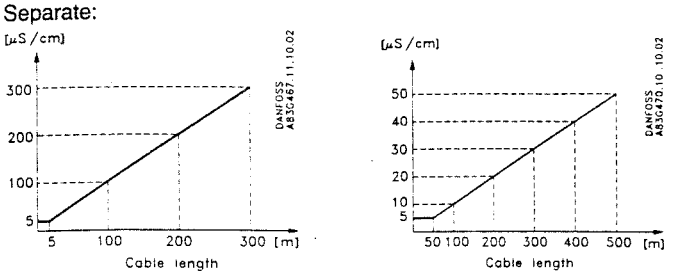
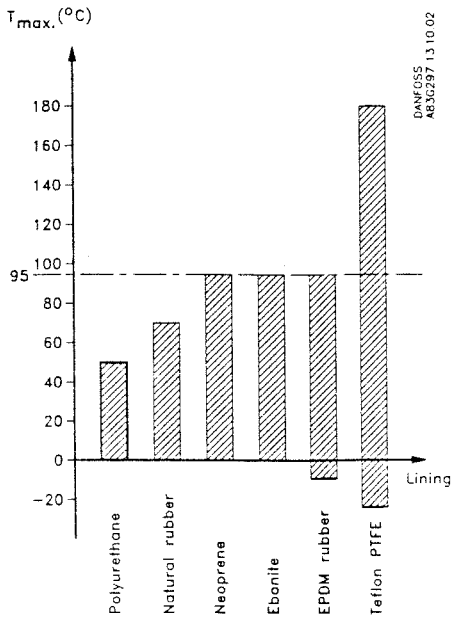
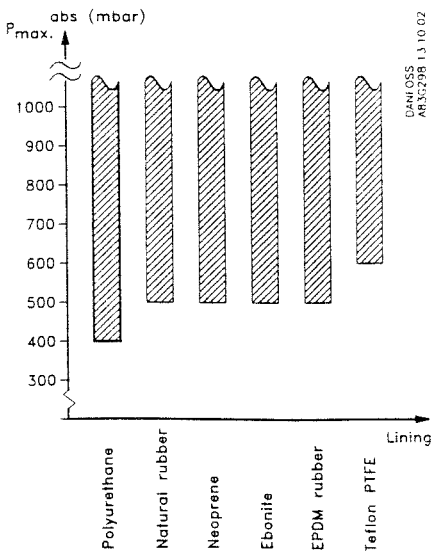
Sensor MAG 3100



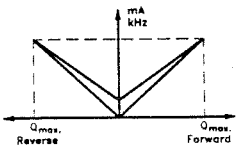
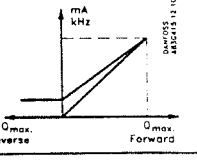
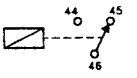
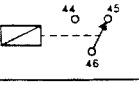
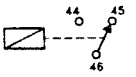
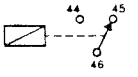
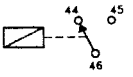
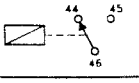
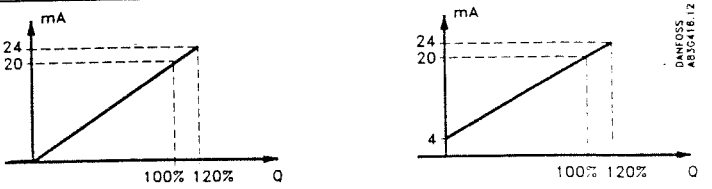
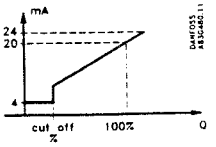
Type	Sensor with flanges
Nominal size	DN 15-2000 mm
Measuring range	Adjustable from 0-0.25 m/s to 0-10 m/s
Coil current	Pulsating d.c. with measuring frequency: $3^1/_8$ Hz, $1^9/_{16}$ Hz, $6^1/_4$ Hz or $12^1/_2$ Hz, depending on sensor
Temperature of liquid	See next page
Ambient temperature Operation	min. –40 °C max. 150 °C [1]
Storage	min. –40 °C max. 75 °C
Pipe connection/ operating pressure BS 4504 (~DIN 2501)	Standard: DN 15-50: PN 40 DN 65-150: PN 16 DN 200-1000: PN 10 DN 1200-2000: PN 6
	Option: DN 65-600: PN 6, PN 40 DN 200-600: PN 16, PN 25
ANSI B 16.5 (~BS 1560)	2"-24": Class 150 (17.5 bar) 2"-24": Class 300 (49 bar)
BS 10	2"-48": Table D/E
AS 2129	2"-48": Table D/E
JIS B 2220	DN 50-1000: K10 (10 bar) DN 50-1000: K16 (16 bar)
On enquiry	High-pressure flanges > 40 bar
Liner Standard	Neoprene
Option	Ebonite, EPDM [2], Teflon (PTFE), Natural rubber, Polyurethanee (PU)
Electrodes Standard	AISI 316 Ti (W.no. 1.4571)
Option	Hastelloy C, Platinum/Iridium, Titanium, Monel
Measuring pipe	AISI 304 (W.no. 1.4301)
Enclosure	St. 35, corrosion-resistant two-component coating
Cable entries	2-off, Pg 13.5
Enclosure rating Standard	IP 67 to IEC 529 and DIN 40050 (tested at 3 m w.g. for 72 hours)
Option	IP 68 to 10 m w.g. when used with submersible kit Code no. 085U0220
Mechanical load	1G,1-800 Hz sinusoidal in all directions, to IEC 68-2-6
Test pressure	1.5 × PN

[1] –20 to +50 °C with signal converter mounted on sensor
[2] With WRC-approval (Water Research Council, UK)

››sor MAG 3100

Conductivity	Compact: Electrically conductive liquids with conductivity ≥ 5 µSiemens/cm With reduced accuracy: ≥ 1 µSiemens/cm Separate:  Standard cable Special cable
Maximum/minimum temperature of liquid	 PN < 40 bar except for PTFE > 120 °C: 16 bar With liquid temp. > 95 °C the signal converter must be installed separately Use high-temperature cable if temperature in terminal box exceeds 70 °C
Minimum pressure	

Signal converter MAG 3000

Measuring method/ magnetising system	Pulsating d.c. with frequency: 3 1/8 Hz, 6 1/4 Hz, or 12 1/2 Hz, depending on sensor
Measuring range	Adjustable from 0-0.25 m/s to 0-10 m/s
Supply voltage and power consumption	Standard versions: 115/230 V a.c. +10% to -15% 50-60 Hz 10 VA 24 V d.c. +33% to -25% 10 W
Basic setup of output characteristic	Bidirectional / Relay indicates flow direction  Unidirectional / Relay indicates error 
Relay	Direction relay / Error relay Power down —  — Power down —  Forward flow —  — Error —  Reverse flow —  — No Error —  Max. load: 42 V 2 A. Permanent load max. 42 V 0.5 A
Current output	 0/4-20 mA galvanically isolated. Load: < 800 ohm
Frequency/pulse output	Active: 24-30 V d.c. Load: max. 2 Hz: ≥ 125 ohm max. 10 kHz: ≥ 1 kohm Passive: 5-50 V d.c. max. 200 mA R_{on} < 5 ohm, F_{max} = 10 kHz
Time constant	Current output: 0.8-30 s adjustable Frequency output: 0.1-30 s adjustable Reaction time relay: Error 1 s - Direction 5 s
Outputs	Galvanic isolation throughout. Min. 500 V in insulation Short-circuit proof
Counters	One internal counter for forward flow and one for reverse flow
Low flow cut-off	Adjustable from 0%-9.9% of Full Scale 
Empty pipe cut-off	Detection of empty measuring pipe. Can be deselected on low conductivity in medium. With separate installation, use special electrode cable.
Autorange	Automatic matching of sensitivity to actual flow. Can be deselected for short measuring sequences.
Display	Background illumination with alphanumerical text, 2 × 16 characters for indicating flow, volume and settings. Reverse flow indicated by negative sign.
Zero point	Automatic zero point adjustment
Ambient temperature Operation	-20 to +50°C
Storage	-40 to +85°C

Electrical noise (EMC)	CENELEC:		Emission	Immunity
		Light industry	EN 50081-1	EN 50082-1
		Heavy industry	EN 50081-2	EN 50082-2

Signal converter MAG 3000

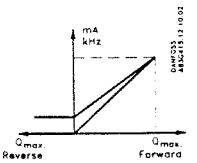
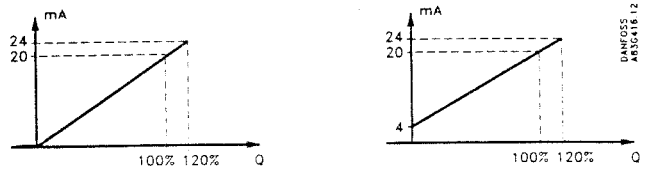
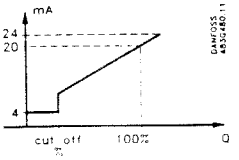
IP 67 version

Enclosure material	Stainless steel, AISI 316 (W.no.1.4401) or fibre glass reinforced polyamide
Enclosure	IP 67 to IEC 529 and DIN 40050 (1 m w.g. for 30 min.)
Mechanical load	3 g 1-800 Hz sinusoidal in all directions, to IEC 68-2-6

IP 00 version

Enclosure material	Standard 19" insert in aluminium/steel. (DIN 41494) Width: 28 HP (142 mm) Height: 3 U (128 mm) Module depth: 160 mm
Enclosure	IP 00 to IEC 529 and DIN 40050
Mechanical load	115/230 V a.c. version: 1 g 1-800 Hz sinusoidal in all directions, to IEC 68-2-6 24 V d.c. version: 3 g 1-800 Hz sinusoidal in all directions, to IEC 68-2-6

9.2
Signal converter MAG 2500

Measuring method/ magnetising system	Pulsating d.c. with frequency 3⅛ Hz.
Measuring range	Adjustable from 0-0,25 m/s to 0-10 m/s
Supply voltage and power consumption	115/230 V a.c. +10% to -15% 50-60 Hz 10 VA
Output characteristics	
Current output	
Frequency/pulse output	Active: 24-30 V d.c. Load: max. 2 Hz: ≥ 125 ohm max. 10 kHz: ≥ 1 kohm Passive: 5-50 V d.c. max 200 mA R_{on} < 5 ohm F_{max} = 10 kHz
Time constant	Current output: 0.8-30 s adjustable Frequency output: 0.1-30 s adjustable
Outputs	Individual galvanic isolation. Min 500 V in insulation Short-circuit proof
Counter	Internal counter for summation volume
Low-flow cut-off	Adjustable from 0%-9,9% of Full Scale 
Display	2 × 16-digit alphanumerical display showing flow, volume and settings
Zero point	Automatic zero point adjustment
Ambient temperature	Operation -20 to +50°C Storage -40 to +85°C

Electrical noise (EMC)	CENELEC:		Emission	Immunity
		Light industry	EN 50081-1	EN 50082-1
		Heavy industry	EN 50081-2	EN 50082-2

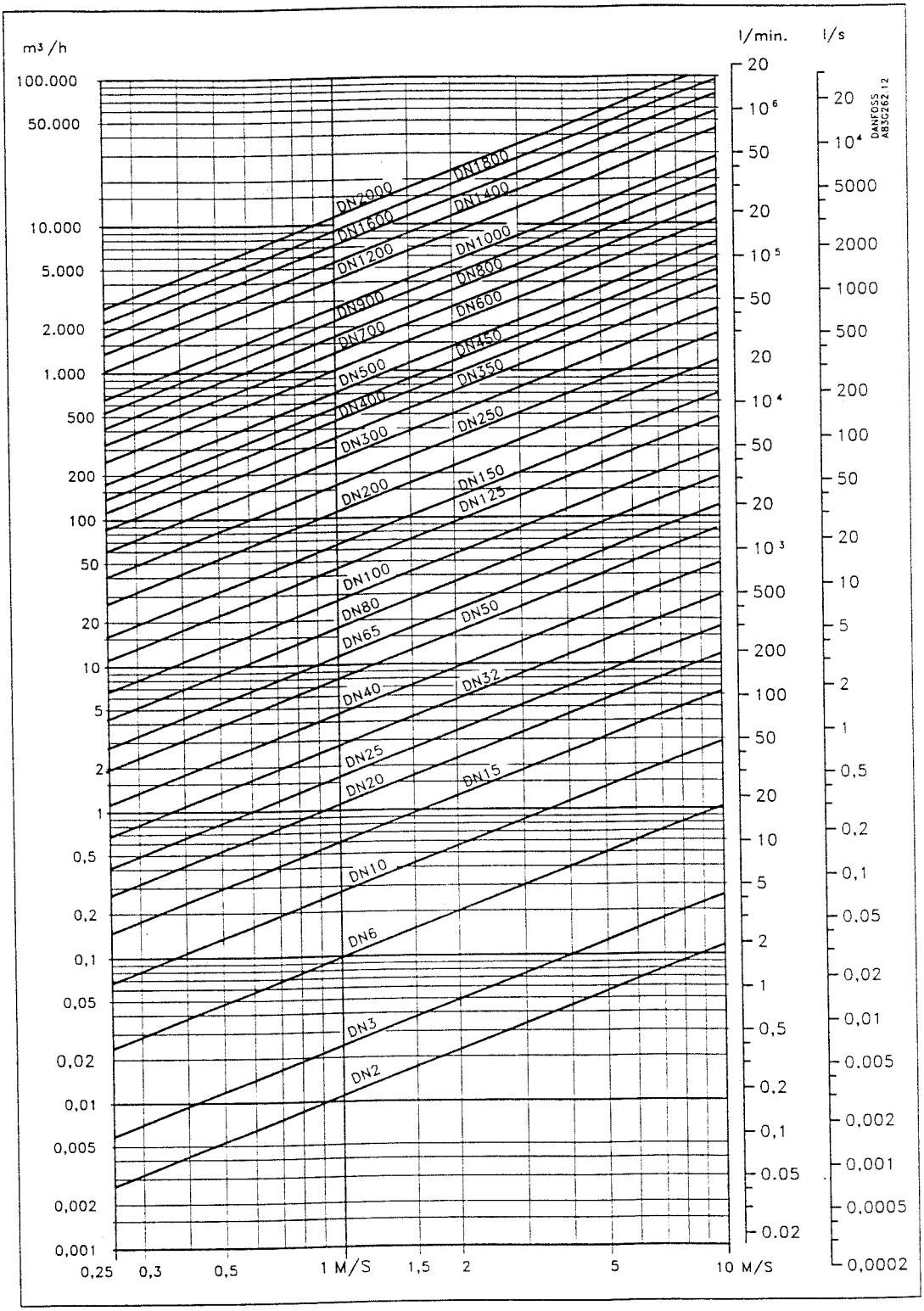
IP 67 version

Enclosure material	Fibre glass reinforced polyamide
Enclosure	IP 67 to IEC 529 and DIN 40050 (1 m w.g. for 30 min)
Mechanical load	3 g 1-800 Hz sinusoidal in all directions, to IEC 68-2-6

IP 00 version

Enclosure material	Standard 19" insert in aluminium/steel. (DIN 41494) Width: 28 TE (142 mm) Height: 3 HE (128 mm) Module depth: 160 mm
Enclosure	IP 00 to IEC 529 and DIN 40050
Mechanical load	1 g 1-800 Hz sinusoidal in all directions, to IEC 68-2-6

Sizing table (DN 2-2000)

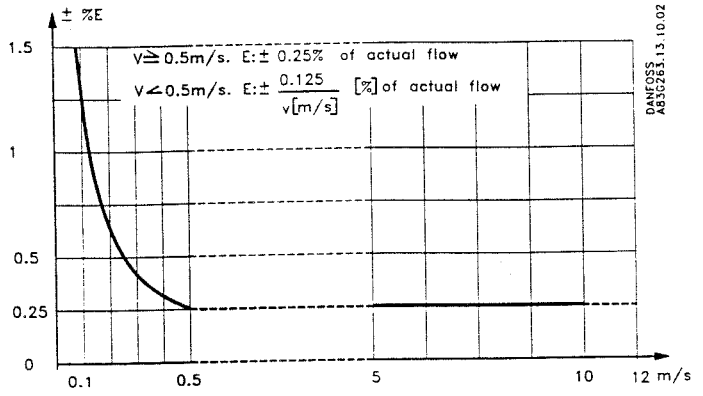


The table shows the relation between flow velocity V, flow quantity Q and sensor dimension DN.

Selection of sensor
Min. measuring range 0-0.25 m/s
Max. measuring range 0-10 m/s
Normally, the sensor is chosen so that V lies within the measuring range 1-2 m/s.

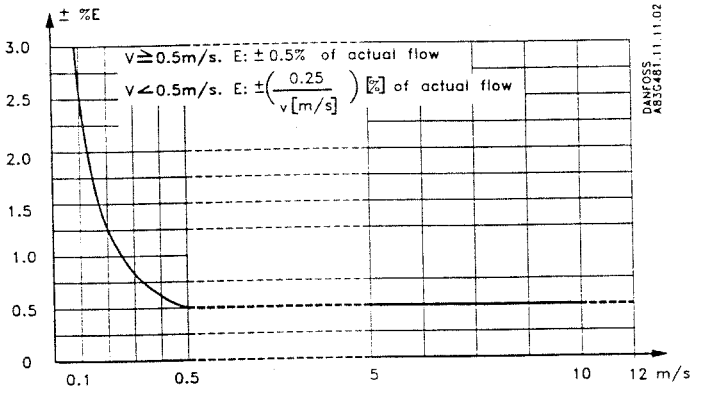
Meter uncertainty under reference conditions (Display/frequency/ pulse output)

MAG 3000



V: Actual flow velocity [m/s]
E: Meter uncertainty in % of actual flow

MAG 2500



V: Actual flow velocity [m/s]
E: Meter uncertainty in % of actual flow

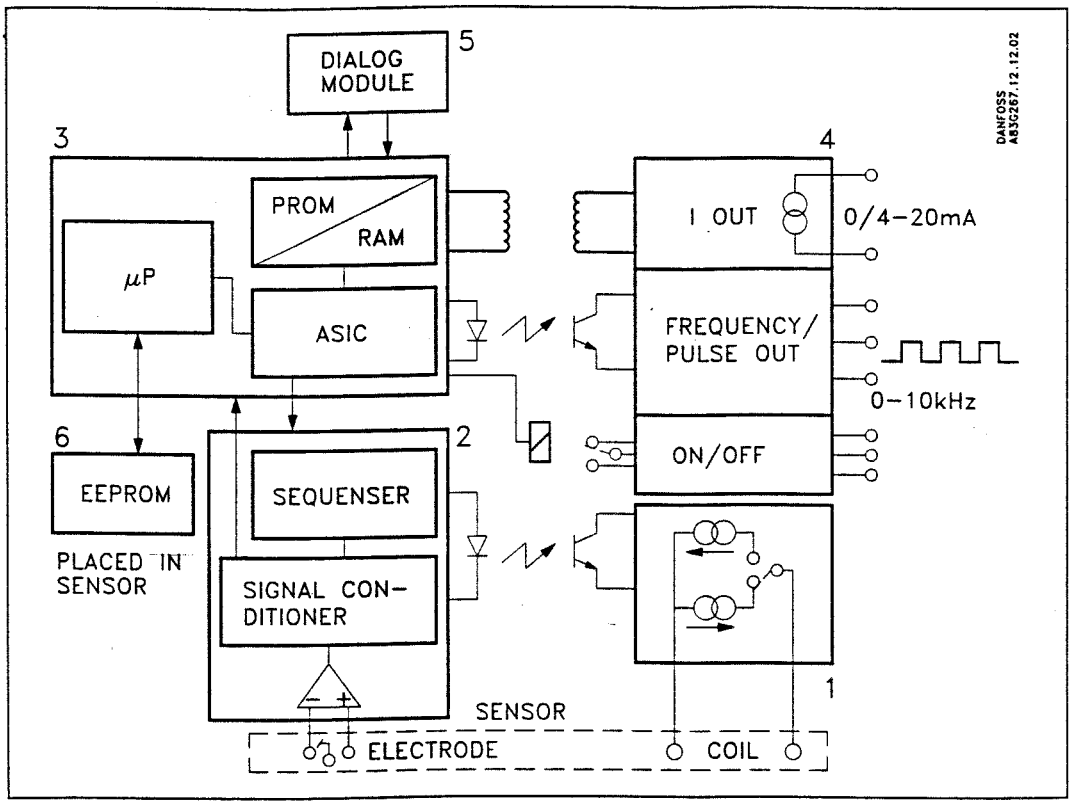
Reference conditions (ISO/DP9104 and DIN 19200 draft)

Temperature of medium	20°C ±2 K
Ambient temperature	20°C ±2 K
Supply voltage	Un ±1%
Warming-up time	30 min
Building into pipe section in accordance with reference conditions (ISO and DIN)	Inlet section 10 × DN Outlet section 5 × DN Sensor optimum earthed and centred For further information, contact Danfoss
Flow conditions	Fully-developed flow profile

Addition on deviations from reference conditions

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

MAG 3000 and MAG 2500 are built up of a number of function blocks



1. **Coil current module** generates a pulsating magnetising current that drives the coils in the sensor. The current is monitored and the circuit signals fault in the event of irregularities, e.g. cable fracture.

2. **Front end module** processes the signal for the sensor electrodes via a patented circuit that suppresses electrode noise. Inaccuracies in the signal converter as a result of long-term drift and temperature drift is monitored and continuously compensated for via a reference circuit. The electrode signal is then converted from an analog to a digital value and 16-bit signal resolution is reached without the use of a traditional A/D converter.
   MAG 3000 also has a circuit that constantly monitors the impedance between electrodes. If the sensor is empty or cable fracture arises, a fault signal is given.
   To ensure a better dynamic range, MAG 3000 incorporates an AUTORANGE function that makes signal processing optimum at all flow velocities.

3. **Processor module** consists of an advanced microprocessor driven by the signal converter software. The block therefore has several main functions:
   - The digital signal from block 2 is converted to flow-proportional sizes.
   - Two counters sum the flow continuously in the respective positive and negative direction.
   - Communication with block 5 ensures that settings are stored in block 6, and that all flow values and any errors can be signalled.
   - All internal circuit adjustments are performed via software so that nowhere are potentiometers necessary.
   - The measuring process itself and all vital circuits in the signal converter are monitored. Errors are registered and stored for up to 180 days.

4. **Output module** converts flow data to current and pulse/frequency.
   Any current loop break results in a fault signal.
   MAG 3000 contains a relay circuit that indicates either flow direction or fault.

5. **Dialogue module** consists of a keypad and a display for communication with the signal converter.

6. **SENSORPROM™ module** contains sensor data and signal converter settings.
   SENSORPROM™ is located on the connecting plate for the signal converter. Immediately on starting, MAG 3000/2500 immediately reads off the settings relevant to the sensor being used. The settings can then be optimised.
   If the signal converter is subsequently replaced the previous settings are retained, i.e. converter replacement does not influence SENSORPROM™.