Fuji Electric

Magnetoflow™ M2000

INSTALLATION AND OPERATION MANUAL

July 2016

MID_M2000_BA_02_1607

1. Basic safety precautions

Before installing or using this product, please read this instruction manual thoroughly. Only qualified personnel should install and/or repair this product. If a fault appears, contact your distributor.

Installation
Do not place any unit on an unstable surface that may allow it to fall.
Never place the units above a radiator or heating unit.
Route all cabling away from potential hazards.
Isolate from the mains before removing any covers.

Power connection
Use only the type of power source suitable for electronic equipment. If in doubt, contact your distributor. Ensure that any power cables are of a sufficiently high current rating.
All units must be earthed to eliminate risk of electric shock.
Failure to properly earth a unit may cause damage to that unit or data stored within it.

Protection class
The device has protection class IP 67 and needs to be protected against dripping water, water, oils, etc.

Setup & operation
Adjust only those controls that are covered by the operating instructions. Improper adjustment of other controls may result in damage, incorrect operation or loss of data.

Cleaning
Switch off all units and isolate from mains before cleaning.
Clean using a damp cloth. Do not use liquid or aerosol cleaners.

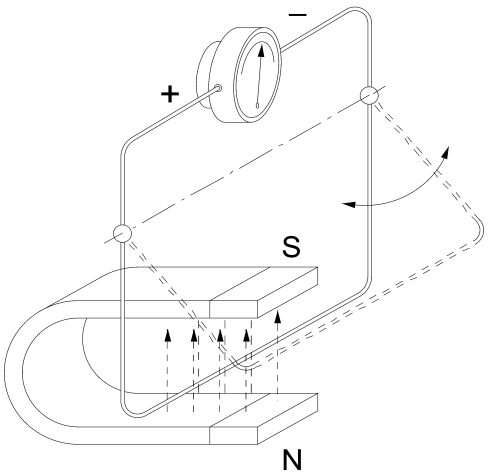
Repair of faults
Disconnect all units from power supply and have it repaired by a qualified service person if any of the following occurs:

- If any power cord or plug is damaged or frayed
- If a unit does not operate normally when operating instructions are followed
- If a unit exposed to rain/water or if any liquid has been spilled into it
- If a unit has been dropped or damaged
- If a unit shows a change in performance, indicating a need for service.

RoHs
Our products are RoHs compliant.

2. System description

The electromagnetic flow meters are intended for the metering of all fluids with electric conductivity of at least 5 μS/cm (20 μS/cm for demineralized water). These series of meters is characterized by a high degree of accuracy. Measuring results are independent of density, temperature and pressure.



Measuring principle

In accordance with Faraday's induction principle, electric voltage is induced in a conductor moving through a magnetic field. In case of the electromagnetic flow measurement, the moving conductor is replaced by the flowing fluid. Two opposite measuring electrodes conduct the induced voltage which is proportional to flow velocity to the amplifier. Flow volume is calculated based on pipe diameter.

3. Installation

Warning:
- *Installation instructions given in the following are to be observed in order to guarantee a perfect functioning and a safe operation of the meter.*

3.1 General information

3.1.1 Temperature ranges

Caution:
- *In order to prevent a damaging of the meter, you are requested to strictly observe amplifier's and detector's maximum temperature ranges.*
- *In regions with extremely high ambient temperatures, it is recommended to protect the detector.*
- *In cases where fluid temperature exceeds 100°C, foresee separate amplifier and detector (separate version).*

Amplifier	Ambient temp.		-20 to + 60 °C
Detector	Fluid temp.	PTFE / PFA	-40 to +150 °C
		Hard rubber	0 to +80 °C
		Soft rubber	0 to +80 °C

3.1.2 Protection class

In order to fulfill requirements in respect of the protection class, please follow the following guidelines:

Caution:
- *Body seals need to be undamaged and in proper condition.*
- *All of the body screws need to be firmly screwed.*
- *Outer diameters of the used wiring cables must correspond to cable inlets (for M20 Ø 5....10 mm). In cases where cable inlet is not used, put on a dummy plug.*
- *Tighten cable inlets.*
- *If possible, lead cable away downwards. Thus humidity cannot get into cable inlet.*

We normally deliver the meter in accordance with protection class IP 67. If you however require a higher protection class, the amplifier is to be installed separately from the detector. If requested, we can also deliver the detector in IP 68.

3.1.3 Transport

Caution:
- *Use lifting lugs when lifting meter flow tubes that are 150 in diameter or larger.*
- *Do not lift meter on measuring amplifier or on detector's neck.*
- *Do not lift meter with a fork lift on the jacket sheet. This could damage the body.*
- *Never place rigging chains, forklift forks, etc inside or through the meter's flow pipe for hoisting the meter. This could damage the isolating liner.*

3.2 Installation

In order to provide a perfect functioning and to prevent the meter from eventual damages, please follow the following installation instructions.

Caution:
- *Carefully observe the forward flow label on the meter body and install the meter accordingly.*
- *As for detectors with PTFE liner, remove protective cap on the flange or on the threaded pipes of milk pipe screws as per DIN 11851 not until shortly before installation.*

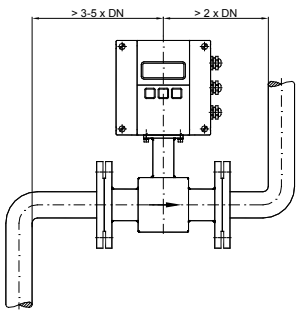
3.2.1 Meter orientation

Meters can operate accurately in any pipeline orientation. Meters can be installed in horizontal as well as in vertical pipelines.
Meters perform best when placed vertically with liquid flowing upward as it prevents solids build-up.
When installing the meter on a horizontal pipe, mount the meter to the pipe with the flow-measuring electrode axis in a horizontal plane as it prevents that gas bubbles result in a temporary isolation of the flow-measuring electrodes.

Carefully observe the forward flow label on the meter body and install the meter accordingly.

3.2.2 Inlet and outlet pipe

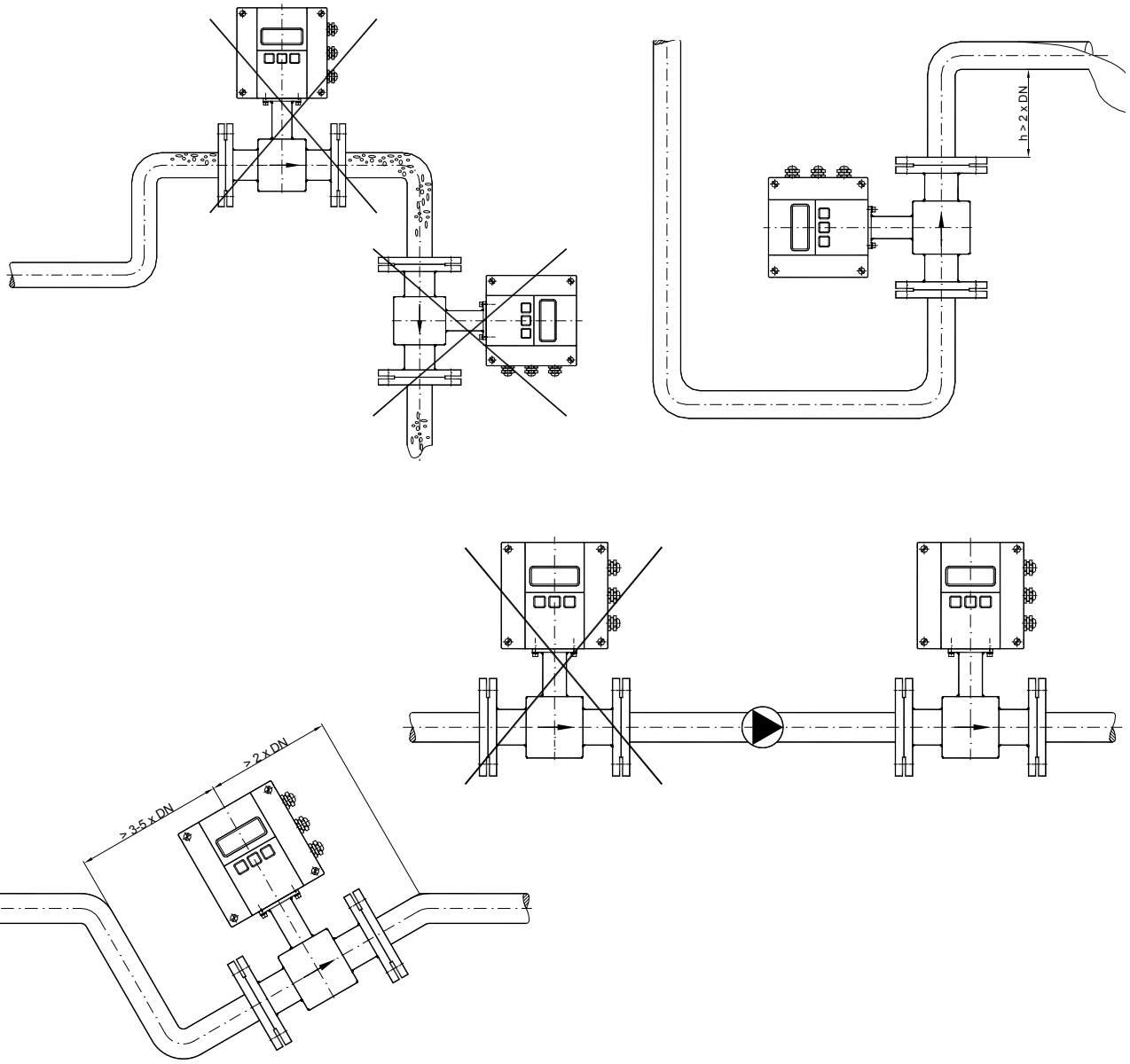
Always install the detectors in front of fittings producing turbulences. If this is simply not possible, foresee distances of > 3 x DN. Distance ought to be > 2 x DN.



3.2.3 Meter location

Caution:

- *Do not install the detector on the suction sides of pumps. This could damage the liner (in particular PTFE liners).*
- *Verify that the pipeline is always filled on the measuring point, if not - a correct or accurate measurement is not possible.*
- *Do not install the detector on the highest point of a pipeline system. Gas accumulation may follow.*
- *Do not install the detector in downcomer pipes with free outlet.*
- *Do not install the detector on pipes with vibrations. If pipes are strongly vibrating, make sure that detector and amplifier are separated (separate version).*



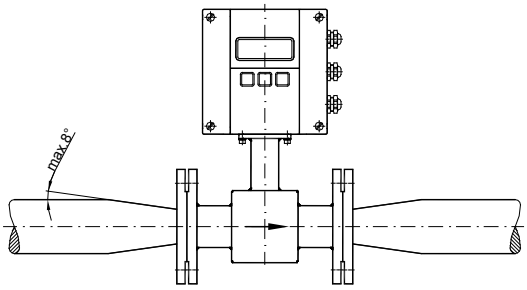
3.2.4 Pipe reducer requirements

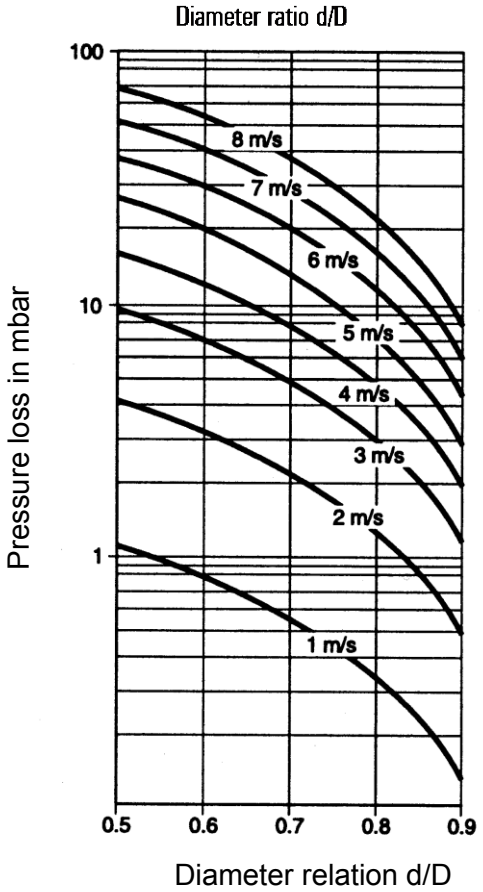
With pipe reducers as per DIN 28545 detectors can be mounted in larger pipelines.

You can determine the occurring pressure drop by using the shown nomogram (only applicable to liquids with similar viscosity like water).

Note:
- *In cases where flow velocities are very low, you can increment them by reducing the size on the measuring point and hence obtain a better measuring accuracy.*

D = pipeline
d = detector





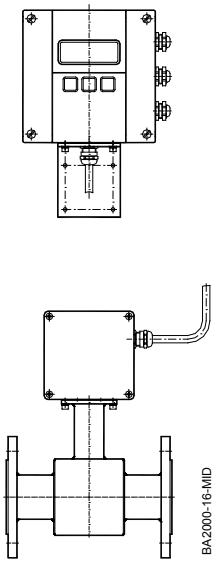
Define pressure loss:
1. Calculate diameter ratio d/D.
2. Read pressure loss depending on d/D ratio and flow velocity.

3.2.5 Separate version

Provide a separate version in the following cases:

Note:
- *Detector protection class IP 68*
- *Fluid temperature > 100 °C*
- *Strong vibrations*

Caution:
- *Do not install the signal cable close to power cables, electric machines, etc.*
- *Fix signal cables. Due to capacity changes, cable movements may result in incorrect measurements.*

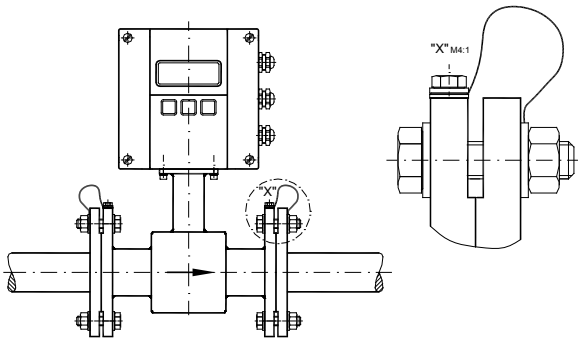


3.2.6 Grounding and potential equalization

In order to obtain an accurate measurement, detector and fluid need to be on the same electric potential.

If flange or intermediate flange versions with additional grounding electrode are used, grounding is provided by the connected pipeline.

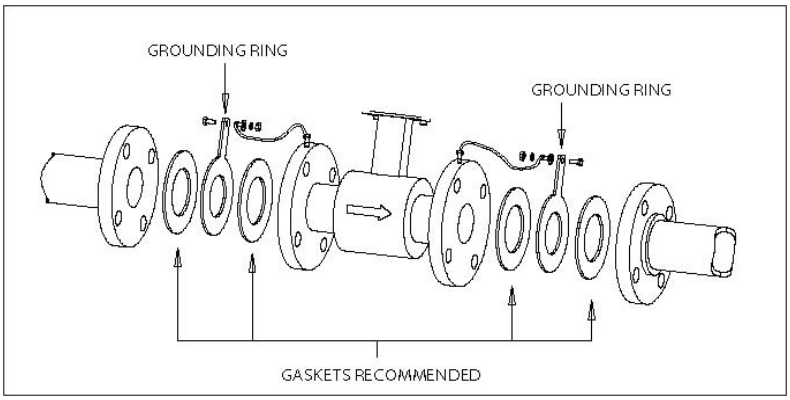
Caution:
- *In case of a type with flange a connection cable (min. 4 mm²) between grounding screw on the meter's flange to the counterflange is to be used in addition to the fixing screws. Verify that a perfect electric connection is provided.*
- *Color or corrosion on the counterflange may have a negative effect on the electric connection.*
- *In case of types with intermediate flanges, the electric connection to the detector is done via two ¼ AMP plugs installed on detector's neck.*



3.2.7 Plastic or lined pipelines

If non-conductive pipelines or pipelines lined with non-conductive material are used, install an additional grounding electrode or grounding rings between the flanges. Grounding rings are installed like gaskets between the flanges and are connected with a grounding cable to the meter.

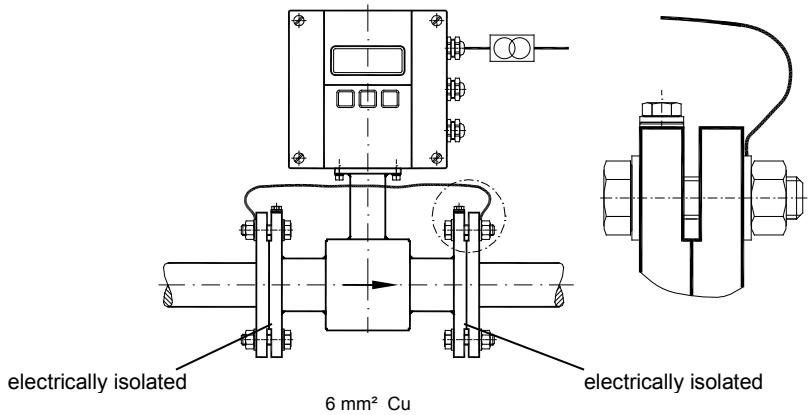
Caution:
- *When grounding rings are used, please make sure that the material is resistant to corrosion. If aggressive fluids are measured, use grounding electrodes.*



3.2.8 Pipelines with cathodic protection

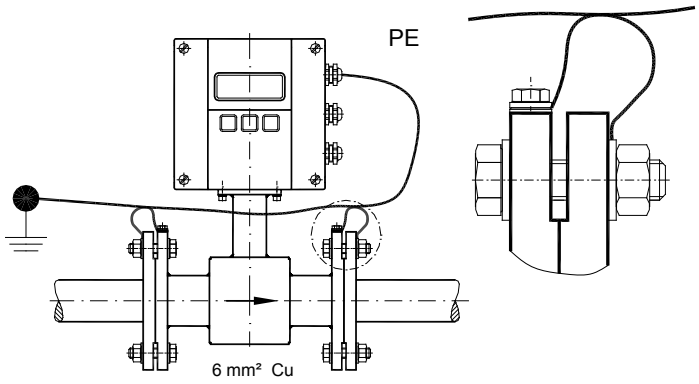
As for pipelines with cathodic protection, install meter potential-free. No electric connection from the meter to the pipeline system may exist and power supply is to be provided via isolating transformer.

Caution:
- *Use grounding electrodes (grounding rings also need to be installed isolated from the pipeline system).*
- *Observe national rules in respect of a potential-free installation*



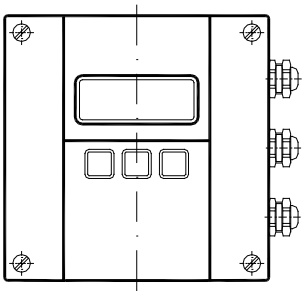
3.2.9 Electrically disturbed environment

If the pipe material is in an electrically disturbed environment or if metallic pipelines that are not grounded are used, we recommend a grounding as shown in the following picture in order to assure that measurement is not influenced.



4. Power connections

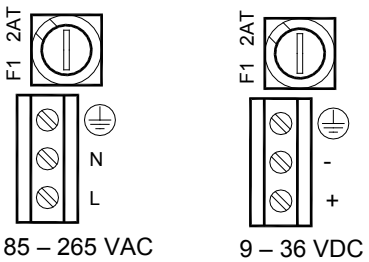
Caution:
- *For the 3 x M20 cable inlets only use flexible electric cables.*
- *Use separate cable inlets for auxiliary power, signal and input/output cables.*



4.1 Auxiliary power

Warning:
- *Do not connect meter under impressed mains voltage.*
- *Take national applicable rules into account.*
- *Observe type plate (mains voltage and frequency).*

1. Slightly loosen both of the left cover screws and loosen the two right cover screws completely. Open cover to the left side.
2. Push auxiliary power cable through the upper cable inlet.
3. Connection as shown in the picture.
4. In the following close connection cover again firmly.

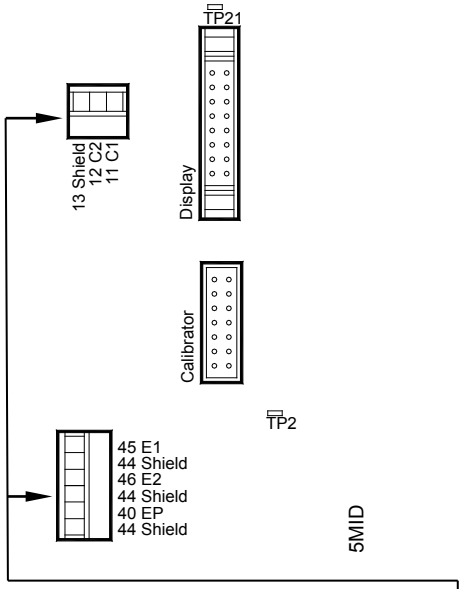


4.2 Separate version

Caution: • *Connect or separate signal connection cable only when the unit has been switched off.*

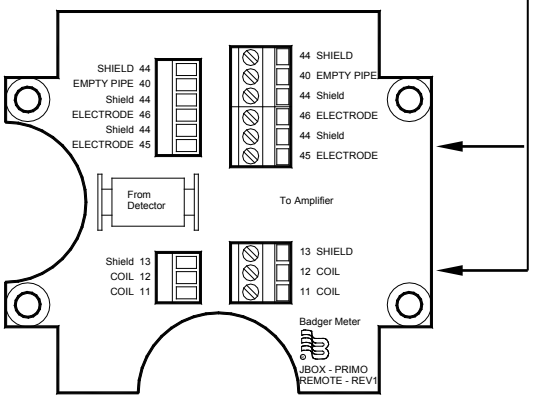
Connection in the measuring amplifier

1. Loosen both fixing screws of the connection cover and remove cover.
2. Loosen upper and lower cover screw and open cover to the left side.
3. Push signal cable on the upper side of the device through cable inlet.
4. Connection as shown in the picture.
5. Close device and connection cover again firmly.



Connection on the detector

1. Loosen fixing screws of the connection cover and remove cover.
2. Push signal cable through cable inlet.
3. Connection as shown in the picture.
4. Close device and connection cover again firmly.



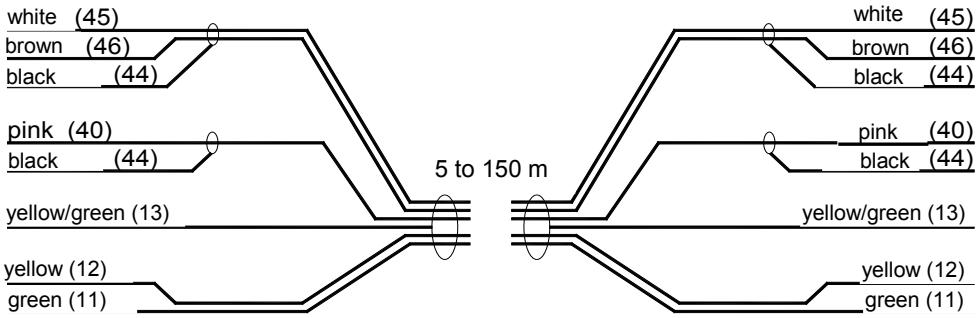
Terminal box – Terminal		M2000	Description	Wire color
Standard	Stainless steel			
11	5	C1	Coil 1	Green
12	4	C2	Coil 2	Yellow
13	PE	CS	Main shield	Yellow/Green
45	1	E1	Electrode 1	White
44*	PE	ES	Electrode shield	Black
46	2	E2	Electrode 2	Brown
40	3	EP	Empty pipe	Pink
44*	PE	ES	Empty pipe shield	Black

*) Connections with number 44 are on the same potential.

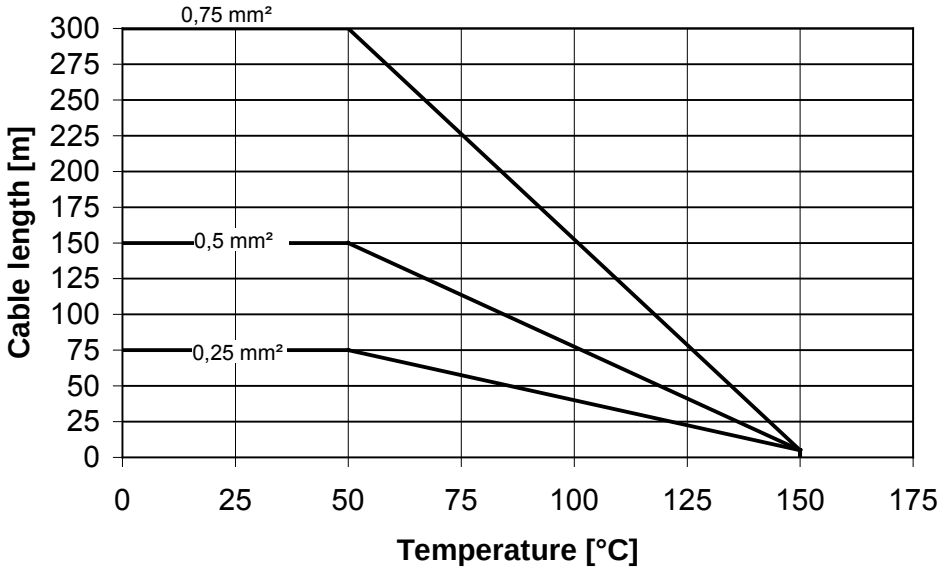
4.2.1 Signal cable specification

Note:
- *Only use signal cables delivered by Badger Meter or corresponding cable in accordance with the following specification.*
- *Take max. signal cable length between detector and amplifier into account (keep distance as low as possible).*

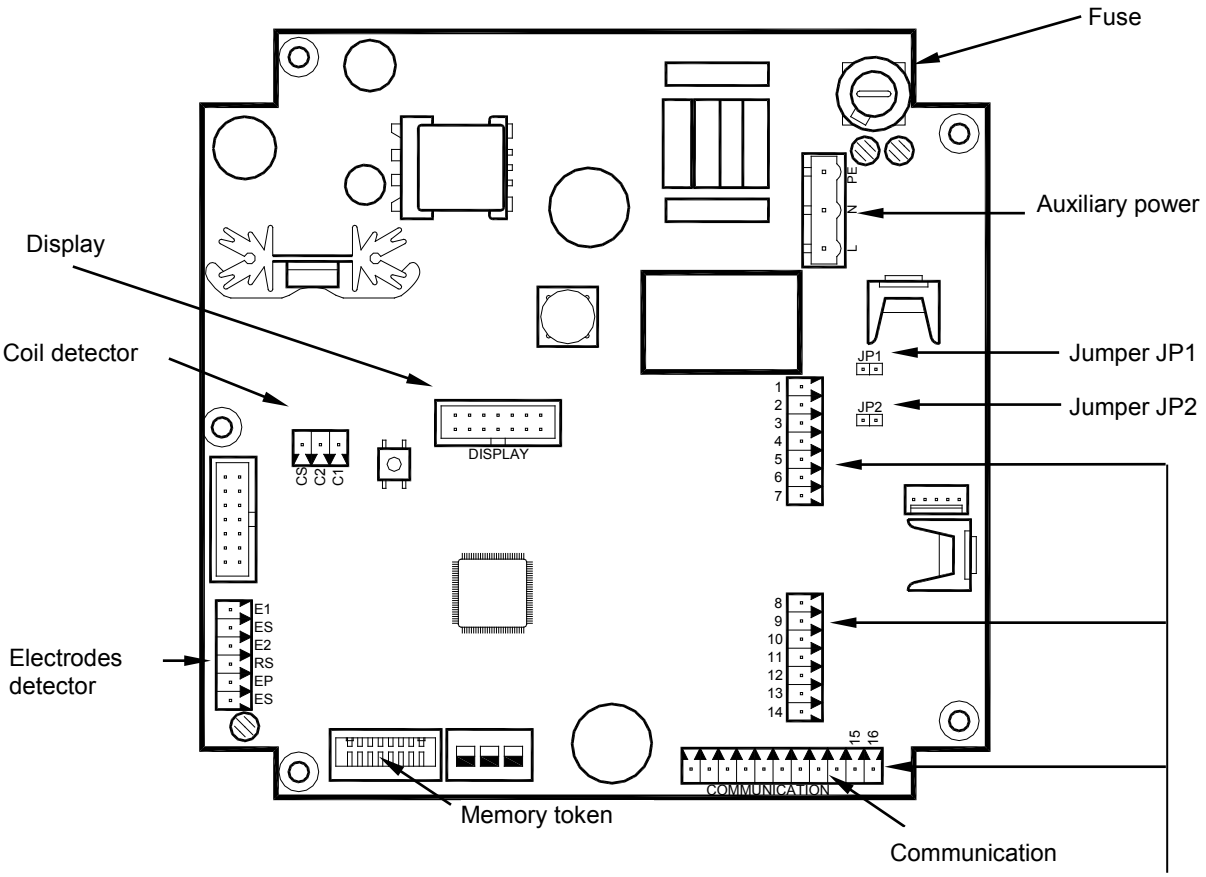
Distance	With electrode idle	Loop resistance
0 – 75 m	3 x (2 x 0,25 mm²)	=< 160 Ω/km
> 75 – 150 m	3 x (2 x 0,50 mm²)	=< 80 Ω/km
PVC cable with pair and total shield Capacity: wire/wire < 120 nF/km, wire/shield < 160 nF/km Temperature range –30 to +70 °C		



Maximum cable length at different fluid temperatures



4.3 Configuring input/output (I/O)



Input/Output	Description	Terminal
Analog output	0 - 20 mA 4 - 20 mA RL < 800 Ohm 0 - 10 mA 2 - 10 mA	16 (+) 15 (-)
Digital output		
1	Open collector max. 10 kHz * Passive max. 30 VDC, 100 mA * Active 24 VDC, 50 mA (Jumper JP1 placed)	1 (+) and 2 (-)
2	Open collector max. 10 kHz * Passive max. 30 VDC, 100 mA * Active 24 VDC, 50 mA (Jumper JP2 placed)	3 (+) and 4 (-)
3	Open collector passive max. 30 VDC, 100 mA, max. 10 kHz or Solid State Relais max. 48 VAC, 500 mA, max 1 kHz	10 (+) and 11 (-) 10 and 11
4	Open collector passive max. 30 VDC, 100 mA, max. 10 kHz or Solid State Relais max. 48 VAC, 500 mA, max 1 kHz	13 (+) and 14 (-) 13 and 14
Digital input	5 - 30 VDC	8 (+) and 9 (-)
RS 232	Remote display information or Modbus RTU	7 GND 6 RxD 5 TxD
Communication	Optional communication ports like HART, Profibus DP, ModBus® RS 485, M-Bus	Communication

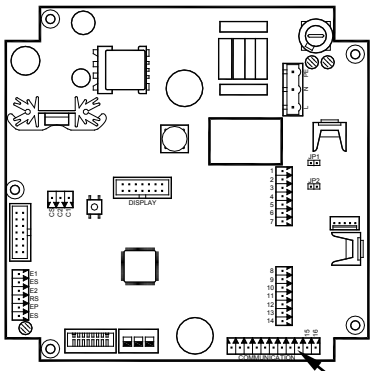
4.4 Communication interfaces

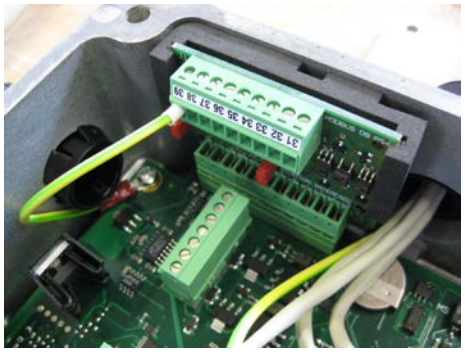
M2000 offers following communication interfaces:

- Modbus® RTU RS485
- M-Bus
- HART
- Profibus DP

The additional interface board is already plugged in by the manufacturer or can be ordered and easily plugged in afterwards.

The interface board is plugged in to the 11 pin connector at the lower right of the main board.





Communication interface

The internal communication between main board and interface board are done via the Port B. Please consider that for M-Bus, HART and Profibus DP following adjustments are done in the menu Communication->Port B

Port B: Port Adr. 001
Baudrate 38400
Data bits 8
Parity Even
Stop bits 1

For the Modbus® RTU RS485 the communication parameters are adjusted via Port B.

For more information, see the separate interface manual.

Note:
If an interface board is used, the access to the analog output (terminal 15/16) is not possible, except for the HART and Modbus® RTU RS485 interface.

5. Programming

The LCD display with 4 lines and 20 digits shows following information:

Line	Uni-directional	Bi-directional
1	Meter type, software version and alternating error messages	
2	Flow velocity (v)	
3	Flow rate (R)	
4	Totalizer T1	Totalizer T+
5	Totalizer T2	Totalizer T-
6	Pre-selection volume (PS)	Net. totalizer TN
7		Pre-selection volume (PS)

Uni-directional

```
M-Series          V1.14
v =          0.0000 m/s
R =       0.000000 M3H
T1                0 M^3
T2                0 M^3
PS                0 M^3
```

Bi-directional

```
M-Series          V1.14
v =          0.0000 m/s
R =       0.000000 M3H
T+                0 M^3
T-                0 M^3
TN                0 M^3
PS                0 M^3
```

The display can be scrolled by using the up ▲ and down ▼ buttons.

Programming is accomplished by using the three functional buttons ▲(+),▼(-) and **E(►)**.
You can move from the measuring mode to the programming mode by pressing twice the button **E**. While first pressing this button, you activate the backlight and while pressing it for a second time, you get into the programming menu.
The cursor → on the left side of the display is moved upward and downward with the buttons ▲▼. The menu manager or selection from a list is marked with the cursor and acknowledged by pressing the button **E**.
To enter a parameter, the first number is marked with an underline **0.** By pressing the buttons **+** / **-,** you can increment or decrement them. As soon as the requested number has been selected, you can acknowledge it by pressing the button **E**. After having entered the last number, the value is stored by pressing the button **E** or press the button **+** in order to edit the value again.

You get access to the individual menus through three programmable access levels: Administrator, service and user level.
Access rights of the individual menu items is shown in the following with three symbols:

Administrator

Service

User

For programming the access levels, see the chapter “passwords”.
No passwords were set at the factory.

5.1 Quick setup

The M2000 amplifier provides you with a quick setup utility that allows you to quickly set most of the important parameters like flow units, totalizer units, full scale flow and low flow cutoff settings.

Flow Units

Flow units let you select among the flow units mentioned below. Flow units are automatically converted into the selected unit.

	Unit		Unit
LPS	Liter/Second	GPM	Gallons/Min.
LPM	Liter/Minute	GPH	Gallons/Hour
LPH	Liter/Hour	MGD	MegaGallon/Da
M3S	Cubic meters/Sec.	IGS	UKG/Sec.
M3M	Cubic meters/Min.	IGM	UKG/Min.
M3H	Cubic	IGH	UKG/Hour
F3S	Cubic Feet/Sec.	MID	MegaUKG/day
F3M	Cubic Feet/Min.	LbM	Pound/Min.
F3H	Cubic Feet/Hour.	OPM	Ounce/Min
GPS	Gallons/Sec.	BPM	Barrel/Min

Totalizer Unit

This parameter establishes the units of measure for the totalizers:

	Unit		Unit
L	Liters	UKG	Imperial Gallons
HL	HectoLiters	MIG	Mega Imp. Gal.
M³	Cubic Meters	Lb	Pounds
CFt	Cubic Feet	Oz	Fluid Ounces
USG	U.S. Gallons	Aft	Acre Feet
MG	MegaGallons	BBL	Barrel

Full Scale Flow

This parameter sets the maximum flow the system is expected to measure. This parameter has influence on other system parameters. These parameters include: Frequency output and current output.

In terms of flow velocity, the meter's limit are from 0.1 to 12 m/sec.

Moreover the values for Low Flow Cut-off and limits monitoring depend on Full Scale Flow.

The full scale flow is valid for both flow directions.

Note: If the flow rate exceeds the full scale setting, an error message indicates that the configured full scale range has been exceeded.

Low Flow Cut-off

Low Flow Cut-off defines the threshold at which flow measurement will be forced to zero. The cutoff value can be from 0 % to 9.9 % of the full scale flow. Increasing the threshold will help prevent false reading during "no flow" conditions possible caused by vibrations or liquid fluctuations.

5.2 Main menu

The following menu items are available to you in the main menu:

- Meter setup
- Measuring
- Inputs and outputs
- Reset of the totalizer
- Setting of communication port
- Specific counter settings
- Counter information
- Language selection

5.2.1 Meter setup

Scale Factor 	You may chose this factor to optimize an accuracy or to achieve an accuracy in flow measurement that is close or better than the reproduceability of the meter. This factor corrects the actual flow rate in percent (positively or negatively). Note: Changing this value has an influence on the meter accuracy!
Empty Pipe Detection 	Fluid monitoring shows if measuring pipe has only partly been filled with liquid. Monitoring can be switched on or off. Note: On request, fluid monitoring can be adjusted to fluid's conductivity or to cable length.
Power Line Frequency 	For an optimum operation of the meter, set Power Line Frequency in this menu at operating location.
Excitation Frequency 	This value shows in which frequency the meter's coils are operated. Supported frequencies are dependent on the configured power line frequency and meter's size. **50 Hz** / **60 Hz** 1 Hz / 1 Hz 3.125 Hz / 3.75 Hz 6.25 Hz / 7.5 Hz 12.5 Hz / 15 Hz Note: When selecting excitation frequency, make sure to always observe that the ratio in respect of power frequency is integer.

Pipe Diameter 	This figure is used for setting pipe's diameter (size). Several sizes DN 6 to DN 2000 as well as specific sizes in [mm] can be set. Note: Pipe diameter is set at the factory. Changes of size have an impact on meter's accuracy.
Detector Factor 	This parameter is set at the factory. This factor compensates for accuracy error as a result of the installed detector. If accuracy adjustment of the meter is required, please refer to the scale factor. In the event the amplifier is replaced, this parameter must be reprogrammed with the original detector factor.
Detector Offset 	This parameter is set at the factory. This factor compensates for accuracy error as a result of the installed detector. If accuracy adjustment of the meter is required, please refer to the scale factor. Note: Changes of the detector offset have an impact on meter's accuracy at low flow.

5.2.2 Measurement

Velocity Unit 

This function let you select among the velocity units mentioned below. The units are automatically converted into the selected unit.

- meters/sec
- feet/sec

Flow Units 

Flow Units let you select among the Flow Units mentioned below. Flow units are automatically converted into the selected unit.

	Unit		Unit
LPS	Liter/Second	GPM	Gallons/Min.
LPM	Liter/Minute	GPH	Gallons/Hour
LPH	Litre/Hour	MGD	MegaGallon/Da
M3S	Cubic meters/Sec.	IGS	UKG/Sec.
M3M	Cubic meters/Min.	IGM	UKG/Min.
M3H	Cubic	IGH	UKG/Hour
F3S	Cubic Feet/Sec.	MID	MegaUKG/day
F3M	Cubic Feet/Min.	LbM	Pound/Min.
F3H	Cubic Feet/Hour.	OPM	Ounce/Min
GPS	Gallons/Sec.	BPM	Barrel/Min

Totalizer Unit 

This parameter establishes the units of measure for the totalizers:

	Unit		Unit
L	Liters	UKG	Imperial Gallons
HL	HectoLiter	MIG	Mega Imp. Gal.
M³	Cubic Meters	Lb	Pounds
CFt	Cubic Feet	Oz	Fluid Ounces
USG	U.S. Gallons	Aft	Acre Feet
MG	MegaGallons	BBL	Barrel

Full Scale Flow 	This parameter sets the maximum flow the system is expected to measure. This parameter has influence on other system parameters. These parametes include: Frequency output and current output. In terms of flow velocity, the meter's limit are from 0.1 to 12 m/sec. Moreover the values for Low Flow Cutoff and meter's limits monitoring depend on Full Scale Flow. The full scale flow is valid for both flow directions. Note: If the flow rate exceeds the full scale setting, an error message indicates that the configured full scale range has been exceeded.
Low Flow Cut-off 	Low Flow Cut-off defines the threshold at which flow measurement will be forced to zero. The cutoff value can be from 0 % to 9.9 % of the full scale flow. Increasing the threshold will help prevent false reading during "no flow" conditions possible caused by vibrations or liquid fluctuations.
Flow Direction 	Flow direction lets you set the meter to measure forward flow only (uni-directional) or both forward and reverse flow (bidirectional). Unidirectional means that the flow is totalized in only one direction. The flow direction is indicated by the arrow printed on the detector label. In this mode, the two totalizers T1/T2 can be used as totalizers and resettable day counters. Bidirectional means the flow is totalized in both directions. The totalizer T+ registers forward flow and the totalizer T-totalizes in reverse flow direction. The net totalizer TN registers total flow and shows the difference between T+ and T-. A change of the flow direction can be signalized by the digital outputs.
Damping Factor 	The damping factor establishes the stability of the measured flow rate.Time constant can be set from "none" up to a max. of 30 seconds. Note: Damping has no influence on the totalizers.

5.2.3 Inputs and outputs

Analog output

Range

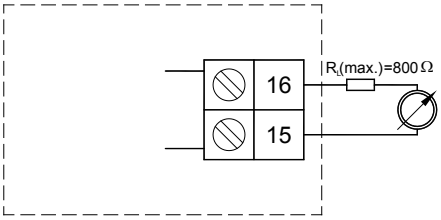
This parameter establishes the range of the analog output signal: 0 to 100% (= full scale). The following current ranges are available to you:

Current output
0 to 20 mA
4 to 20 mA
0 to 10 mA
2 to 10 mA

Note:

In case that an error message is displayed, set current to 22 mA. In case that you select bidirectional operation, you can signal flow direction via digital outputs.

Also see full scale setting.



Alarm Mode

This parameter configures the behavior of the analog output during alarm conditions. Three options exist for this parameter: **OFF, LOW and HIGH**.

OFF: Analog signal is based on flow rate and always within the configured range.

LOW: During alarm conditions, the analog signal will be 2 mA less than the configured lower range.

HIGH: During alarm conditions, the analog signal will be 2 mA more than the configured upper range.

For example, if the analog range is 4 to 20 mA and the alarm mode is set to HIGH, then during a full scale flow alarm condition, the analog output current will be 22 mA.

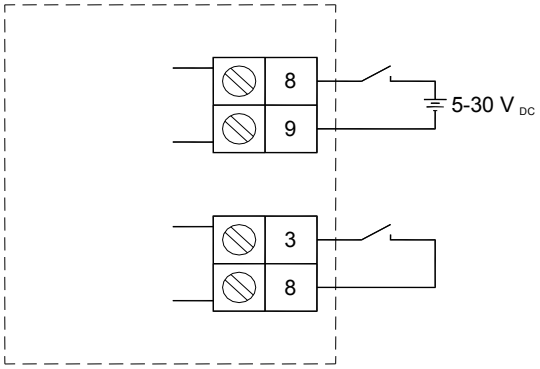
Note: This alarm mode is also valid for the empty pipe detection alarm.

5.2.3 Inputs and outputs

Digital Input

Digital input lets you reset totalizers, batches, interrupt flow measurement (Positive Zero Return) or set to ADE.

Input switching (by a normaly open contact) is provided by applying an external potential of 5 to 30 VDC or by an internal voltage source of 24 VDC via output #2.



By using the internal source, set the function of digital output #2 to “24 VDC Supply“. Jumper JP2 must be placed.

Reset Totalizer
Totalizer T2 will be reseted (only if the programmed flow direction is in uni-directional mode)

Batch Reset
Starts the dosing process.

Positive Zero Return
Stops measurement until the contact is closed (for example during a cleaning process).

ADE
Absolute Digital Encoder (ADE®). Remote meter reading technology using ASCII communications protocols. See also menu Advanced / Encoder protocol.

5.2.3 Inputs and outputs

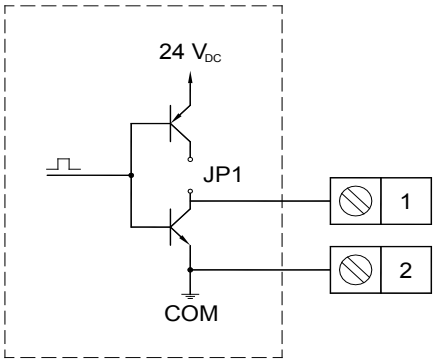
Digital Outputs

In the sub-menu “Functional operation“, you can configure functional operation of the 4 digital outputs. You can select e.g “forward pulse” for the digital output and define the pulses per totalizer unit via “pulse scale”.

Digital outputs 1 and 2

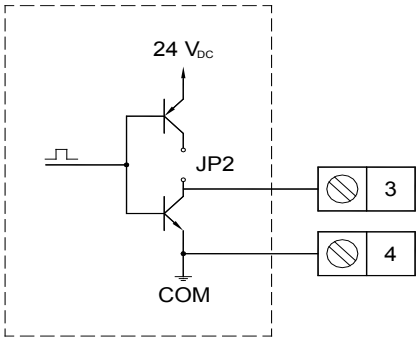
The two outputs can be operated as open collector passively or actively. Setting can be done via the hardware Jumper JP1 or JP2. Jumper placed means “active output operation“, otherwise “passive output operation“. Jumper placement on circuit board, see chapter 4.3 Configuring inputs and outputs.

Output #1



Open collector 10 KHz
Passive max. 30 VDC, 100 mA
Active 24 VDC, 50 mA

Output #2



Open collector 10 KHz
Passive max. 30 VDC, 100 mA
Active 24 VDC, 50 mA

Caution:

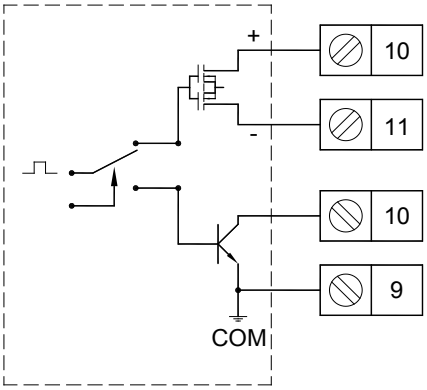
If analog output and digital output 1 and 2 (only as open collector) are used at the same time, we recommend the use of a galvanic isolation (for example Phoenix Mini-Solid-State-Relais-OPT-24 VDC/24 VDC) of the digital outputs to the external device (like SPS). This is necessary as terminal COM (2) of digital output #1 and COM (4) of digital output #2 are electrically connected to terminal 15(-) of the analog output. In this case, the meter output must be active (JP1/JP2 set) to drive the coupling relais.

Digital Outputs

Digital outputs 3 and 4

The two outputs can be operated as open collector and as relay (solid state relais SSR). You can select operating mode by programming the relative outputs (output hardware).

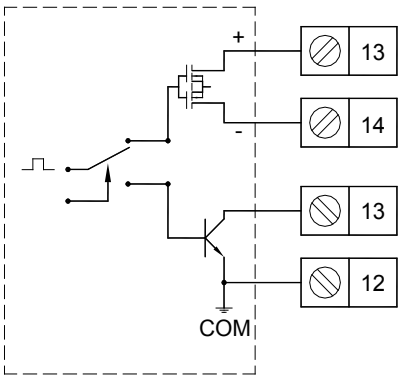
Output #3



Solid state relais
max. 48 VAC, 500 mA, 1 KHz

Open collector
Passive max.
30 VDC, 100 mA, 10 KHz

Output #4



Solid state relais
max. 48 VAC, 500 mA, 1 KHz

Open collector
Passive max. 30 VDC,
30 VDC, 100 mA, 10 KHz

Caution:

If analog output and digital output 3 and 4 are used at the same time, we recommend using the digital outputs only as “solid state relais” and not as “open collector” because terminal COM (9) of digital output #3 and COM (12) of digital output #4 are electrically connected to terminal 15(-) of the analog output. There is no electrical connection when using it as “solid state relais”.

Digital Outputs

Functional selection

The following functions can be selected for the outputs 1 to 4:

Function	Dig1	Dig2	Dig3	Dig4
Inactive	X	X	X	X
Forward pulse	X	X		
Reverse pulse	X	X		
AMR (50 ms)	X			
Frequency output	X	X	X	
Flow set point	X	X	X	X
Empty pipe alarm	X	X	X	X
Flow direction	X	X	X	X
Preset output	X	X	X	X
Error alarm	X	X	X	X
24 VDC Supply	X	X		
ADE	X			
Totalizer alarm	X	X	X	X

Inactive means digital output is switched off.

Forward pulse generates pulses during forward flow conditions.

Reverse pulse generates pulses during reverse flow conditions.

AMR (50 ms) serves for an adaptation to the "Automatic Meter Reading" system.

Frequency output generates pulses correlated to the absolute value of the flow rate.

Flow set point provides indication when flow rate exceeds thresholds defined by flow set points.

Empty pipe alarm provides indication when pipe is empty.

Flow direction provides indication on current flow direction

Preset output provides indication when preset batch amount has been realized.

Error alarm provides indication when meter has error condition.

24 VDC Supply provides constant 24 volts on output (forces output type to normally open. The jumper JP1 or JP2 must be placed (active output).

ADE Absolute Digital Encoder (ADE®). Remote meter reading technology using ASCII communications protocols. See also menu Advanced/Encoder protocol.

Totalizer Alarm is triggered by a totalizer roll over.

	Pulses/Unit 	The Pulses/Unit parameter lets you set how many pulses per unit of measure will be transmitted. The configurable range is from 0.0001 to 99.999 pulses/ volume unit, however the max. output frequency of 10,000 pulses/sec. (10 kHZ) must not be exceeded.
	Pulse Width 	This parameter establishes the “On” duration of the transmitted pulse. The configurable range ist from 0 msec to 9999 msec. If 0 msec is configured, pulse width is automatically adapted depending on pulse frequency (pulse/pause ratio 1:1). During the configuration the program checks if pulses/unit and pulse width are in accordance with full scale defined, if not an error alarm is displayed. In case of an error alarm, scale, pulse width or full scale need to be adapted.
	Preset Amount 	Preset amount lets you set the reset value for the associated PS totalizer when the digital input is set to Batch Reset. You can configure preset amounts from 0.01 to 99999.99 totalizer units in steps of 0.01 volume units. Preset amount is counted down from the configured value to 0 and a digital output shows that the preset amount has been reached. Note: You can only set one preset amount. If you set the preset amount for digital output 1, it will be the same for 2, 3 and 4.
	Flow Set Point 	The Flow Set Point (min, max) establishes as a percentage of full scale flow, the threshold at which the output alarm will be activated. You can freely select thresholds in 1% steps. Flow rates below/above the threshold will activate the output alarm.
	Output Type 	The Output Type parameter lets you set the output switch to “normally closed“ or “normally open“.
	Hardware selection 	The hardware type parameter lets you select the type of hardware used to drive the two digital outputs 3 and 4: Either passively as open collector or relay (solid state relais SSR).
	Full Scale Frequency 	This parameter establishes to define the digital output 1, 2 or 3 as frequency output. Full scale frequency can be configured from 0 to 10,000 Hz. Output hardware should be defined as open collector – otherwise problems may occur with higher frequencies (> 500 Hz).

Flow Simulation 	Flow Simulation provides analog and digital output simulation based on a percentage of the full scale flow in cases where no real flow is occurring. The range of simulation includes -100% to +100% in steps of 10% of the full scale flow. This function still remains active once you have left the menu. It is necessary to set Q on “Deactivate”. If the simulation is still active, the message “STS simulation” will be displayed in the measuring mode.

5.2.4 Clear totals	
T1 	The unidirectional totalizer T1 is reset within the menu manager.
T2 	The unidirectional totalizer T2 is reset within the menu manager or with digital input.
T+ 	The bidirectional totalizer T+ is reset within the menu manager.
T- 	The bidirectional reverse flow totalizer T- is reset within the menu manager.
TN 	The bidirectional net TN is reset within the menu manager.
VW 	The preset batch is reset within the menu manager or with digital input.
Tpwroff 	Reset the Power Off Totalizer**.** This totalizer accumulates the time which the device was switched OFF. See menu Help/Info.

5.2.5 Communications

Port A

The port configuration lets you configure how the RS232 communication port (terminal 5/6/7) will be used:

- Modbus® RTU (default)
- Remote Menu (remote control)
- Primo 3.x (emulation of the Primo interface)
- Flow Diagnostic
- Disable Port (deactivate port)

The function **Modbus RTU** allows access via a ModBus® address that you can configure from 1 to 247 in the menu “Port A Address“.

The **Remote Menu** port will check for display updates once a second. If a change is detected, the display contents will be transmitted in ASCII format over the RS232 communication port. If a suitable PC program is used, the display cannot only be displayed on the PC but the counter can also be configured.

Primo 3.x is the emulation of the former Primo amplifier interface.

Flow Diagnostic is a service tool that allows Badger Meter to acquire data from the device about the flow velocity measurements. When enabled, every flow velocity measurement is transmitted in ASCII form out the serial port and can be logged on a PC with a special program (hyperterminal or similar). These data can be analysed by the service.

Port Address 	The range of addresses supported is 1-247. Requests will only be processed if the configured port address of the meter matches with the request address found. Address 0 is processed as “broadcast packets“. Default address is [1].
Baud Rate 	The following baud rates are supported: • 9600 • 19200 • 38400 Default setting is [9600 baud].
Parity 	The following parities are supported: • Even • Odd • None Default setting is [Even]

<table>
<tr><td colspan="3">5.2.5 Communications</td></tr>
<tr><td></td><td>Data Bits
  </td><td>The following data bits are supported:
• 8 bits
• 7 bits
• 5 bits
Default settting is [8 bits]</td></tr>
<tr><td></td><td>Stop Bits
  </td><td>The following stop bits are supported:
• 1 Stop Bit
• 2 Stop Bits
Default setting is [1 Stop Bit]</td></tr>
<tr><td>Port B</td><td colspan="2">This interface is for the internal communication between the main board and the interface card for ModBus® RTU RS485, HART, Profibus DP and M-Bus. See also chapter 4.4.</td></tr>
<tr><td>Diagnostics Port A
  </td><td colspan="2">This function allows diagnostics in cases where the port ModBus® RTU is used.
<table><tr><th>Counter</th><th>Description</th></tr><tr><td>Pkts Processed</td><td>Number of packets processed by meter.</td></tr><tr><td>Broadcast Pkts</td><td>Number of broadcast packets (Address = 0) processed by meter.</td></tr><tr><td>CRC Errors</td><td>Number of received packets with CRC error; packet is discarded.</td></tr><tr><td>Pkts Rcvd</td><td>Number of packets received with an address of the configured port address</td></tr><tr><td>Pkts Sent</td><td>No. of packets transmitted in response to a received</td></tr><tr><td>Parity Errors</td><td>Number of characters with parity errors; packet is discarded.</td></tr><tr><td>Framing Errors</td><td>Number of characters with framing error (e.g. missing stop bit – synchronization problem); packet is discarded.</td></tr><tr><td>Overrun Errors</td><td>Number of received characters that were not processed due to degradation of system performance.</td></tr><tr><td>Break Detects</td><td>Number of breaks during transmission.</td></tr></table></td></tr>
</table>

5.2.6 Advanced

Datalogger

Note: For this feature is a special memory card necessary (blue memory token) which will pluged in into a memory slot on the main board. This is optional and will be not delivered with the common product.

First adjust the system clock before programing the interval time otherwise the data logging records have the wrong time stamps.

Once the system clock is configured, ensure the supplied memory token is inserted into the meter before configuring the Data Logging interval time. Configuring the interval time will format the memory token (when necessary) and assign it to the meter. This formating process can take approximately 30 seconds. A flash screen indicates if the token is being formatted.

Note: Placing this token after it has been formatted into an alternate meter will reformat the token and all previously logged data will be lost.

All logged events can be extracted from the meter using the supplied flow meter tool software, which connects the laptop to the meter via the supplied RS232 cable.

The Data Logging feature records three types of events to a memory token:

- Totalizer/error events
- Configuration change events
- Startup events (power up, power down or reset events)

Up to 10.000 totalizations, 768 configuration and start up events can be recorded.

Logging Interval 	The table below defines the capacity of the memory token: • 15 minutes (104 days) • 1 hour (1 year / 51 days) • 12 hours (13 years) • 24 hours (27 years) Over time the data logging will reach capacity of the memory token. Any new event to be recorded will overwrite the oldest event on record.
View System clock 	Display internal system clock (24-hour mode) with following format: TT/MM/JJ HH/MM/SS
Set System clock 	Configure the internal system clock using 24-hour format: TT/MM/JJ HH/MM/SS

<table>
<tr><th colspan="3">5.2.6 Advanced</th></tr>
<tr><td>Token Copy</td><td colspan="2">Note: For this feature is a special memory card necessary (red memory token) which will pluged in into a memory slot on the main board. This is optional and will be not delivered with the common product.</td></tr>
<tr><td></td><td>Configuration
  </td><td>Token properties
Write protection (ON/OFF)
Power on load (ON/OFF)
On time load (ON/OFF)
Parameter Selection
Group 0 (ALL)
Group 1 (User)
Group 2 (PRV)
Group 3 (FACT)
Group 4 (PORT A)
Group 5 (PORT B)
Group 0 (SECURATY)</td></tr>
<tr><td></td><td>Store to Token
  </td><td>Store the selected device datas at the memory token.</td></tr>
<tr><td></td><td>Restore from Token
  </td><td>Restoring data from the memory token to the device.</td></tr>
<tr><td>Encoder protocol
  </td><td colspan="2">Disabled
V1
V2
Absolute Digital Encoder (ADE®). Remote meter reading technology using ASCII communications protocols.</td></tr>
<tr><td>Totalizer Dial
  </td><td colspan="2">4-dial up to 10-dial

Select the number of digits how the totalizer should be displayed.
For example 6-dial will be displayed with 6 total digits like
12.3456 m³/h.

Note: A totalizer roll over can be indicated by a totalizer alarm via the digital output (see Digital Output / Functional selection)

See also Totalizer Resolution.</td></tr>
</table>

5.2.6 Advanced

Totalizer Resolution

This function lets you define totalizers' formatting. You can select among the following formats:

Format	
0.0001	1
0.001	10
0.01	100
0.1	1000

With this function, the best possible resolution is automatically chosen.

For example:
7-dial and resolution 0.001 is indicated 1234.567 m³/h
7-dial and resolution 0.1 is indicated 123456.7 m³/h

Note: A totalizer roll over can be indicated by a totalizer alarm via the digital output (see Digital Output / Functional selection)

Backlight Control

You can set the meter's backlight to "Aways On", "Always Off" or "Time (1 min)".

When set to "Time (1 min)", the backlight will automatically turn off after one minute of inactivity (no buttons pressed). Pressing one of three buttons will turn the backlight on.

Note: A longer operation with the option „always on" can have a negative effect on LCD's life.

Analog Calibrate

The analog output has already been set at the factory. An additional calibration is not necessary.

Custom settings

Use this function in the case that you wish to adapt the output to your external system. Enter the offset value for the 4 mA and 20 mA signal.

First select "Set 4 mA Offset" and enter the difference to 4 mA. In the case that your system shows 3.70 mA instead of 4.00 mA, enter the difference of -00.30 mA as corrective factor. Do the same with "Set 20 mA Offset" to correct the offset.

Factory setting

The analog output has already been set at the factory to exactly 4.00 mA (zero) and 20.00 mA (margin). This function is used for a recalibration of the analog output. Don't use this function to adapt the value to your external system – use instead the custom settings.

5.2.6 Advanced

Software Filter 	**MDN-Filter** The Median filter smoothes out short-term fluctuations. The filter level can be adjusted from S0 (off) to S9.	
	ACC-Filter This filter is intended to help eliminate unrequested peaks during measurement.	
	Activation	Activates or deactivates the software filter
	Filter Delay	Filter Delay lets you set the amount of time that the flow will be held constant once the filter is activated (change of flow per time unit).
	Acceleration Factor	This parameter lets you set the maximum acceleration for a given pipe diameter (change of flow per time unit). If the realized fluid acceleration exceeds the configured maxi-mum acceleration, fluid flow will be held constant for the time set at the Filter Delay parameter.
	Constant Flow	This parameter lets you set the acceleration limit for a constant flow.
	Peak Detect	Peak Defect offers a diagnostic view of acceleration components observed during flow condition and records the “high water mark“. Press **+** button to reset.
	ZFS-Filter Zero Flow Stability Filter. A specific volume is defined which must be totalized during a defined time window. If this is not fulfilled, the measured volume during this time will be ignored. The actual situation can be monitored with this status function.	
	IIR-Filter Adaptive noise filtering used by the service people only.	

5.2.6 Advanced	
Empty Pipe Cal. 	Note: To compensate different fluid conductivity, signal cable lengths or sizes during measurements, you can calibrate them accordingly. This is important in case that fluid monitoring has been activated and “empty pipe” is signalized although the pipe is filled. Proceed as follows: 1. Select “Empty Pipe Cal“ 2. Set calibration to “CAl [on]“ 3. Observe the voltage “Volt“ 4. When stable, select “Store“ and press **E** 5. Fill pipe with fluid 6. Select “Cal. Pipe Full“ 7. Set calibration to “Cal [AN]“ 8. Observe the voltage “Volt“ 9. When stable, select “Store“ and press **E**
Password Security	There are three possible access levels, each with its own unique password: • Administrartor PIN  • Service PIN  • User PIN  The password security consists of a five-digit PIN and is set at the factory to [00000]. Enter a number above zero to activate password security. Activate password security in the following order: Administrator, Service, User. Note: You cannot activate the user password before administrator and service passwords have been activated. About 5 minutes after configuration, password security becomes active. As soon as password security has become active, a PIN is required for configuration. Depending on the individual PINs, you are either in the administrator, service or user levels with corresponding access rights (identified in the operating manual by the lock A, S and B).

5.2.7 Info/Help

Error Counts

The following list gives you an overview about the kind and frequency of various messages and hence provides a diagnostic of the counter or the measuring point.

Prior to any diagnostic, we suggest to reset the individual parameters in order to exclude impacts occurring due to installation, maintenance or other anormal operation conditions.

You can reset the individual parameters by selecting them with the cursor and by pressing **E**. Select “number“ and press **E** [J]. Select „store“ and press again **E**.

Detector	The number of times an invalid detector condition has been observed
Empty Pipe	The number of times an empty pipe condition has been observed by the meter
Full Scale	The number of times the flow has exceeded the full scale setting
Totalizer	The number of times the totalizers have exceeded limits of the meter
Pulse Sync.	The number of times the pulse outputs have fallen out of synchronization
ADC Interrupt	The number of times an analog input measurement has been missed
ADC Range	The number of times the analog input measurement range has been exceeded
System Error	A diagnostic system message indicating the reason for a system reset
System Resets	The number of times the meter has been reset
System Reset ID	Diagnostic information about a system reset as a result of expired internal timers

PowerUp Counter	The number of times that the unit has been powered on.
Power Off Totalizer	The totalizer accumulates the time which the device was switched OFF. This time can be reset by the function “Reset Totalizer -> Tpwroff“
Version info	The current software version of the unit.
Serial number	The manufacturing serial number of the installed electronics in the format YYMM####.
Meter Tag Name	Customer tag name. Programmed via the interface modules.
Daughterboard Info	Information about the plugged in interface board (HART, Profibus, etc.).
Polariztation Voltage	Measure electrode polarizing voltage in ± V (just for service purpose)
Restore Default	Restores all non-calibrated parameters to the factory defaults.

5.2.8	**Language Select**
Language select 	The unit supports English along with one alternate language. The alternate language choice is set at the factory.

6. Troubleshooting

Error messages can be displayed via the 4 digital outputs. By means of the error list type and frequency of the errors can be logged and analyzed, also see chapter Programming: Info/Help.

Menu Manager Configuration Errors		
Error	**Description**	**Recommended Action**
110	**Output ½:** Pulse Output Configuration Error	This error is observed when improperly configuring the full scale flow, pulse per unit, or pulse width. This error can indicate the following configuration violations: 1. Pulse frequency exceeds limits at full scale flow 2. Pulse duty cycle is less than 50% at full scale flow (pulse on time >pulse off time) Pulse frequency limit is 10 kHz. However, with a non-zero pulse width configuration, the limit is 500 Hz to achieve a 50% pulse duty cycle. If not using the pulse outputs, set the pulses per unit to zero to allow for reconfiguration of the full scale flow. If it is required to use the pulse outputs, reevaluate the pulse output configuration. Consider recording and clearing totalizers prior to changing totalizer units.
120	**Display:** Totalizer Conversion Error – Totalizer cannot be properly converted for display	This error is observed shile trying to change the totalizer units. Limits of display will prevent improber configuration fo the volume unit dependent on current totalizer values. Consider recording and cleaning totalizers prior to changing totalizer.
121	**Output ½:** Pulse Output Configuration Error	This error is observed when changing the totalizer untis of measure. This error implies the pulse configuration exceeds limits (see error 110). Please note the pulses per unit is not automatically updated on volume unit reconfiguration. The pulses per unit should be manually changed to accommodate the desired units of measure. It may be necessary to set the pulses per unit to zero then change to the deired totalizer units.
140	**Output 3:** Configuration Error – Full scale frequency exceeds limits of relay (1000 Hz)	Reduce full scale frequency setting of output when hardware is configured for relay operation.
150	**Output 3:** Configuration Error – Full scale frequency exceeds limits (10 kHz)	Reduce full scale frequency setting of output when hardware is configured for open collector operation.

The following error messages can be displayed:

Description	Possible Cause	Recommended Action
Err: Coil	▪ Meter not connected. ▪ Connection to meter interrupted. ▪ Detector electronics or coils defective.	Check if meter is connected and make sure that cable connection is not interrupted. Otherwise contact Service Department.
Wrn: Pulse Sync	False synchronization of pulse output	
Err: empty pipe	Pipe may not be full.	Make sure that pipe is always filled at the measuring point. Eventually calibrate anew, see calibration of fluid monitoring
Err: full scale	Actual flow rate is exceeding the programmed.	Reduce flow rate or increase the programmed full scale.
Err: ADC range	Input signal from detector too high.	Check the grounding scheme of the meter installation. See grounding section in manual.
Err: Tot. rollover	Number of totalizer digits is exceeded	See programming / Info/Help / Totalizer Rollover
Err: ATOD INT	No measuring signal on analog input.	Contact service.

Some frequently occurring errors are listed in the following:

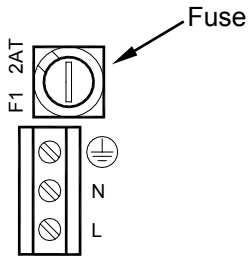
Other error	Possible Cause	Recommended Action
Meter does not function	▪ No auxiliary power. ▪ Fuse defective.	▪ Provide auxiliary power. ▪ Replace fuse.
Fluid is flowing, however display shows zero	▪ Signal cable is not connected or connection is interrupted. ▪ Detector installed opposite to forward flow direction (see arrow on type plate). ▪ Connection cable for coils or electrodes mixed-up.	▪ Check signal cable. ▪ Turn detector by 180°. ▪ Check connection cable.
Inaccurate measurement	▪ Wrong parameters. ▪ Pipe not completely full.	▪ Check parameters (detector, amplifier and size) as per annexed data sheet ▪ Check if measuring pipe completely full.

When one of the errors occurs, the meter stops measuring until the error disappears; then the meter continues to measure.

6.1 Replacing the fuse

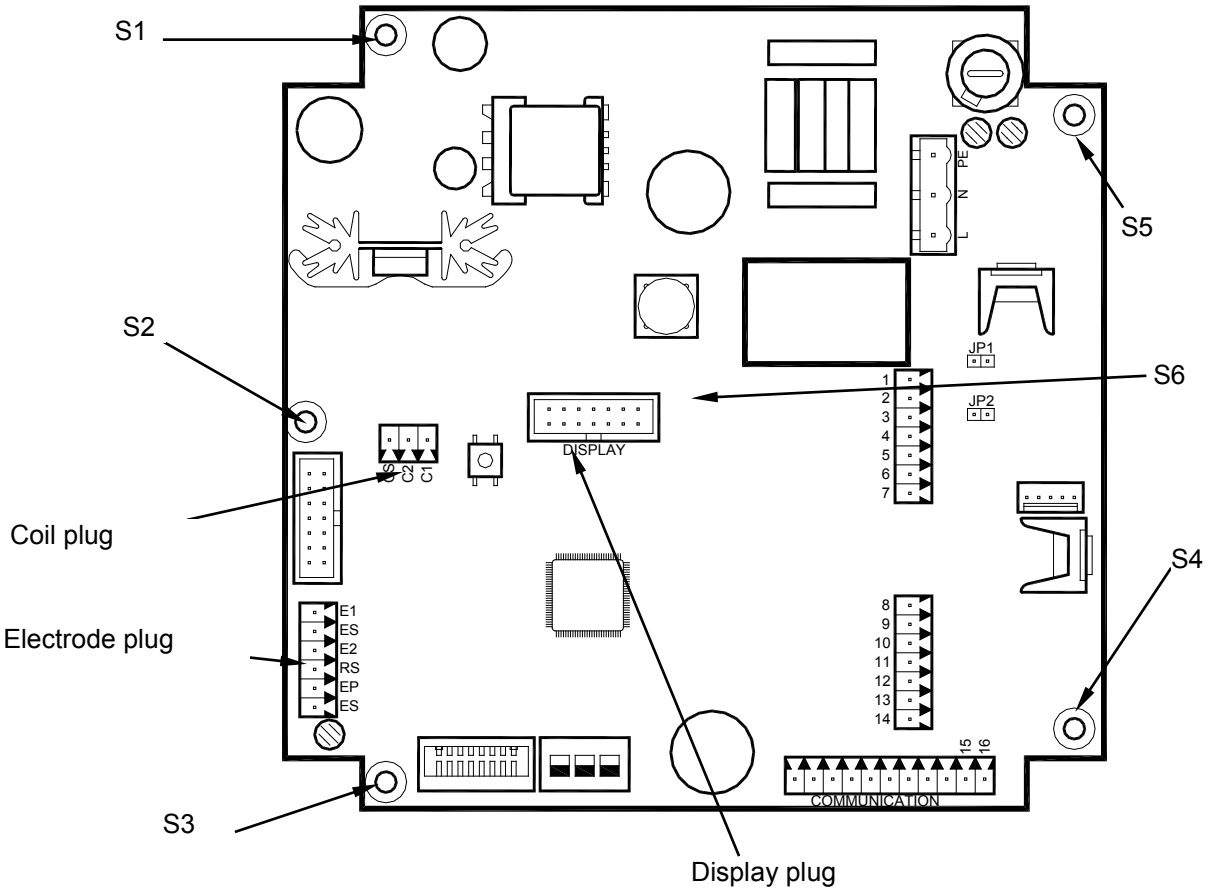
Warning: • *Disconnect main power to the unit before replacing the fuse.*

Fuse type: T2 H 250 V (2A idle)



6.2 Replace meter's electronics

Warning: • *Disconnect auxiliary power before opening body cover.*



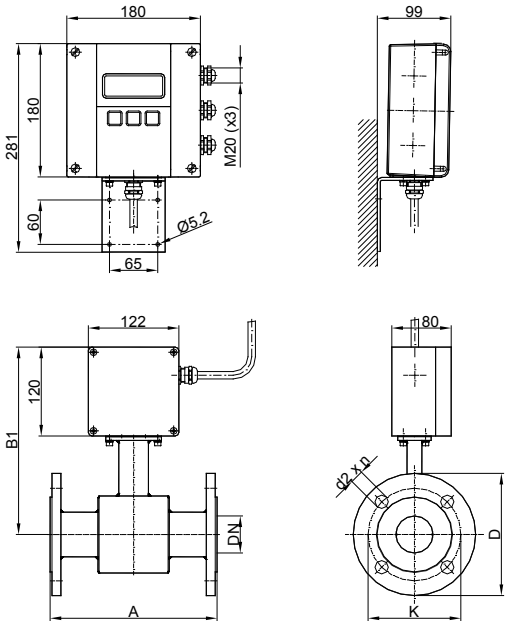
1. Pull out electrode, coil and display plugs. Loosen screws S1-S6 and take out circuit board.
2. Insert new circuit board and fix it by fastening the screws S1-S6. Plug again the three plugs.
3. If necessary, configure new circuit board related to the available meter (detector, size).

7. Technical data

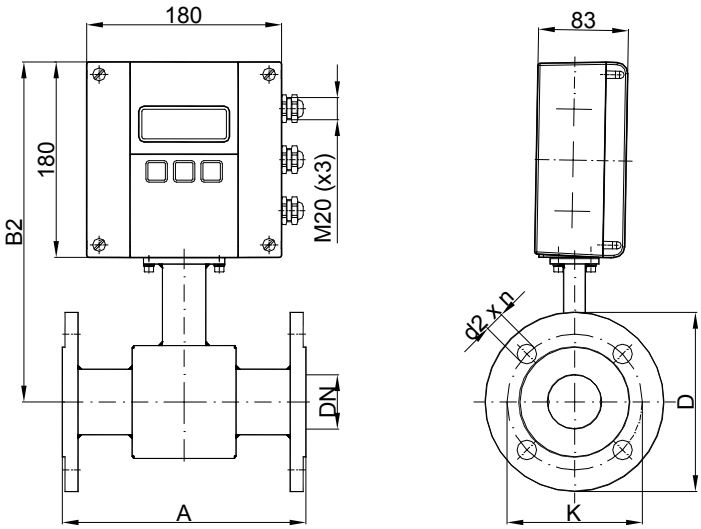
7.1 Detector Type II

Technical data			
Size	DN 6 – 2000 (1/4“...80“)		
Process connections	Flange: DIN, ANSI, JIS, AWWA etc.		
Nominal pressure	Up to PN 100		
Protection class	IP 67, IP 68 optional		
Min. conductivity	5 µS/cm (20 µS/cm demineralized water)		
Liners	Hard/soft rubber	from DN 25 onward	0 to +80°C
	PTFE	DN 6 - 600	-40 to +150°C
	Halar (ECTFE)	ab DN 300	-40 to +150°C
Electrodes	Hastelloy C (Standard) Tantalum	Platinum/Gold platinized Platinum/Rhodium	
Body	Steel/stainless steel optional		
Overall length	DN 6 – 20	170 mm	
	DN 25 – 50	225 mm	
	DN 65 – 100	280 mm	
	DN 125 – 200	400 mm	
	DN 250 – 350	500 mm	
	DN 400 – 700	600 mm	
	DN 750 – 1000	800 mm	
	DN 1200 – 1400	1000 mm	
	DN 1600	1600 mm	
	DN 1800	1800 mm	
	DN 2000	2000 mm	

Process connection flange
M2000® wall mounting



Process connection flange
M2000® mounted version



DN		A Std*	A ISO**	B1	B2	ANSI flanges			DIN flanges		
						∅ D	∅ K	∅ d2xn	∅ D	∅ K	∅ d2xn
6	1/4”	170	---	228	288	88,9	60,3	15,9 x 4	90	60	14 x 4
8	3/10”	170	---	228	288	88,9	60,3	15,9 x 4	90	60	14 x 4
10	3/8”	170	---	228	288	88,9	60,3	15,9 x 4	90	60	14 x 4
15	1/2”	170	200	238	298	88,9	60,3	15,9 x 4	95	65	14 x 4
20	3/4”	170	200	238	298	98,4	69,8	15,9 x 4	105	75	14 x 4
25	1”	225	200	238	298	107,9	79,4	15,9 x 4	115	85	14 x 4
32	1 1/4”	225	200	253	313	117,5	88,9	15,9 x 4	140	100	18 x 4
40	1 1/2”	225	200	253	313	127	98,4	15,9 x 4	150	110	18 x 4
50	2”	225	200	253	313	152,4	120,6	19 x 4	165	125	18 x 4
65	2 1/2”	280	200	271	331	177,8	139,7	19 x 4	185	145	18 x 4
80	3”	280	200	271	331	190,5	152,4	19 x 4	200	160	18 x 8
100	4”	280	250	278	338	228,6	190,5	19 x 8	220	180	18 x 8
125	5”	400	250	298	358	254	215,9	22,2 x 8	250	210	18 x 8
150	6”	400	300	310	370	279,4	241,3	22,2 x 8	285	240	22 x 8
200	8”	400	350	338	398	342,9	298,4	22,2 x 8	340	295	22 x 12
250	10”	500	450	362	422	406,4	361,9	25,4 x 12	395	350	22 x 12
300	12”	500	500	425	485	482,6	431,8	25,4 x 12	445	400	22 x 12
350	14”	500	550	450	510	533,4	476,2	28,6 x 12	505	460	22 x 16
400	16”	600	600	475	535	596,9	539,7	28,6 x 16	565	515	26 x 16
450	18”	600	---	500	560	635,0	577,8	31,7 x 16	615	565	26 x 20
500	20”	600	---	525	585	698,5	635,0	31,7 x 20	670	620	26 x 20
550	22”	600	---	550	610	749,3	692,1	34,9 x 20	---	---	---
600	24”	600	---	588	648	812,8	749,3	34,9 x 20	780	725	30 x 20
650	26”	600	---	613	673	869,9	806,4	34,9 x 24	---	---	---
700	28”	600	---	625	685	927,1	863,6	35,1 x 28	895	840	30 x 24
750	30”	800	---	650	710	984,2	914,4	34,9 x 28	---	---	---
800	32”	800	---	683	743	1060,5	977,9	41,3 x 28	1015	950	33 x 24
850	34”	800	---	708	768	1111,2	1028,7	41,3 x 32	---	---	---
900	36”	800	---	725	785	1168,4	1085,8	41,3 x 32	1115	1050	33 x 28
950	38”	800	---	750	810	1238,3	1149,4	41,3 x 32	---	---	---
1000	40”	800	---	790	850	1346,2	1257,3	41,3 x 36	1230	1160	36 x 28
1200	48”	1000	---	900	960	1511,5	1422,4	41,3 x 44	1455	1380	39 x 32
1350	54”	1000	---	975	1035	1682,8	1593,9	47,8 x 44	---	---	---
1400	56”	1000	---	1000	1060	---	---	---	1675	1590	42 x 36

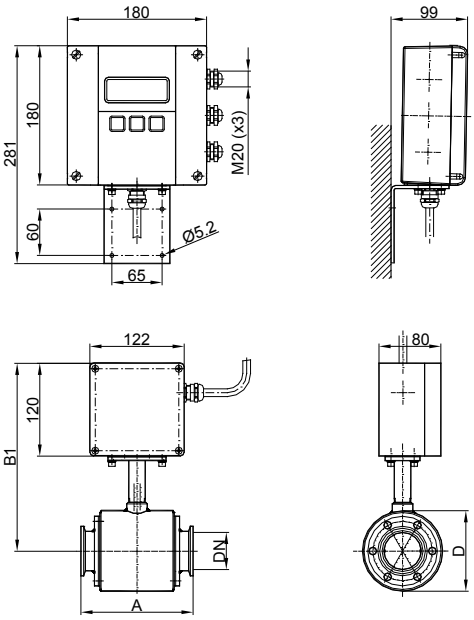
Standard		
ANSI flanges	from DN 6 - 2000	pressure 150 lbs
DIN flanges	from DN 6 – 200	pressure PN 16
	from DN 250 – 2000	pressure PN 10

* Standard **ISO 13359

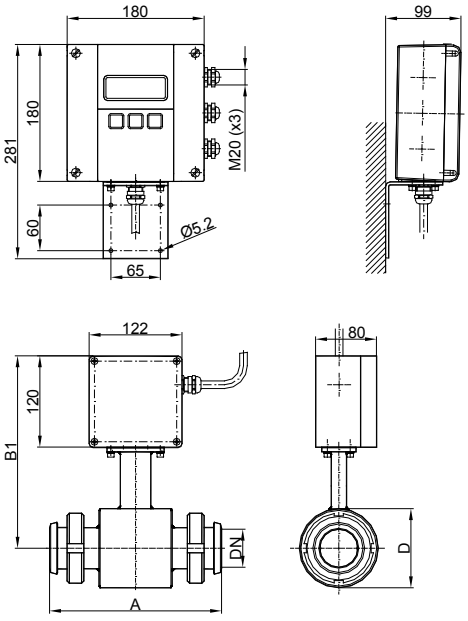
7.2 Detector type Food

Technical data			
Size	DN 10 – 100 (3/8“...4“)		
Process connections	Tri-Clamp®, DIN 11851, ISO 2852, etc.		
Nominal pressure	PN 10		
Protective class	IP 65, IP 68 optional		
Min. conductivity	5 µS/cm (20 µS/cm demineralized water)		
Liners	PTFE	-40 to +150°C	
Electrodes	Hastelloy C (Standard) Tantalum	Platinum/Gold platinized Platinum/Rhodium	
Body	Stainless steel		
Overall length	Tri-Clamp® connection	DN 10 – 50	145 mm
		DN 65 – 100	200 mm
	DIN 11851 connection	DN 10 – 20	170 mm
		DN 25 – 50	225 mm
		DN 65 – 100	280 mm

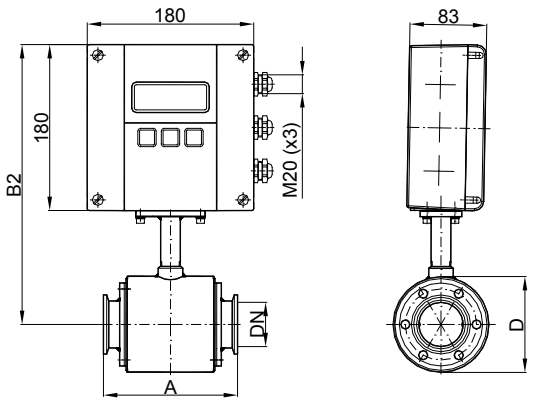
Process connection Tri-Clamp®
M2000® wall mounting



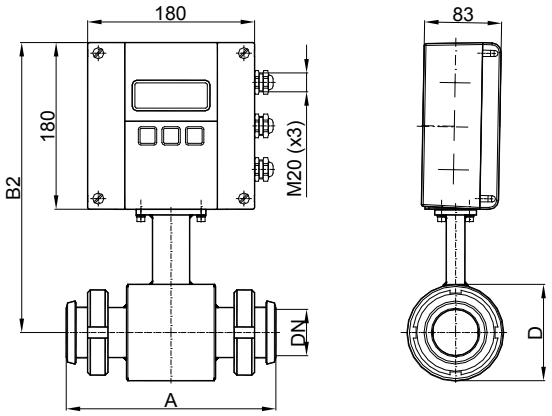
Process connection DIN 11851
M2000® wall mounting



Process connection Tri-Clamp®
M2000® mounted version



Process connection DIN 11851
M2000® mounted version



Type Food Tri-Clamp®

DN		A	B1	B2	D
10	3/8”	145	228	174	74
15	1/2”	145	228	174	74
20	3/4”	145	228	174	74
25	1”	145	228	174	74
40	1 ½“	145	238	184	94
50	2”	145	243	189	104
65	2 ½“	200	256	202	129
80	3”	200	261	207	140
100	4”	200	269	215	156
Pressure PN 10			Dimensions (mm)		

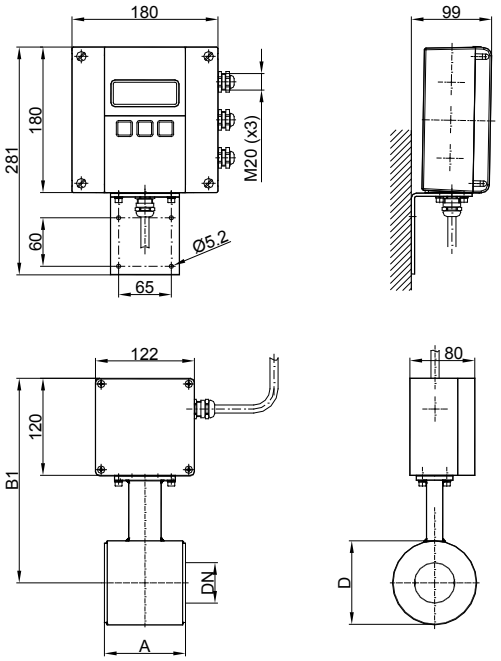
Type Food Milk Pipe DIN 11851

DN		A	B1	B2	D
10	3/8”	170	238	184	74
15	1/2”	170	238	184	74
20	3/4”	170	238	184	74
25	1”	225	238	184	74
32	1 ¼“	225	243	189	84
40	1 ½“	225	248	194	94
50	2”	225	253	199	104
65	2 ½“	280	266	212	129
80	3”	280	271	217	140
100	4”	280	279	225	156
Pressure PN 16			Dimensions (mm)		

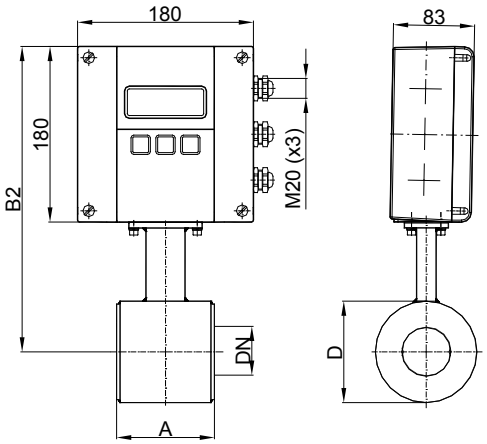
7.3 Detector Type III

Technical Data		
Size	DN 25 – 100 (1“...4“)	
Process connections	Sandwich connection, (intermediate flange mounting)	
Nominal pressure	PN 40	
Protective class	IP 67, IP 68 optional	
Min. conductivity	5 µS/cm (20 µS/cm demineralized water)	
Liner	PTFE	-40 to +150°C
Electrodes	Hastelloy C (Standard) Tantalum	Platinum/Gold platinized Platinum/Rhodium
Body	Steel/stainless steel optional	
Overall length	DN 25 – 50	100 mm
	DN 65 – 100	150 mm

Sandwich connection
M2000® wall mounting



Sandwich connection
M2000® mounted version

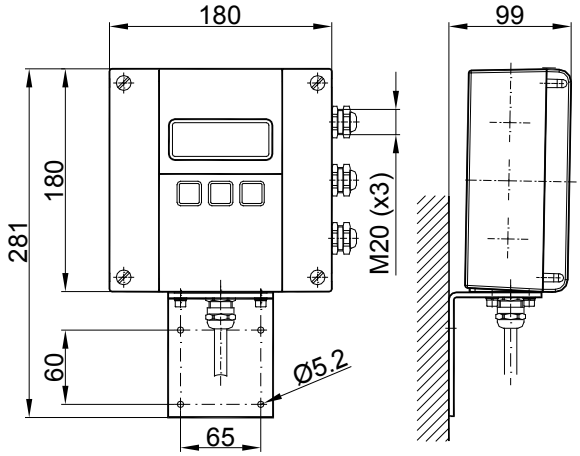


DN		A	B1	B2	D
25	1”	100	238	184	74
32	1 ¼“	100	243	189	84
40	1 ½“	100	248	194	94
50	2”	100	253	199	104
65	2 ½““	150	266	212	129
80	3”	150	271	217	140
100	4”	150	279	225	156
Pressure PN 40					

7.4 Meter type M2000

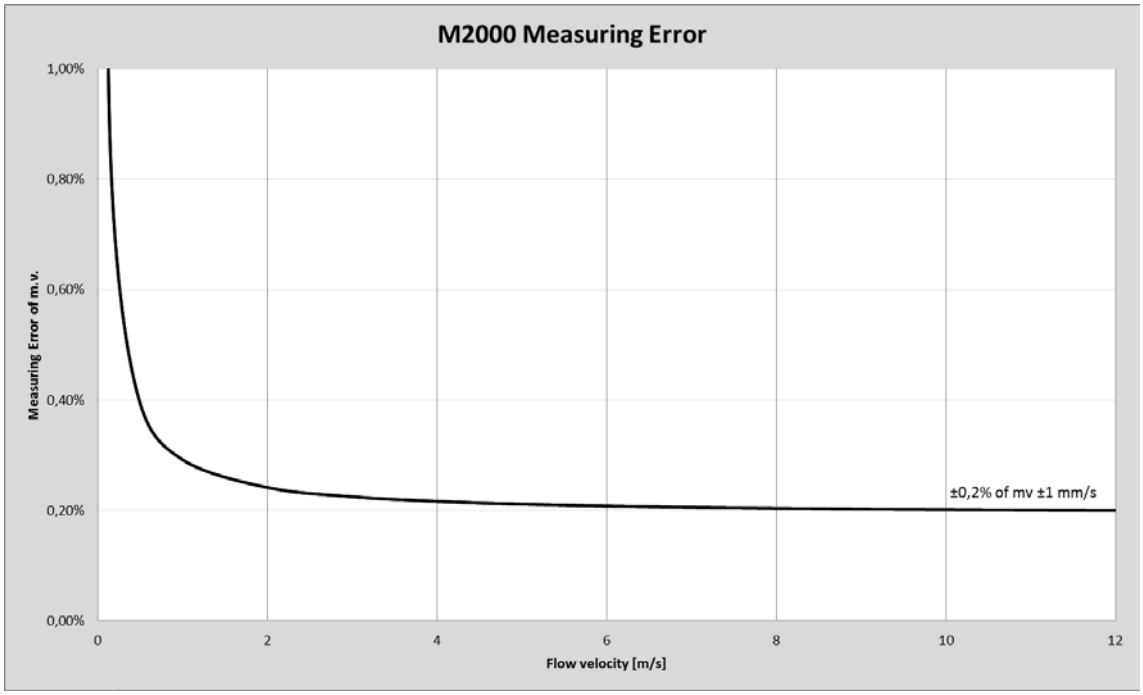
Technical data	
Type	M2000
Auxiliary power	85 – 265 VAC, 45 – 65 Hz Optional 9 - 36 VDC
Analog output	0/4 – 20 mA, ≤ 800 Ohm
	Flow direction is displayed via separate status output
Digital outputs	4 freely configurable open collector outputs Active 24 V, 50 mA or Passiv 30 VDC, 100 mA max. frequency of 10 kHz Optional 2 solid state relais 48 VAC, 500mA Pulse, limit, preselector, status, error messages
Digital inputs	Totalizers and preselectors reset Positive Zero Return
Fluid monitoring	Separate electrode
Configuration	3 buttons
Interface	RS 232/RS845 ModBus® RTU, HART, Profibus DP, M-Bus
Measuring range	0,03 to 12 m/s
Measuring accuracy	±0,2% of m.v. ±1 mm/s
Reproducibility	0,1%
Flow direction	Bidirectional
Pulse length	Configurable up to 2000 msec.
Outputs	Short-circuit-proof and galvanically separated
Low flow cutoff	0 – 10%
Display	LCD, 4 lines/20 digits, backlight, actual flow rate, totalizers, status display
Datalogger	Optional 32 MB/10.000 data records
Store/Restore	Optional memory for detector and amplifier data
Body	Powder-coated alu die casting
Protective class	IP 67
Cable inlet	Supply and signal cables 3 x M20
Signal cable	From meter M20
Ambient temperature	-20 to + 60°C

Dimensions M2000®



7.5 Error limits

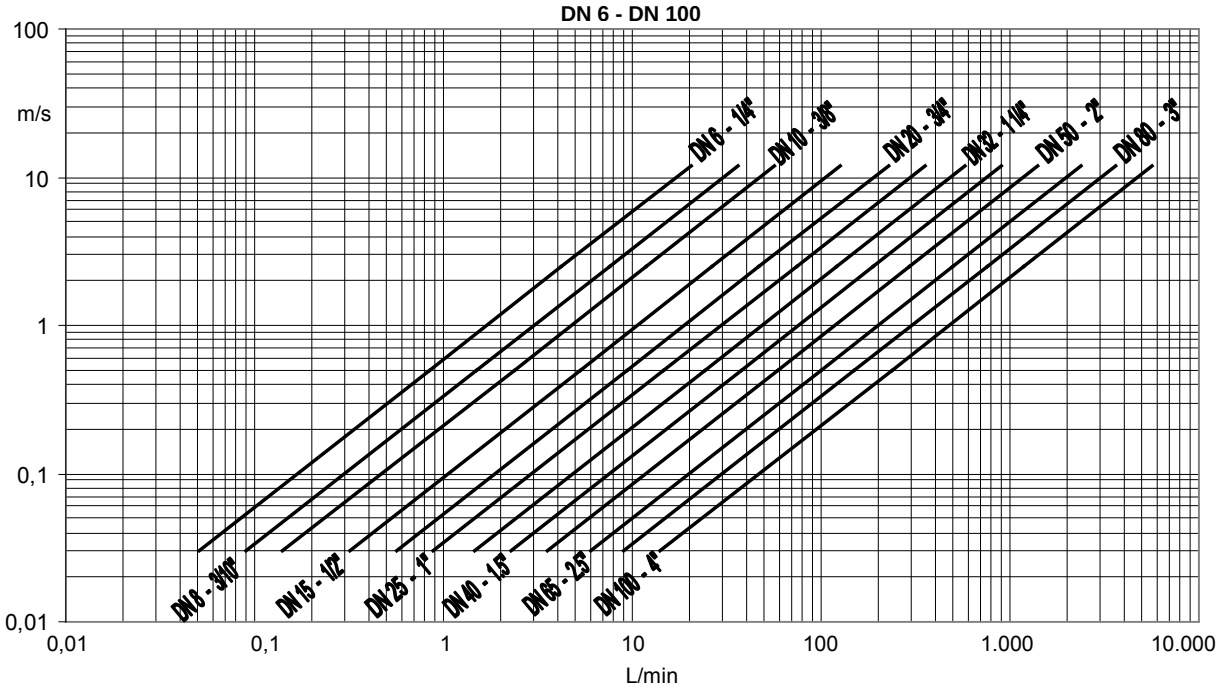
Measuring range	:	0,03 m/sec. to 12 m/sec.
Pulse output	:	±0,2% of m.v. ±1 mm/s
Analog output	:	Similar to pulse output plus ±0,01 mA
Reproducibility	:	±0,1%

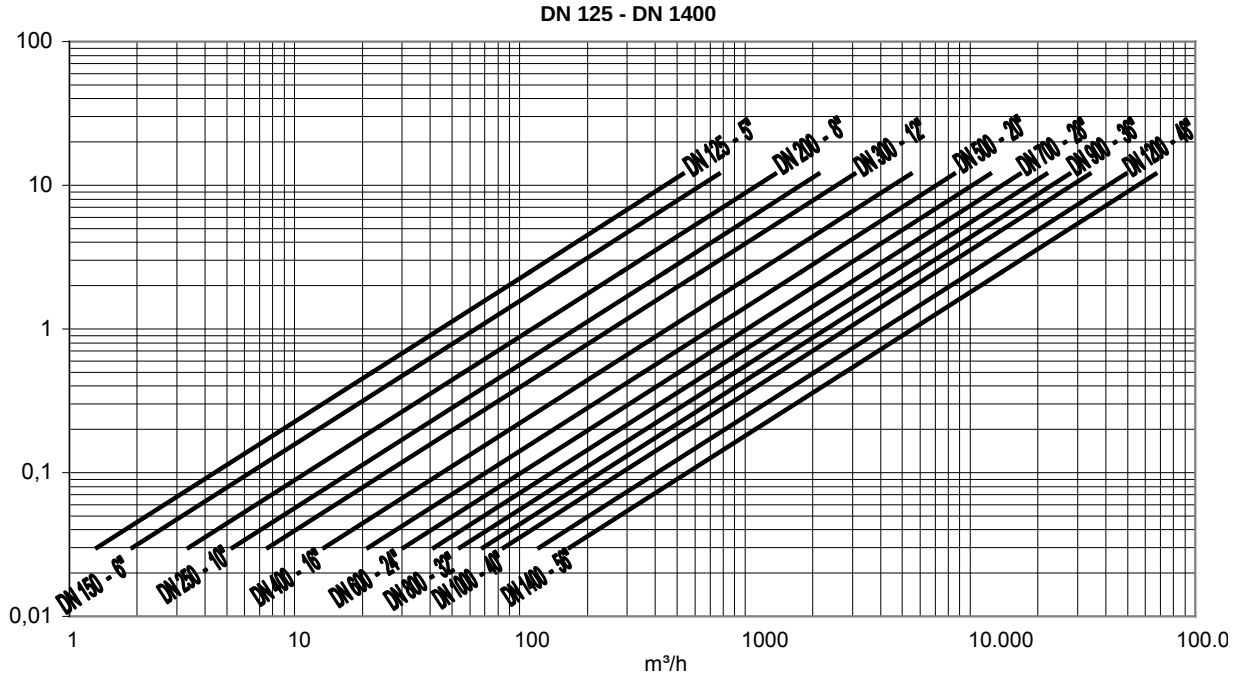


Reference conditions:

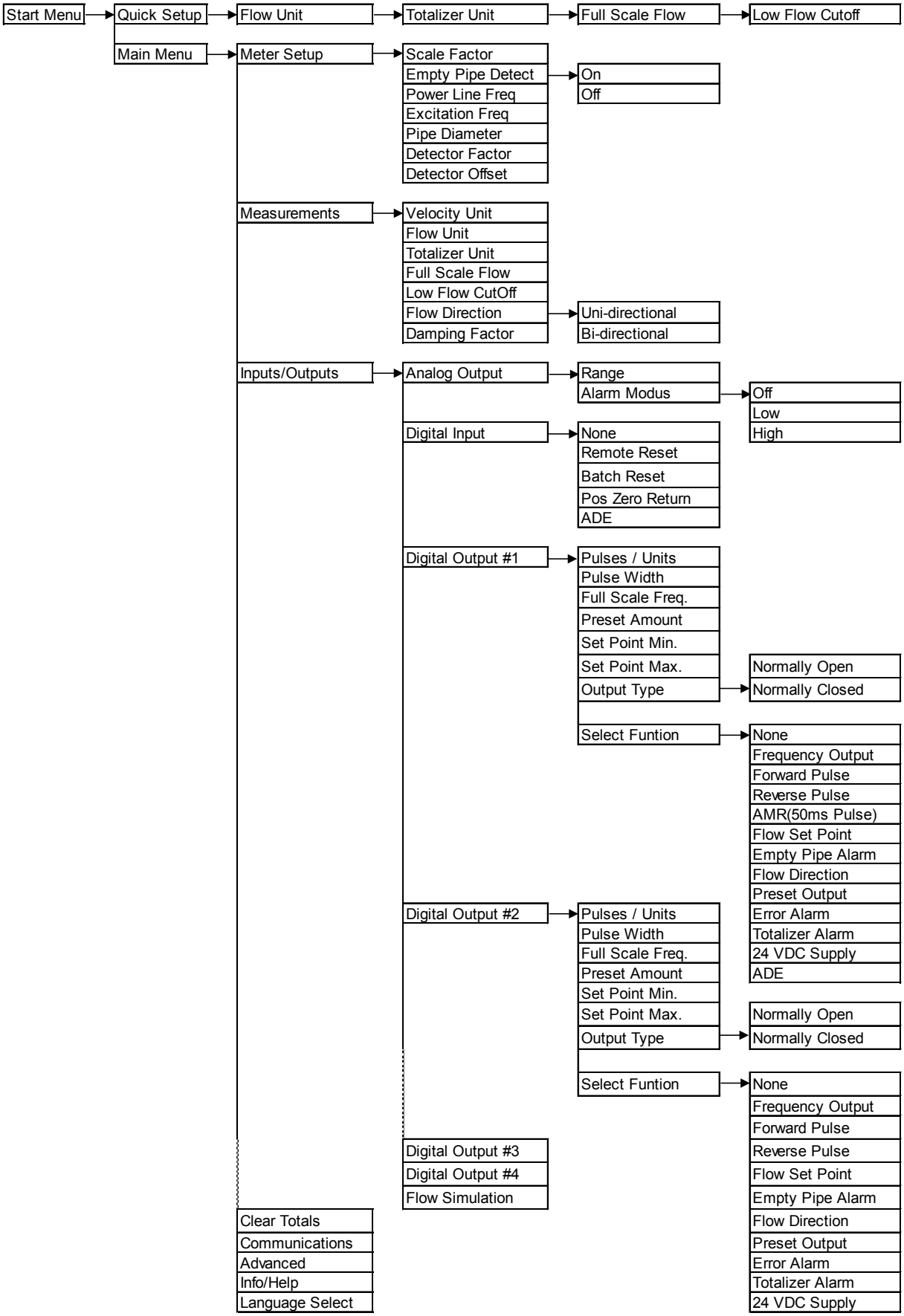
Ambient and fluid temperature	:	20°C
Electr. conductivity	:	> 300 µS/cm
Warm-up period	:	60 min
Mounting conditions	:	> 10 DN inlet pipe > 5 DN outlet pipe Detector properly grounded and centered.

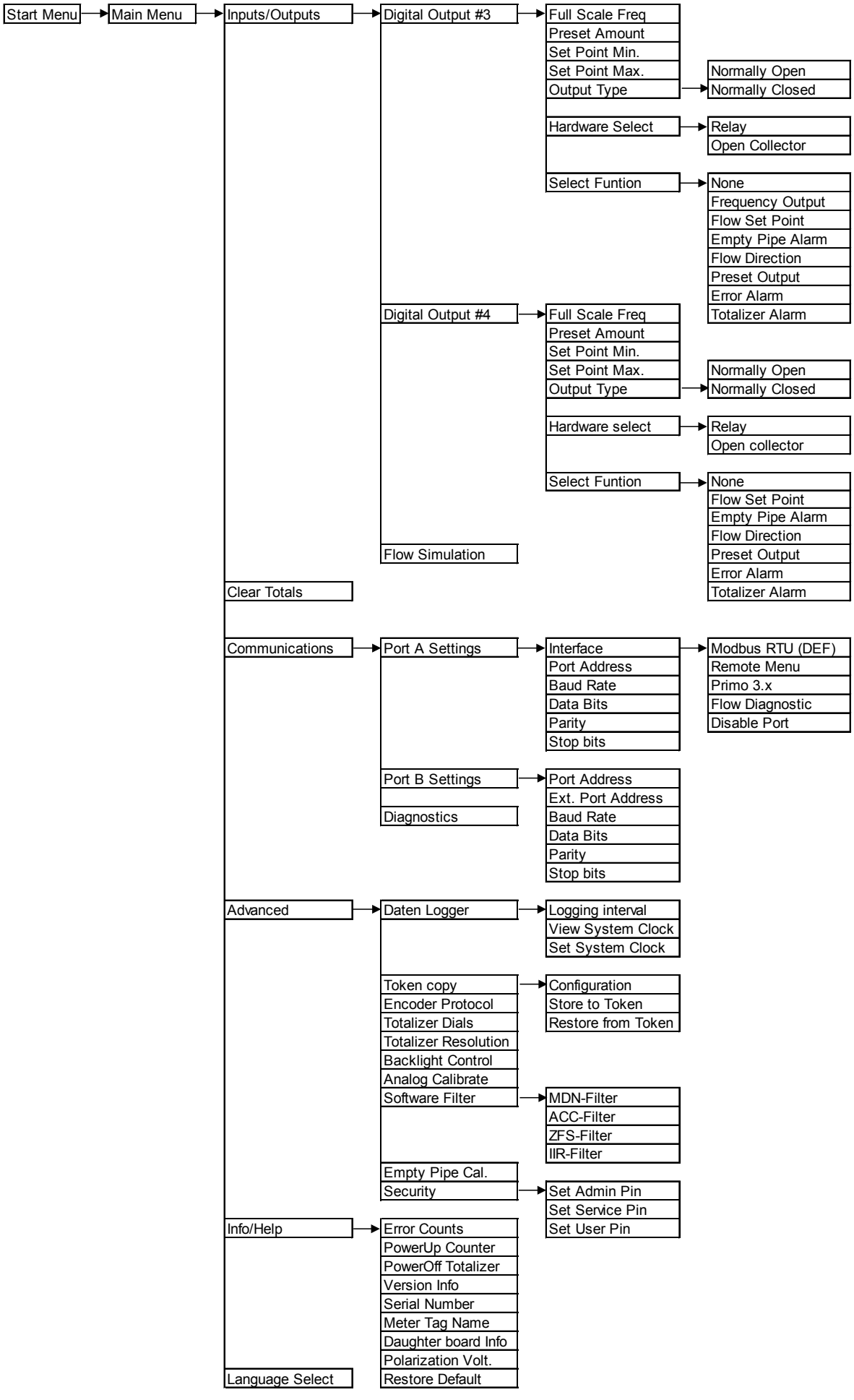
7.6 Size select





8. Program structure




Start Menu
Main Menu
Inputs/Outputs
Digital Output #3
Full Scale Freq
Preset Amount
Set Point Min.
Set Point Max.
Output Type
Normally Open
Normally Closed
Hardware Select
Relay
Open Collector
Select Funtion
None
Frequency Output
Flow Set Point
Empty Pipe Alarm
Flow Direction
Preset Output
Error Alarm
Totalizer Alarm
Digital Output #4
Full Scale Freq
Preset Amount
Set Point Min.
Set Point Max.
Output Type
Normally Open
Normally Closed
Hardware select
Relay
Open collector
Select Funtion
None
Flow Set Point
Empty Pipe Alarm
Flow Direction
Preset Output
Error Alarm
Totalizer Alarm
Flow Simulation
Clear Totals
Communications
Port A Settings
Interface
Port Address
Baud Rate
Data Bits
Parity
Stop bits
Modbus RTU (DEF)
Remote Menu
Primo 3.x
Flow Diagnostic
Disable Port
Port B Settings
Diagnostics
Port Address
Ext. Port Address
Baud Rate
Data Bits
Parity
Stop bits
Advanced
Daten Logger
Logging interval
View System Clock
Set System Clock
Token copy
Encoder Protocol
Totalizer Dials
Totalizer Resolution
Backlight Control
Analog Calibrate
Software Filter
Configuration
Store to Token
Restore from Token
MDN-Filter
ACC-Filter
ZFS-Filter
IIR-Filter
Empty Pipe Cal.
Security
Set Admin Pin
Set Service Pin
Set User Pin
Info/Help
Error Counts
PowerUp Counter
PowerOff Totalizer
Version Info
Serial Number
Meter Tag Name
Daughter board Info
Polarization Volt.
Restore Default
Language Select

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