Badger Meter Europa GmbH

ModMAG® M1500

INSTRUCTION AND OPERATION MANUAL

June 2008

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1. Basic safety recommendations

The electromagnetic flow meter is only suitable for the measurement of conductive fluids. The manufacturer is not liable for damages that result from improper or not in accordance with the requirements use.

The meters are constructed according to state-of-the-art technology and tested operationally reliable. They have left the factory in a faultless condition concerning safety regulations.

The mounting, electric installation, taking into operation and maintenance of the meter may only be carried out by suitable technicians. Furthermore the operating personnel has to be trained by the operating authority and the instructions of this manual have to be followed.

Basically, you have to respect the regulations for the opening and repairing of electrical equipment valid in your country.

Repairs

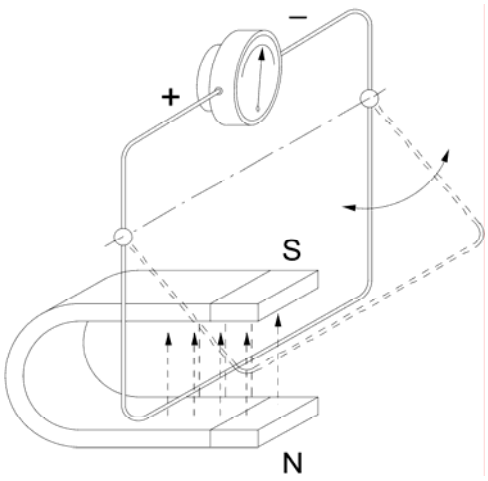
Should you send back a flow meter in operation, please take notice of the following points:

- Please enclose a description of the error as well as a precise statement of the measured medium (if necessary a safety specification sheet).
- The meter has to be in a cleaned condition (outside and inside). Especially with harmful measuring mediums you have to pay attention that there are no impurities in the pipe or at the connections.
- If it is not possible to clean the meter completely, particularly with harmful materials, do not send back the meter.

We reserve the right to repair only cleaned meters. Costs, which result from insufficient cleaning, will be charged to you.

2. Description

The electromagnetic flow meters are ideally suited for flow measurement of all liquids with a minimum conductivity of 5 μS/cm. These meters are very accurate and the flow measurement is independent of density, temperature and pressure of the medium.



Measuring principle

The operating principle of the electromagnetic flow meter is based on Faraday's law of magnetic induction: The voltage induced across any conductor, as it moves right angles through a magnetic field, is proportional to the velocity of that conductor. The voltage induced within the fluid is measured by two diametrically opposed internally mounted electrodes. The induced signal voltage is proportional to the product of the magnetic flux density, the distance between the electrodes and the average flow velocity of the fluid.

3. Installation

Warning:
- *The installation notices described below must be followed in order to ensure the operativeness and the safe operation of the meter.*

3.1 General

3.1.1 Temperature ranges

Attention:
- *In order to prevent damage to the meter, the maximum temperature ranges of the detector and amplifier have to be observed absolutely.*
- *You have to provide a protection from direct insolation in regions with very high ambient temperatures.*
- *At a medium temperature higher than 100°C the amplifier has to be separated from the detector (remote version).*

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

3.1.2 Protection class

In order to guarantee the requirements of the protection class, the following points have to be followed:

Attention:
- *Housing seals have to be undamaged and in a clean condition.*
- *All housing screws have to be tightened.*
- *The outside diameter of the used connection cables have to correspond with the cable insertions (at PG 13.5 Ø 5....15 mm). At non use of the cable insertion use a filler plug.*
- *Cable insertions have to be tightened.*
- *If possible lead the cable away downwards. Humidity can not reach the cable insertion.*

The meter is delivered in protection class IP 65 standard.

3.1.3 Transportation

Attention:
- *All detectors larger than DN 150 are equipped with lifting eyes. For transportation or lifting of the meter you have to use them.*
- *Do not lift the meters at the amplifier or detector neck.*
- *Do not lift the detectors at the sheet casing with a fork lift truck, because the housing will be pushed in.*
- *Do not lead lifting devices (rope, forks of a lifter, etc.) through the tube, otherwise the lining will be damaged.*

3.2 Mounting

In order to secure the function of the meter in full range, as well as to avoid damages, following mounting recommendations have to be observed.

Attention:
- *The meter has to be mounted in the pipeline according to the flow direction sign on the nameplate.*

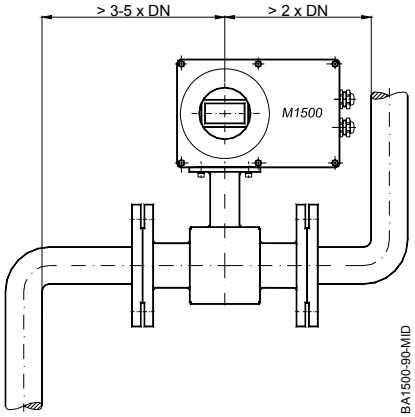
3.2.1 Mounting position

The meter can be mounted in any position. The meter can be mounted in horizontal as well as vertical pipelines.
At vertical mounting the flow direction is to be provided upwards. Carried solid particles are sinking downwards.
At horizontal mounting you have to pay attention that the measure electrodes are lying in a horizontal level. Carried gas bubbles could otherwise lead to a short time isolation of the measure electrodes.

The meter has to be mounted in the pipeline according to the flow direction sign on the nameplate.

3.2.2 Inlet and outlet distance

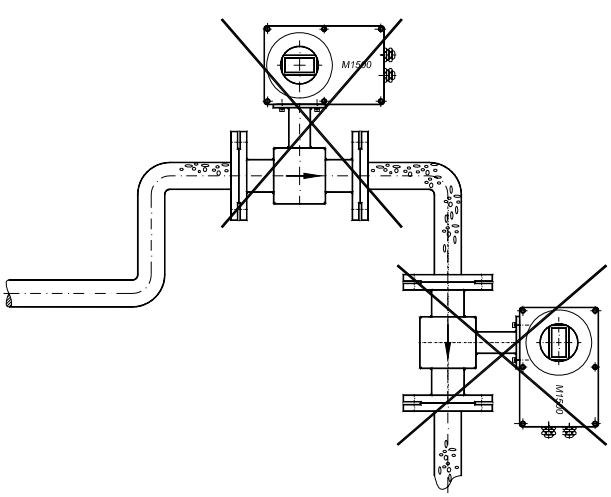
The detector should always be installed in front of turbulence generating fittings. If this is not always possible, then inlet distances of 3 x DN should be provided. The outlet distance should be > 2 x DN.

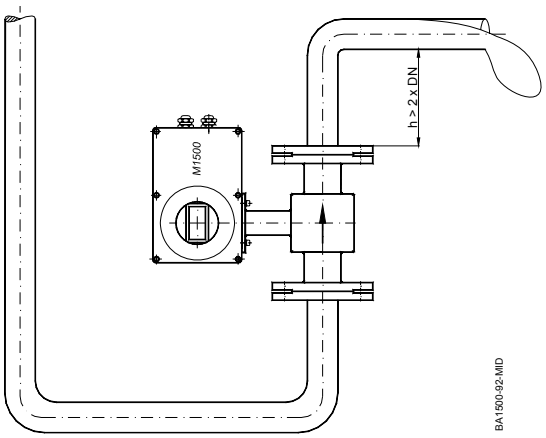


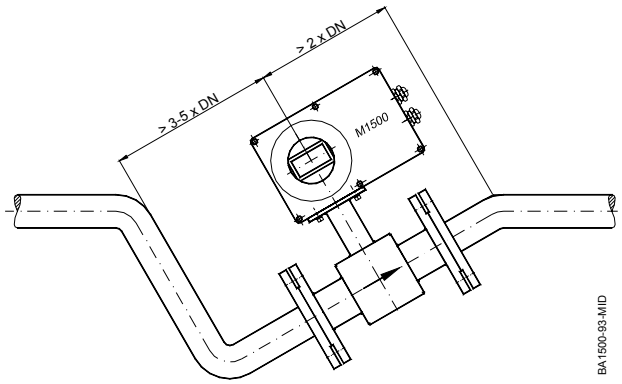
3.2.3 Mounting location

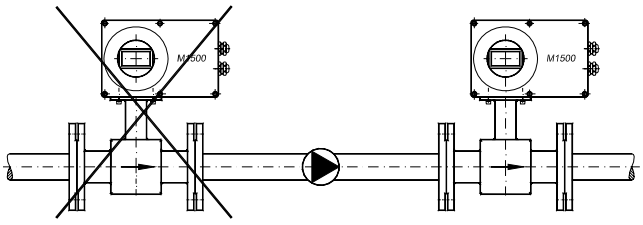
Attention:

- *The detector should not be installed on the suction side of a pump, otherwise there will be danger of damage to the liner (especially PTFE liner) by depression.*
- *Please be careful that the pipeline at the measuring point is always fully filled, otherwise no correct or accurate measuring is possible.*
- *Do not install the detector at the highest point of a system of pipes, otherwise there will be danger of gas accumulation.*
- *Do not install in a downpipe with following free discharge.*
- At vibrations the pipeline has to be fastened before and after the detector. At very strong vibrations the amplifier has to be separated from the detector (remote version)*.*







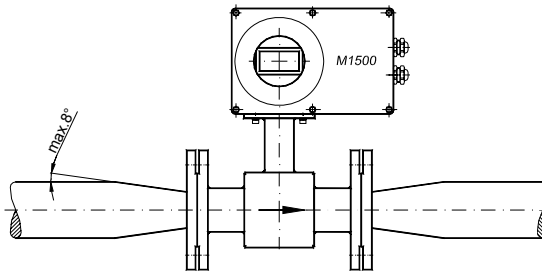


3.2.4 Size reduction

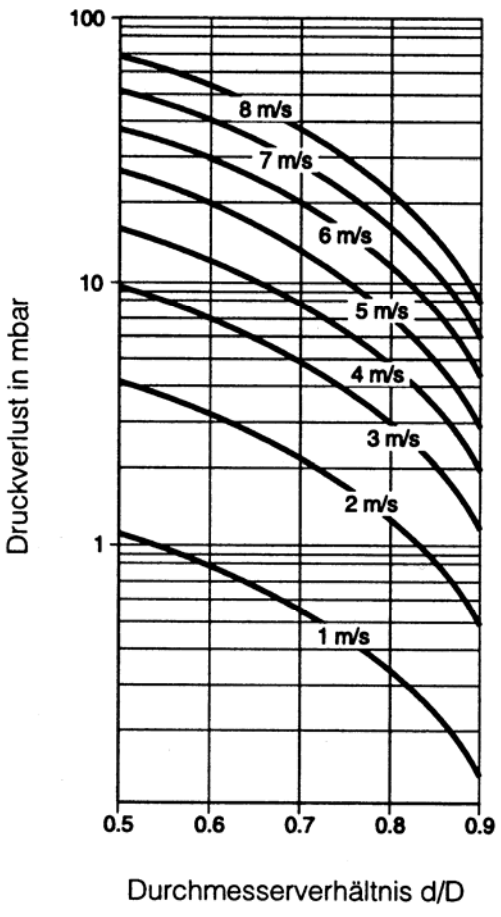
By using pipe adaption pieces according to DIN 28545 the detectors can be mounted in pipelines of larger sizes.

The emerging pressure drop can be determined with the depicted nomogram (only for liquids with a similar viscosity like water).

Notice:
- *At very low flow rates the flow rate can be increased by reducing the size at the measuring point and therefore the measuring accuracy can be improved.*



D = Pipe
d = Detector



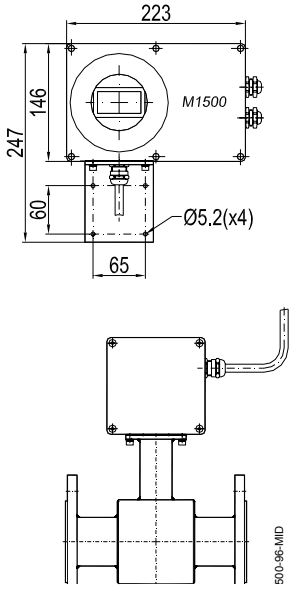
Determination of the pressure drop:
1. Calculate the diameter relation d/D.
2. Read the pressure drop depending of the d/D relation and the flow rate.

3.2.5 Remote version

The remote version is absolutely necessary at the following conditions:

Notice:
- *Medium temperature > 100 °C*
- *Strong vibrations*

Attention:
- *Do not lay signal cables in the direct surrounding of power cables, electrical machines, etc.*
- *Fix the signal cables. Cable movements could otherwise lead to improper measurings by capacity changes.*

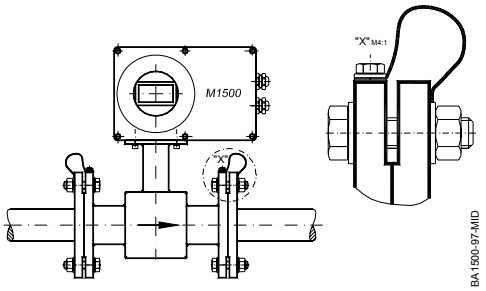


3.2.6 Grounding and equipotential compensation

In order to get an accurate measurement, the detector and the medium to be measured have to be approximately on the same electrical potential.

For flanged or in between flanges without additional grounding electrode this will be carried out by the connected pipeline.

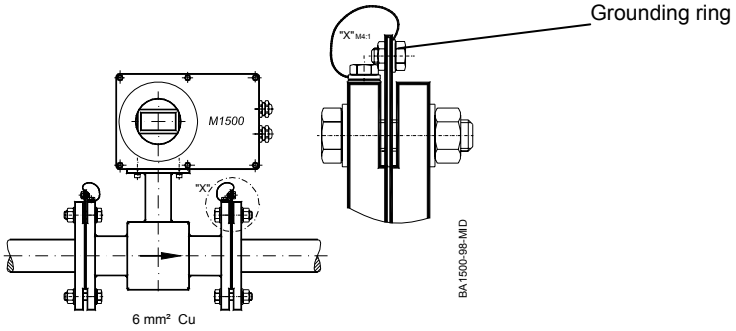
Attention:
- *For the flange design, please take an additional connection cable (min. 4mm²) to the fastening screws between the grounding screw at the flange of the detector to the mating flange. Make sure that a good electrical connection will be established.*
- *Colour or corrosion at the mating flange can reduce a good electrical connection.*
- *For in between flanges designs, the electrical connection to the detector will be executed by two ¼ AMP plugs at the detector neck.*



3.2.7 Plastic or lined pipelines

When using non conductive pipelines or pipelines with a non conductive liner, the equipotential compensation has to happen via an additionally installed grounding electrode or between the flanges mounted grounding rings. The grounding rings are mounted like a gasket between the flange and connected by a ground cable with the detector.

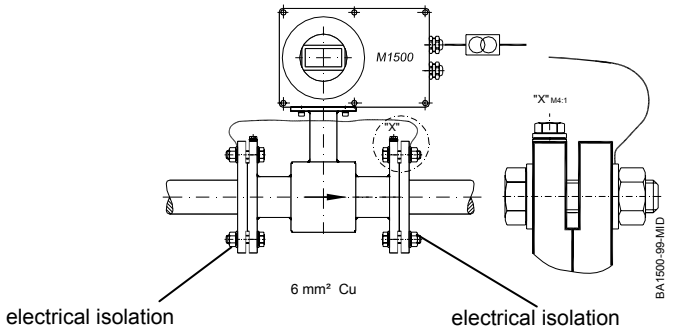
Attention:
- *When using grounding rings the corrosion resistance of the material has to be paid to. For aggressive media, it is recommended to use grounding electrodes.*



3.2.8 Pipes with cathodic protection

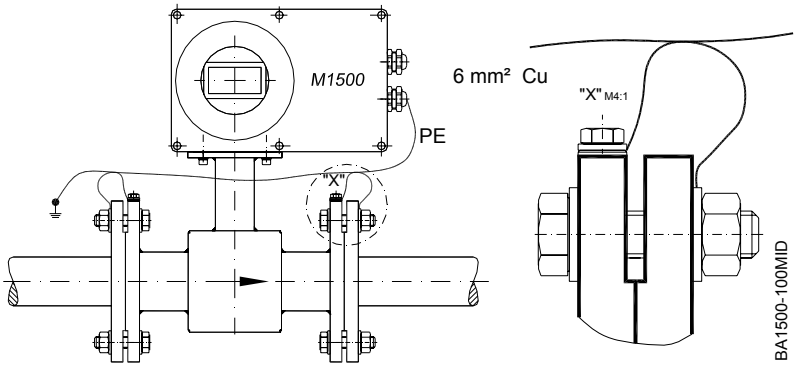
When having a cathodic protection, the meter has to be mounted potential free. The meter may not have any electrical connection to the system of pipes and the voltage supply has to happen via a separation transformer.

Attention:
- *It is required to use grounding electrodes in this case (grounding rings have to be mounted isolated from the system of pipes as well).*
- *National regulations for the potential free mounting have to be observed.*



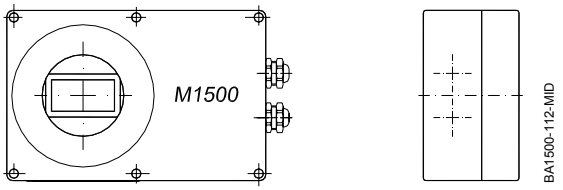
3.2.9 Surroundings with interferences

In surroundings with interferences or pipelines, which are not metallically grounded, a grounding like described below is recommended in order to guarantee an uninfluenced measuring.



4. Electrical connection

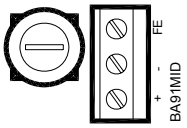
Attention:
- *Only flexible electrical wires can be used for the 2 x M20 cable insertions.*
- *Use separate line entrances for auxiliary power, signal and in-/output wires.*



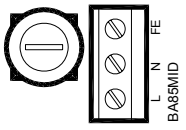
4.1 Power

Warning:
- *Do not install the meter under power.*
- *National valid regulations have to be observed.*
- *Observe the nameplate (power supply and frequency).*

VDC



VAC



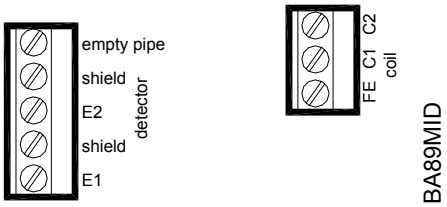
1. Unscrew the cover.
2. Slide the power cable through the relevant cable insertion.
3. Connection according to the wiring plan.
4. Check the selector switch for the power supply. If the power supply is modified, please change fuse according to section 7.1
5. Close the cover tightly again once the connection has been completed.

4.2 Remote version

Attention: • *Connect or detach signal connection wires only when the meter is switched off.*

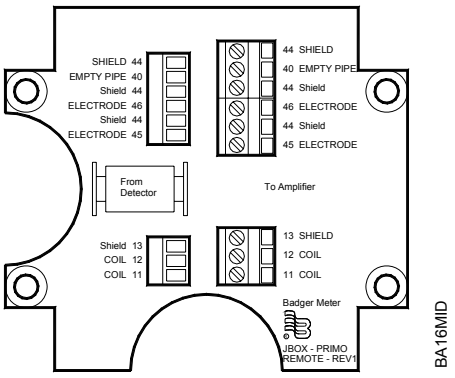
Connection in the amplifier

1. Loosen the six fastening screws of the cover and remove the cover.
2. Loosen the four fastening screws of the board and take it out.
3. Mounting of the wall mounting (incl. cable connection) on the bottom of the housing with the 4 x M5 screws.



4. Slide the signal cable on the bottom of the meter (wall mounting) through the cable insertion.
5. Insert the board again and fasten it, lead out the signal cable between the housing wall upwards (on the side of the terminals).
6. Connection of the signal cable according to the wiring plan.
7. Close the connection cover tightly again.

Connection at the detector



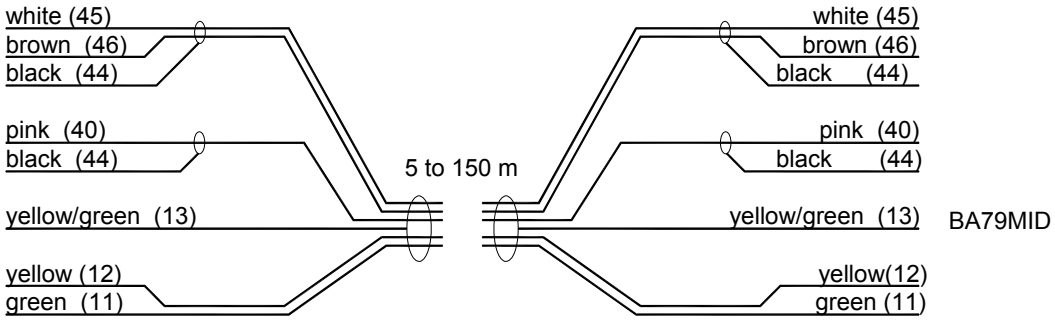
Terminal box	Amplifier	Description	Wire colour
11	C1	Coil 1	Green
12	C2	Coil 2	Yellow
13	FE	Shield complete	Yellow/green
45	E1	Electrode 1	White
44*	shield*	Shield electrodes	Black
46	E2	Electrode 2	Brown
40	empty pipe	Empty pipe detection	Pink
44*	shield*	Shield empty pipe detection	Black

*) Connections are lying on the same potential

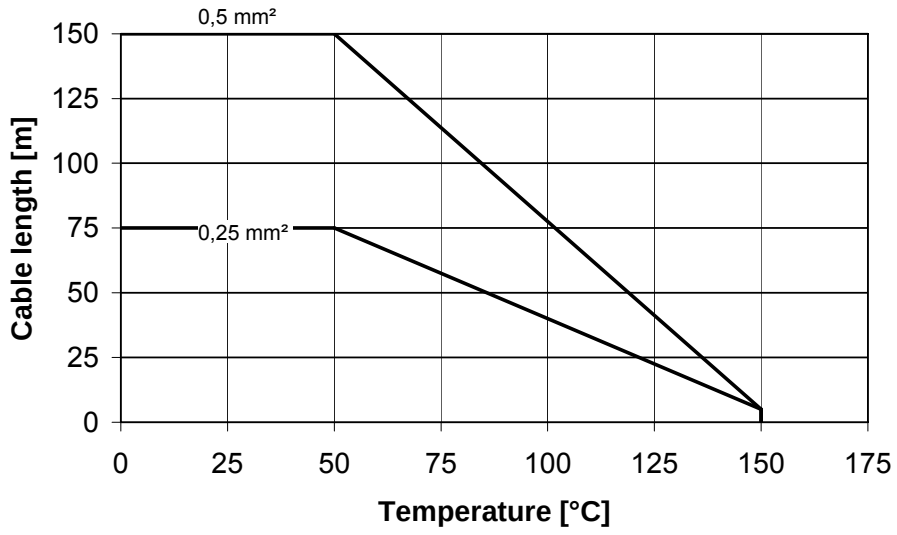
4.2.1 Signal cable specifications

Notice:
- *Use only the signal cables supplied by Badger Meter or corresponding cables with the following specifications.*
- *Observe the max. signal cable length between detector and amplifier (keep the distance as short as possible).*

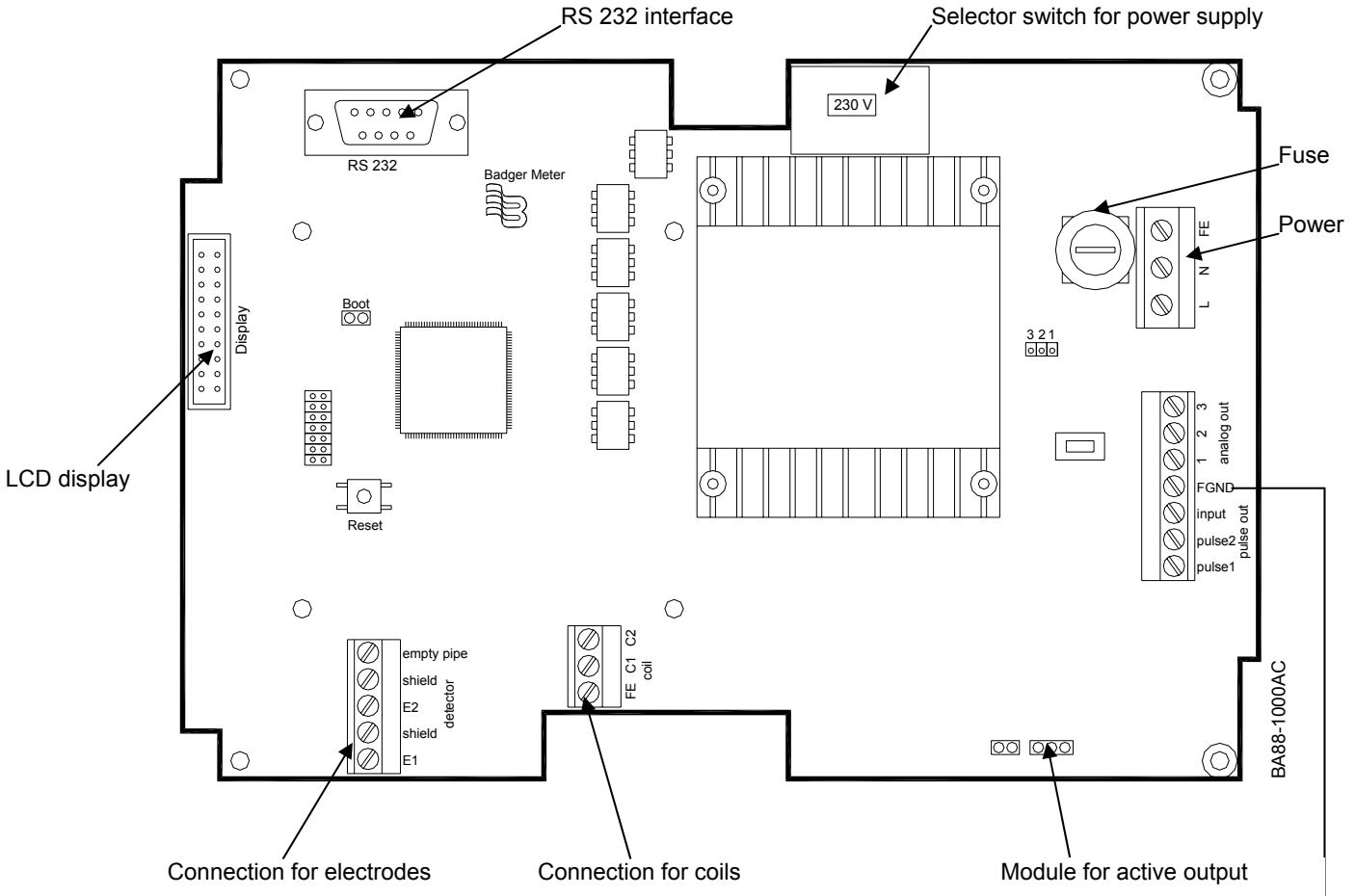
Distance	with electrode for empty pipe detection	Loop resistance
0 – 75 m	3 x (2 x 0,25 mm²)	=< 160 Ω/km
> 75 – 150 m	3 x (2 x 0,50 mm²)	=< 80 Ω/km
PVC-wire with pair and total shield Capacity: Lead/lead < 120 nF/km, lead/shield < 160 nF/km Temperature range –30 up to +70 °C		



Maximum cable length at different media temperatures



4.3 Terminal connecting plan inputs and outputs



In- / output		Terminal	Description	
Analog	Passive	2 (+) and 1 (-)	4 - 20 mA	12 - 30 VDC
	active*	3 (+) and 2 (-)	4 - 20 mA	RL < 500 Ohm
Digital output 1	Passive	Pulse 1 (+), FGND (-)	0 - 10 kHz, pulse-/break relation approx. 1:1 adjustable pulse length 5 - 500 ms (5 ms steps) Pulse output invertable passive, max. 36 V DC, 500 mA	
	active*	3 (+), Pulse 1 (-)		
Digital output 2	Passive	Pulse 2 (+), FGND (-)		
	active*	3 (+), Pulse 2 (-)		
Digital input		input (+), FGND (-)	min. 5 V up to max. 36 V	
RS232		RS232 plug	Communication to the computer	

* Either analogue or digital outputs can be used as active output, but not both simultaneously.

5. Measuring mode

The backlighted LCD display consists of 4 lines each 16 digits and is used for displaying the following information depending on the set flow direction:

Notice: • *If an overflow of the totalizers occurs, they will start again at zero.*

Uni-directional

Line	Information	Value*
1	Software version or error messages	16 digits
2	Current flow Q	8 digits
3	Totalizer in main flow direction T1	10 digits
4	Totalizer in main flow direction T2	10 digits
5	Preselection meter VW	7 digits

*Number of digits without decimal point and sign.

Bi-directional

Line	Information	Value*
1	Software version or error messages	16 digits
2	Current flow Q	8 digits
3	Totalizer in main flow direction T+	10 digits
4	Totalizer backward T-	10 digits
5	Totalizer Netto TN (for-/backwards)	10 digits
6	Preselection meter VW	16 digits

*Number of digits without decimal point and sign.

You can scroll the display with the + or – keys to display the preselection meter and the net totalizer.

The parameter mode is shown if by pressing the ENTER key in the measuring mode.

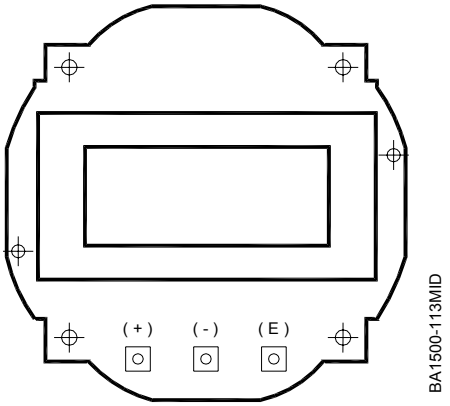
If a password is used, following display appears:

```
CHG. PASSWORD 16
 Enter new
>password: 0000
Chg:+,-  E=Next
```

See section „Password“.

6. Parameter setting

The parameter setting of the meter is done with 3 keys and a LCD display. Therefore open the cover of the amplifier housing.



By pressing the **ENTER** key in the measuring mode the parameter setting mode can be reached. If no input is done in the parameter setting mode within 2 minutes, the program automatically returns to the measuring mode. Even during the parameter setting mode measurements can be carried out.
The two keys + and – enable the item selection in each selection menu as well as any parameter change. Press ENTER to confirm.

In every selection menu the chosen item or the chosen value is marked with the cursor > to the left. The ENTER key can then open the menu or confirm the according value.

If you want to show e.g. the menu “measurement” in the main menu, press the + key until the cursor > is left to measurement and then press the ENTER key.

```
MAIN MENU     00
>Exit this Menu
 Meter Setup
 Measurements
```

If a parameter is changed by entering a value, the underline _ shows the relevant number, which can be increased with the + key or reduced by the – key. The entry is acknowledged with the ENTER key and the next digit to the right is chosen.

```
FullScaleFlow 23
 Max= 94.248 LPS
>   000084.823
Chg:+,-  E=Next
```

6.1 Basic configuration

6.1.1 Size

Notice:
- *The diameter of the detector has already been programmed in the factory. Changes of the value are influencing the measuring accuracy of the meter.*

This parameter is used for setting the detector diameter (size). The setting of the different size degrees is possible.

6.1.2 Detector constant

Notice:
- *The meter was calibrated in the factory and the detector factor belonging to the detector has already been programmed. Changes of the calibration constant are influencing the measuring accuracy of the meter.*

Each meter has been wet calibrated in the factory and the corresponding correction factor has been determined. Each detector has its individual constant, which is programmed in the amplifier. This constant is shown on each detector nameplate.

6.1.3 Excitation frequency

Notice:
- *Please follow an integral relation to the power frequency when choosing the excitation frequency*

This value indicates with which frequency the coils of the detector are operated. The possible settings are according to the power frequency.

	Excitation frequency		
Power frequency of 50 Hz	3,125 Hz	6,25 Hz	12,5 Hz
Power frequency of 60 Hz	3,75 Hz	7,5 Hz	15 Hz

6.1.4 Calibration (hydraulical zero point)

Notice:
- *The meter was calibrated in the factory and the detector factor belonging to the detector has already been programmed. Changes of the hydraulical zero point are influencing the measuring accuracy of the meter.*

Each meter has been wet calibrated in the factory and the corresponding correction factor has been determined. Each detector has its individual hydraulical zero point, which is programmed in the amplifier.

6.1.5 Calibrating the empty pipe detection

Notice:
- *In order to compensate different conductivity of the media, cable length or sizes at the medium control, a calibration is recommended. This is important, if the empty pipe detection will be activated.*

```
EMPTY PIPE    15
 Cal. empty pipe
>Cal. full pipe
 Enable/Disable
```

The calibration of the empty pipe detection is done as follows:

1. Make sure that the measuring pipe is completely empty.
2. Go to the menu item „Cal. pipe empty“ and activate the empty pipe calibration CAL [ON]. The read in voltage in Volt is indicated. Turn off the empty pipe calibration afterwards CAL [OFF].
3. Store this value with „Store“.
4. Now fill the measuring pipe with the measuring media.
5. Go to the menu item „Cal. empty full“ and activate the empty pipe calibration CAL [ON]. A voltage is indicated there that has to be lower than the one in the empty condition. If the value of the indicated voltage should be very high here (similar to the value in the empty condition), then the conductivity of the medium is very low. Turn off the empty pipe calibration afterwards CAL [OFF].
6. Store this value with „Store“.

The empty pipe detection can now be activated or deactivated with the menu item “On/Off”.

The status of the empty pipe detection can be given out on the digital output 1 or 2. See section “digital outputs“.

6.1.6 Password

Notice:
- *Please contact the manufacturer at loss of the password.*

The password consists of a number between 0 and 999. The value 0 is for „no password protection active“. If a value bigger than zero is entered, the password protection is activated. When calling the parameter setting mode again, the password has to be entered.

6.2 Measuring

6.2.1 Measuring units

12 flow measuring units can be chosen. The flow values are automatically converted in the chosen unit.

l/h	Liter/hour
l/min	Liter/minute
l/s	Liter/second
m³/h	Cubic meter/hour
m³/min	Cubic meter/minute
m³/s	Cubic meter/second
GPM	US gallon/minute
MGD	US million gallon/day
LbM	US liquid pounds/minute
OzM	US fluid ounces/minute
IGPM	Imperial gallon/minute
F3M	Cubic feet/minute
BPM	Barrel/minute

6.2.2 Totalizer units

The following totalizer units can be set independently of the flow measuring units.

L	Liter
m³	Cubic meter
USG	US gallon
MG	US million gallon
Lb	US pounds
Oz	US fluid ounces
UKG	UK gallon
aft	Acre feet
ft³	Cubic feet
bbl	Barrel

6.2.3 Full scale

The full scale can be chosen in a range of 0,1 up to 12 m/s. A flow is assigned to the power output as well as the frequency output by the full scale scaling. The scaling is valid for both flow directions.

Notice: The full scale and low flow cut off are also referring to the full scale.

6.2.4 Low flow cut off

If a display or a sum of „wrong“ liquid movements, e.g. caused by vibrations or fluctuating of the liquid column, shall be prevented, the low flow cut off can be set accordingly.

Depending on the full scale, flow values in the lower measuring range can be cut off. The display is in percent of the full scale.

6.2.5 Flow direction

The flow direction can be programmed to uni- or bi-directional direction.

Uni-directional means that only the flow in one direction (arrow direction on the detector = main direction) is measured and added. If the medium is flowing in this setting opposite to the main direction, the counter is showing zero on the display and the outputs. Both totalizers can be used in as total- (T1) and resettable daily counter (T2) in this mode.

At bi-directional setting the flow is measured and added in both directions. Totalizer (T+) is adding in the main direction and totalizer (T-) opposite to the main direction. A change of flow direction can be indicated via the digital output 1 or 2. Totalizer (TN) shows the difference between the forward and backward flow.

6.2.6 Filter (damping)

This option is used for damping all output signals. The damping factor (time constant) can be set from „inactive“ up to max. 30 s. The damping corresponds to a low pass filter.

Notice:
- *The damping has no influence on the totalizers.*

6.2.7 Resetting the totalizers

The totalizers can be individually resetted via the menu „Clear Totals“.

Notice:
- *See also section „external resetting of the totalizers“.*

6.3 Outputs

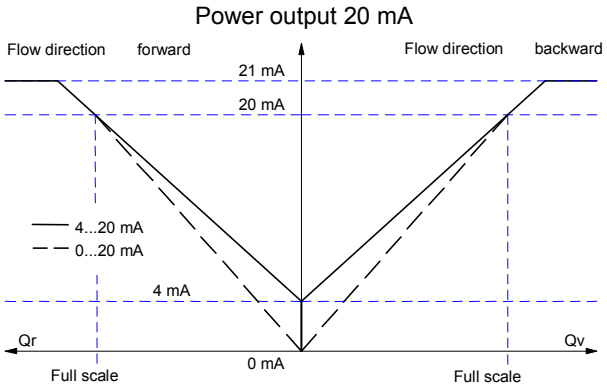
6.3.1 Analog output

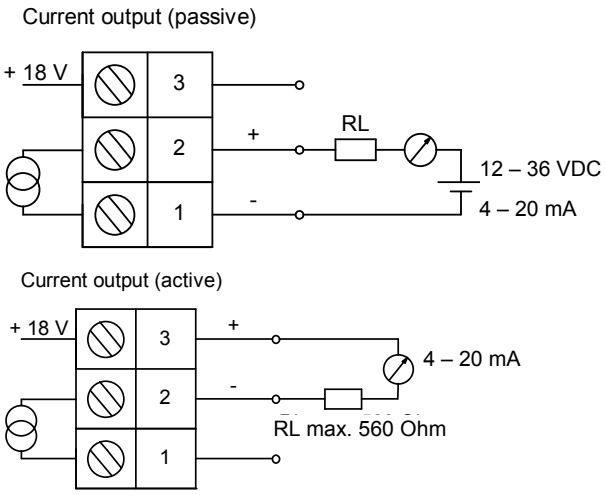
The 4-20 mA range range corresponds to 0-100% measuring range (full scale).

Notice:
- *If the full scale is exceeded, a full scale error is indicated on the display.*
- *At bidirectional operation according to the flow setting, the flow direction is indicated via the digital output 1 or 2.*
- *See also setting of the full scale.*

If you are using the passive analog output, the following max. loads RL have to be observed:

External power supply	max. RL
36 VDC	1100 ohms
24 VDC	750 ohms
20 VDC	680 ohms
18 VDC	560 ohms
12 VDC	220 ohms





6.3.2 Digital outputs / inputs

6.3.2.1 Selecting the function

The following functions can be assigned to the two digital outputs or the digital input.

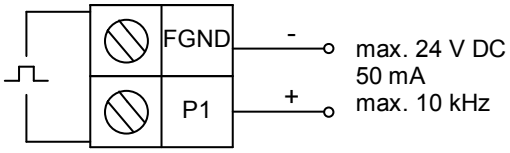
Function	Digital outputs		Digital input
	Output 1	Output 2	
Pulse forward	X		
Pulse backward		X	
Frequency		X	
Preselection		X	
Setpoint	X	X	
Meter error	X	X	
Empty pipe detection	X	X	
Flow direction	X	X	
Reset (preset & totalizer)			X
Measure value cut off			X
AMR (US)	X		

6.3.2.2 Pulse output

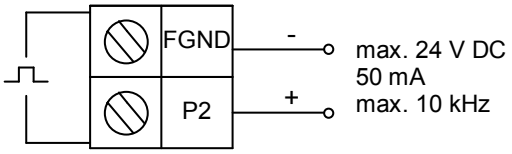
The pulse value defines how many pulses per volume unit are dispensed. These can be totalized and displayed as total flow volume via an external counter.
A setting of 0,001 up to 10.000 pulse/volume unit is possible. A max. output frequency of 10 kHz (10.000 pulses/sec) may not be exceeded. The program is checking, if the entered pulse rate at the given full scale exceeds the max. output frequency.

Notice:
- *The volume unit can be set independently of the flow unit (see units).*
- *If the analogue output is active, the digital outputs can only be used passively.*

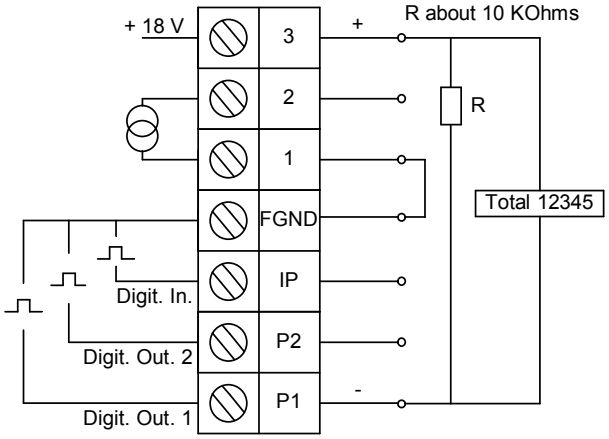
Pulse output 1 (passive)



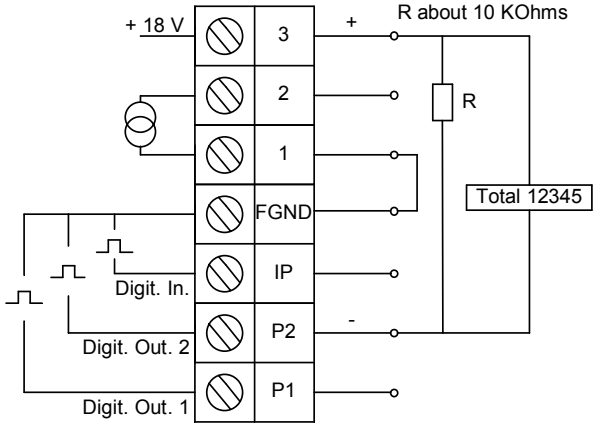
Pulse output 2 (passive)



Pulse output 1 (active)



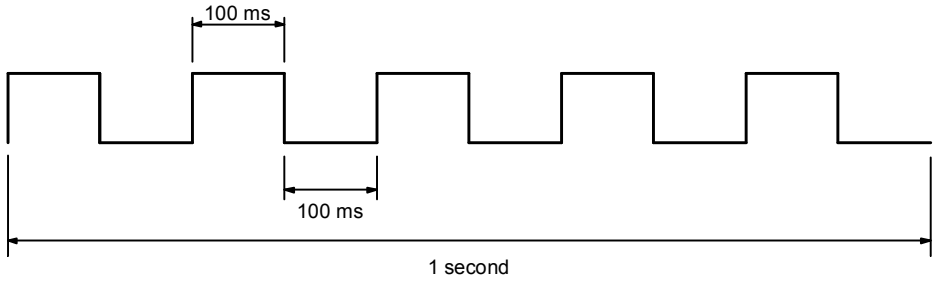
Pulse output 2 (active)



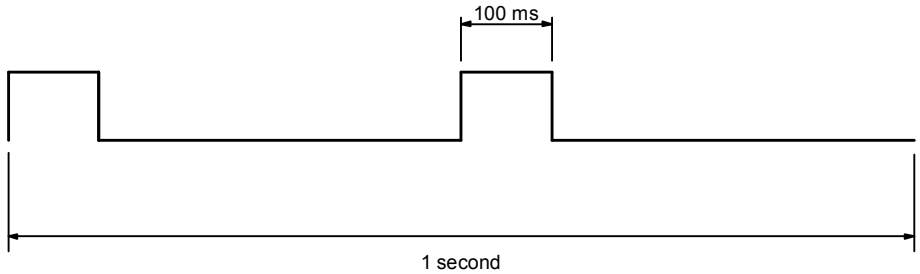
The pulse/break relation is approx. 1:1. At a setting of pulse width 0 ms, the pulse width is automatically adjusted to each pulse frequency. The pulse width can however be programmed up to max. 9999 ms.

The program is checking, which maximum pulse length is possible at maximum pulse output frequency (full scale) and allows no higher values.

Pulse width 1:1

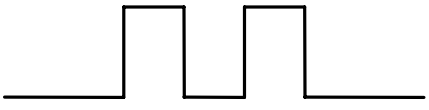


Pulse width 100 ms

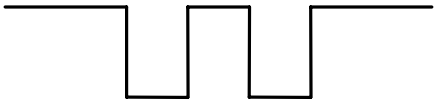


The pulse can be inverted via the function pulse type.

Normal open



Normal closed

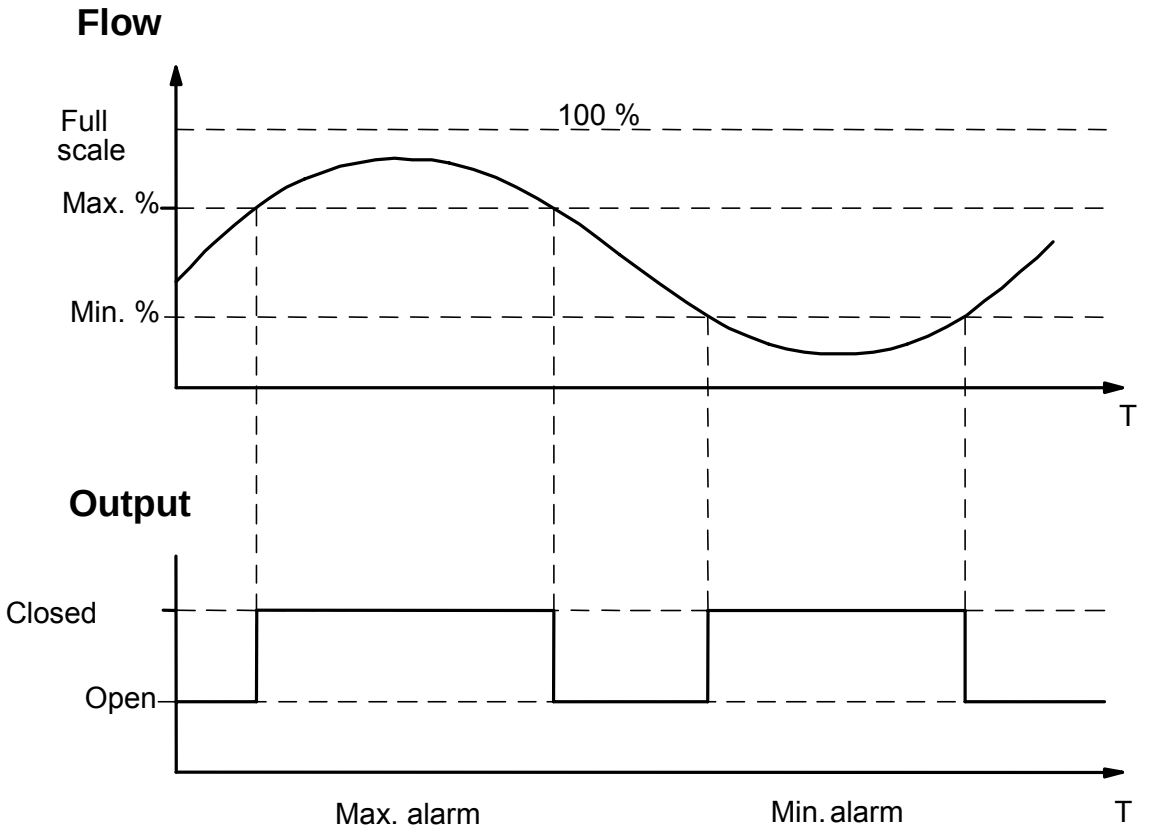


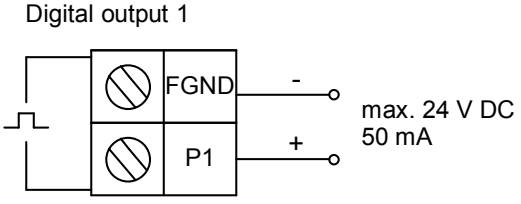
6.3.2.3 Frequency output

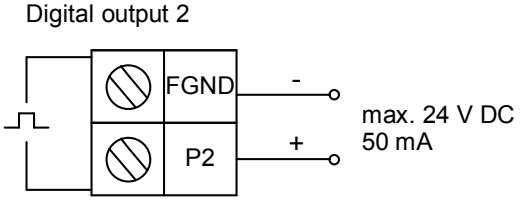
The frequency for the scaled terminal value can be set from 0,01 up to 15 kHz and is indicated via the digital output 2.

6.3.2.4 Setpoint

The set point (min, max) is used for control of the momentary flow rate and is set in percent from the full scale. The values can be chosen in 1% steps between 0 to 199%. The exceeding/underflowing of the set setpoint is indicated via the digital output 1 or 2.







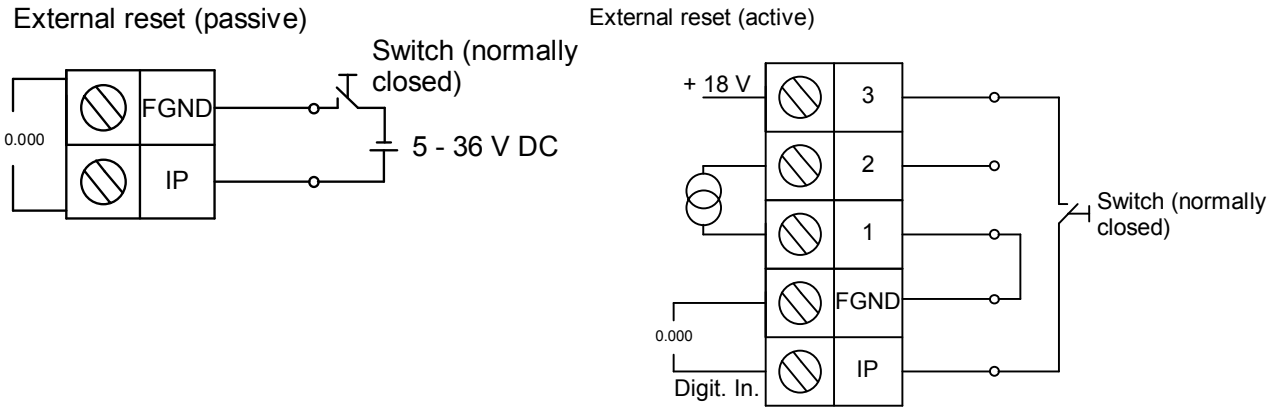
6.3.2.5 Digital input

The following two functions can be assigned to the digital input:

Notice: • *If the input is not used, it should be deactivated (inactive).*

1. External resetting of the totalizers and the preselection meter

   With the help of the digital input, the totalizer T2 indicated on the display and/or the preselection meter VW will be resetted to the set preset value. This, however, needs to be the resetted first via the menu point „Digital input“ to the function „Reset external“.



2. Measure value cut off

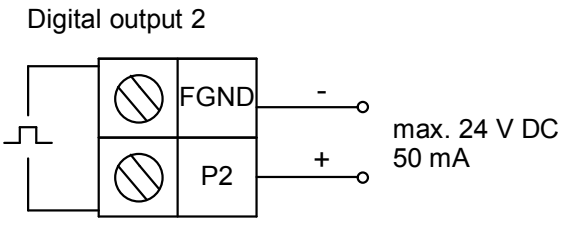
   If a signal is put on the digital input, a cut off of the measuring takes place and all outputs are resetted to zero.
   Connection method like under point 1.

6.3.2.6 Preselection

The menu point preselection is used for realisation of simple batches. The value for the preselection quantity can be set from 0,01 to 9999,99 volume units in steps of 0,01 volume units.
The preselection quantity is counted down to 0 from the programmed value and the reaching of the preselected quantity is indicated via the digital output 2. The preselection meter can be resetted via an external switch.

Notice: • *After the reset, the preset value VW is indicated on the display. See also section “External resetting”.*

• *In the measuring mode the current preset value VW can be indicated on the display by pressing the + or – key. See also section “Measuring mode”.*



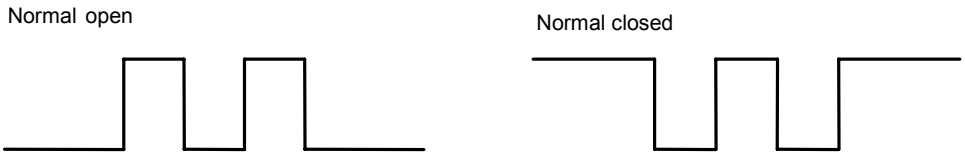
6.3.2.7 External reset of the totalizers and the preselection meter

See section „digital input“.

6.3.2.8 Output type

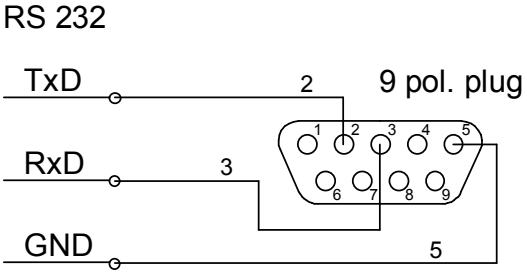
The „output type“ function controls the behaviour of the two digital outputs 1 and 2. Is the output type set to “Normal open”, the output is closed if it is activated. At „Normal closed“ it is reversed.

This behaviour is valid for all functions of these two outputs.



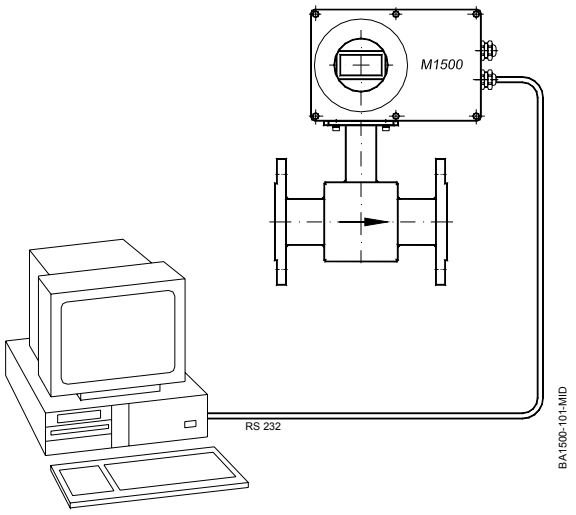
6.4 Communication (RS 232)

The RS232 interface does not need to be set up.



Configuration of the COM interface

Baud	= 9600
Data bits	= 8
Stop bits	= 1
Parity	= none
Protocol	= none



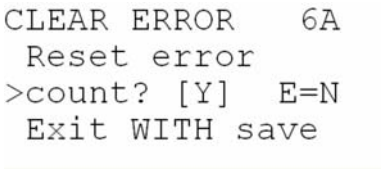
6.5 Info/help

6.5.1 Error list

The following error list and the frequency of the occurred error are displayed.

Error	Meaning (see also section 8)
Sensor	Coil circuit is interrupted
Empty pipe	Empty pipe detection
Full scale	Defined full scale is exceeded
Totalizer	An overflow of the counter has occurred
ADC24 Int.	A/D converter gives no measure values
WDT reset	only for service
Sys error	only for service
Temp. range	only for service
Mem alloc	only for service
ADC range	Measuring range of the A/D converter exceeded

The error messages in this list can be resetted individually. Choose the error message from the list and press the ENTER key. Move the cursor to “Resetting the meter“ and press again ENTER. Choose “Store” with the key + and the error counter is resetted to 0 with ENTER.



6.5.2 Power Up counter

This function shows the sum of all switch-on actions; it can also be used for an easy check of possible voltage losses.

6.5.3 Version number

This menu shows the software version of the meter.

6.5.4 Parameter default settings

All in- and outputs are set to factory default values. Other factors like size and detector constant remain unchanged.

6.6 Language selection

Another language can be selected via this menu.

7. Error indication and clearance

Error indications of the meter are indicated on the display (line 4) as well as via the digital outputs. The type and frequencies of the errors are protocolled in the error list in the parameter setting mode and can be retrieved from there. See also section “error indications”.

The following error indications can appear

Error indication	Possible cause	Measures
Err: sensor	▪ No detector connected. ▪ Connection to the detector interrupted. ▪ Detector electronic or coils of the detector defective.	Check, if the detector is connected and if no interruption is in the cable connection. Otherwise contact service.
Err: empty pipe	Tube is not fully filled.	Tube at the measuring point always has to be fully filled. Possibly new calibration. See calibration of the empty pipe detection.
Err: full scale	The current flow exceeds the programmed full scale.	Decrease flow or increase the programmed full scale.
Err: ADC 24 Int.	A/D converter defective	Contact service.
Err: ADC range	Input signal from detector is too high.	Check and improve the grounding of the meter. See installation of the detector.

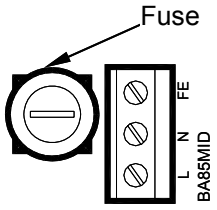
Some frequent errors are listed in the following:

Other errors	Possible cause	Measures
No operation of the meter	▪ No power. ▪ Fuse defective.	▪ Provide power. ▪ Replace the fuse.
Despite of flow ZERO is displayed	▪ Signal cable not connected or connection interrupted. ▪ Detector mounted opposite to the main flow direction (see arrow on the nameplate). ▪ Connection cable of the coils or electrodes permutated.	▪ Check signal cable. ▪ Turn detector by 180°. ▪ Check connection cable.
Inaccurate measuring	▪ Parameter wrong. ▪ Pipe not fully filled.	▪ Check the parameters (transmitter factor and size) according to attached data sheet). ▪ Check if tube is fully filled.

7.1 Replacing the meter fuse

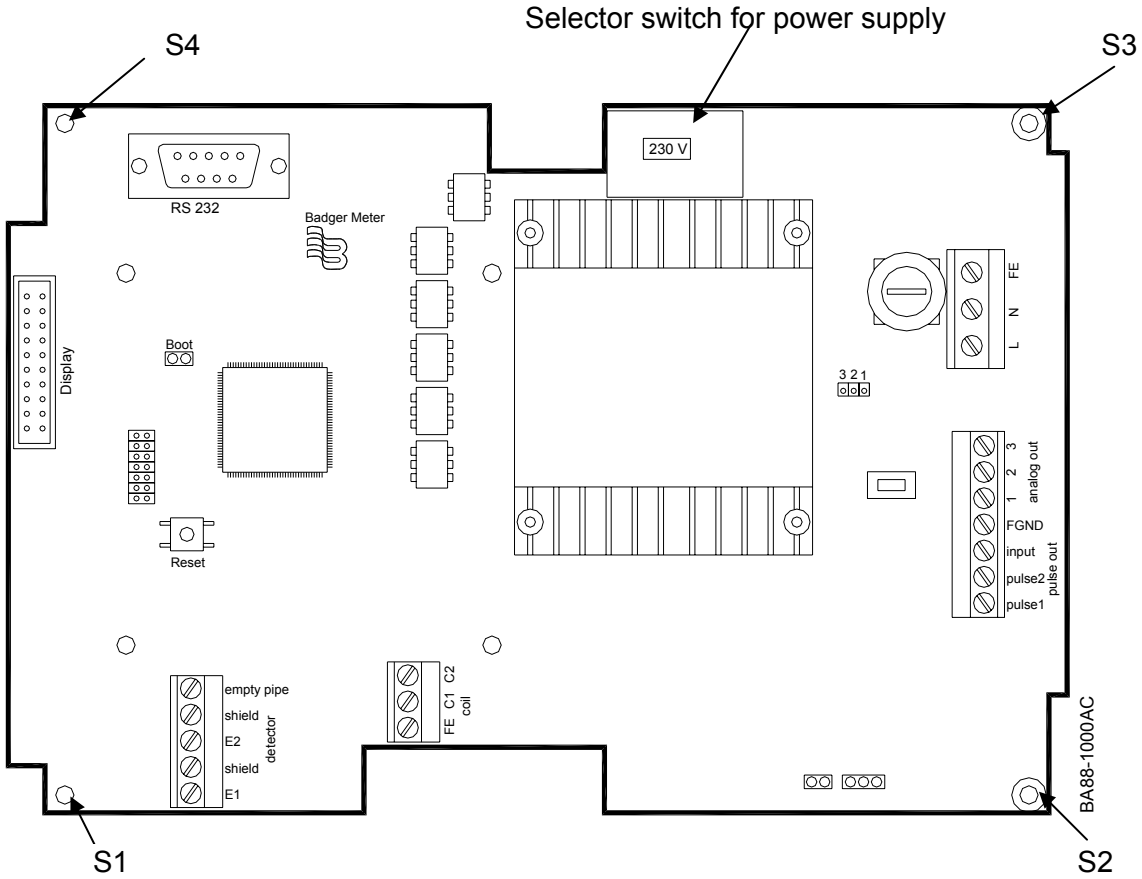
Warning: • *Do not exchange the fuse under power.*

230 VAC – 100mA (slow-blow)
115 VAC – 200mA (slow-blow)
24 VDC – 630mA (slow-blow)



7.2 Replacing the amplifier electronic

Warning: • *Switch off the auxiliary power before opening the casing cove.*



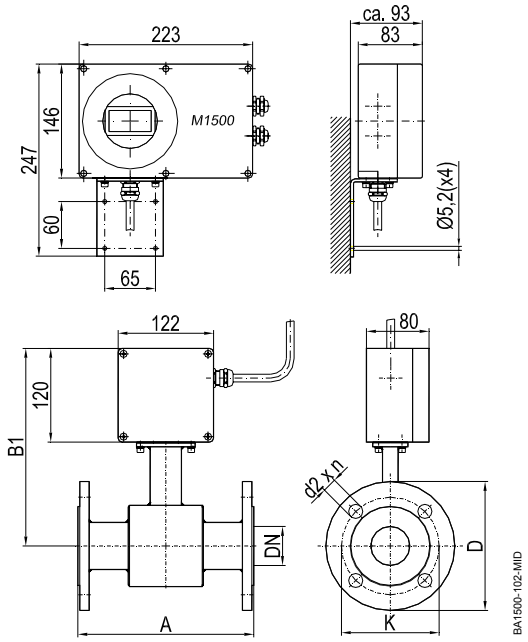
1. Loosen the electrode and coil cables. Loosen the screws S1 to S4 and take out the circuit board.
2. Put in new circuit board and fasten with the screws S1 to S4. Connect the signal cable again.
3. The new circuit board possibly has to be programmed to the existing detector (transmitter factor, size, in-/outputs, etc.).

8. Technical data

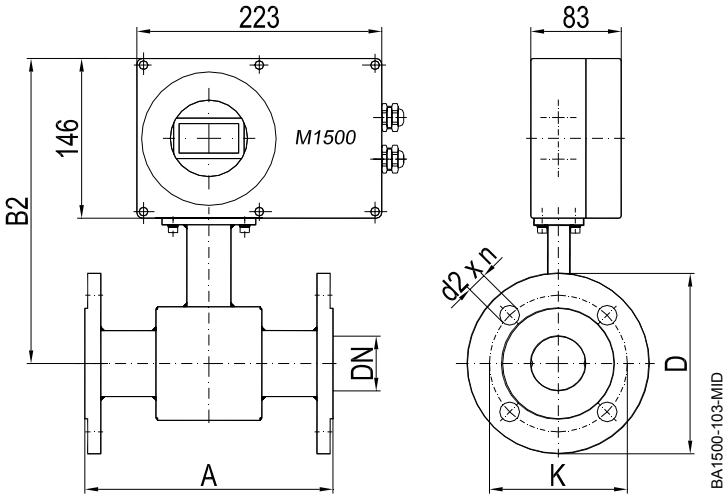
8.1 Detector type II

Technical data			
Size	DN 6 – 200 (1/4“...8“)		
Process connections	Flange: DIN, ANSI, JIS, AWWA etc.		
Nominal pressure	Up to PN 100		
Protection class	IP 65, optional IP 68		
Min. conductivity	5 µS/cm		
Liner materials	Hard-/soft rubber	From DN 25	0 up to +80°C
	PTFE	DN 6 - 600	-40 up to +150°C
Electrodes materials	Hastelloy C (standard) Tantalum Platinum/Gold plated Platinum/Rhodium		
Housing	Steel/optional stainless steel		
Lay length	DN 6 – 20	170 mm	
	DN 25 – 50	225 mm	
	DN 65 – 100	280 mm	
	DN 125 – 200	400 mm	

Flange process connection
Wall mounted



Flange process connection
Meter mounted

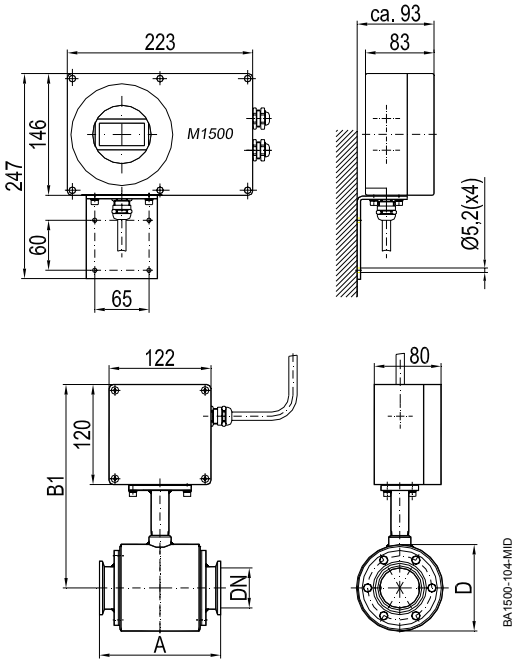


Dimensions (mm)											
						with ANSI flanges			with DIN flanges		
DN	Size	A Std	A ISO	B1	B2	Ø D	Ø K	Ø d2 x n	Ø D	Ø K	Ø d2 x n
6	1/2“	170		228	254	88,9	60,3	15,9 x 4	90	60	14 x 4
8	3/10“	170		228	254	88,9	60,3	15,9 x 4	90	60	14 x 4
10	3/8“	170		228	254	88,9	60,3	15,9 x 4	90	60	14 x 4
15	1/2“	170	200	238	264	88,9	60,3	15,9 x 4	95	65	14 x 4
20	3/4“	170	200	238	264	98,4	69,8	15,9 x 4	105	75	14 x 4
25	1“	225	200	238	264	107,9	79,4	15,9 x 4	115	85	14 x 4
32	1 1/4“	225	200	253	279	117,5	88,9	15,9 x 4	140	100	18 x 4
40	1 1/2“	225	200	253	279	127	98,4	15,9 x 4	150	110	18 x 4
50	2“	225	200	253	279	152,4	120,6	19 x 4	165	125	18 x 4
65	2 1/2“	280	200	271	297	177,8	139,7	19 x 4	185	145	18 x 4
80	3“	280	200	271	297	190,5	152,4	19 x 4	200	160	18 x 8
100	4“	280	250	278	304	228,6	190,5	19 x 8	220	180	18 x 8
125	5“	400	250	298	324	254	215,9	22,2 x 8	250	210	18 x 8
150	6“	400	300	310	336	279,4	241,3	22,2 x 8	285	240	22 x 8
200	8“	400	350	338	364	342,9	298,4	22,2 x 8	340	295	22 x 12
Standard											
With ANSI flanges		from DN 6 – 200		Pressure rating 150 lbs							
With DIN flanges		from DN 6 – 200		Pressure rating PN 16							

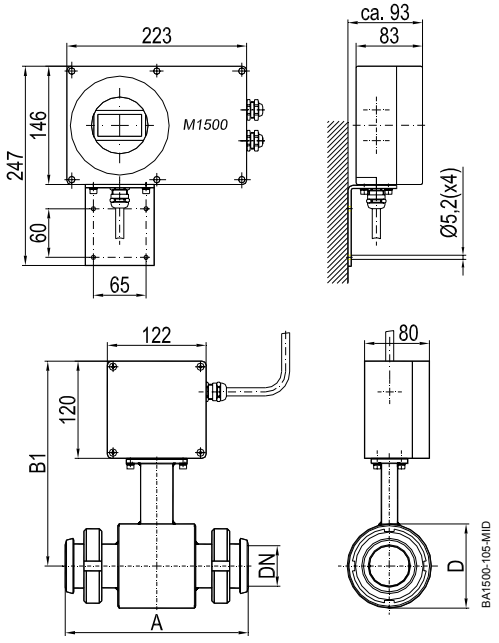
8.2 Detector type food

Technical data			
Size	DN 10 – 100 (3/8“...4“)		
Process connections	Tri-Clamp®, DIN 11851, ISO 2852, etc.		
Nominal pressure	PN 10		
Protection class	IP 65, optional IP 68		
Min. conductivity	5 µS/cm		
Liner materials	PTFE	-40 up to +150°C	
Electrodes materials	Hastelloy C (standard) Tantalum Platinum/Gold plated Platinum/Rhodium		
Housing	Stainless steel		
Lay 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

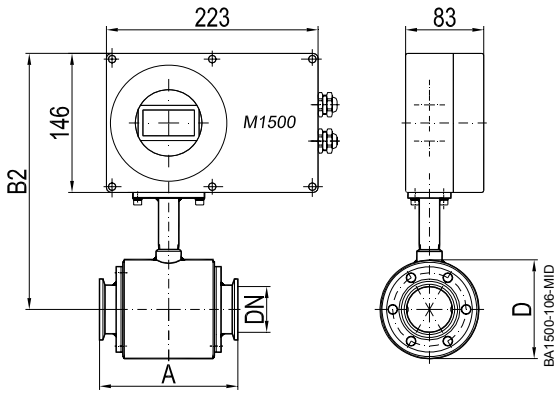
Tri-Clamp® process connection
Wall mounted



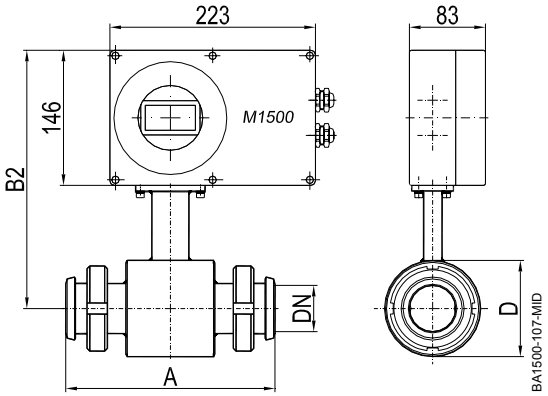
DIN 11851 process connection
Wall mounted



Tri-Clamp® process connection
Meter mounted



DIN 11851 process connection
Meter mounted



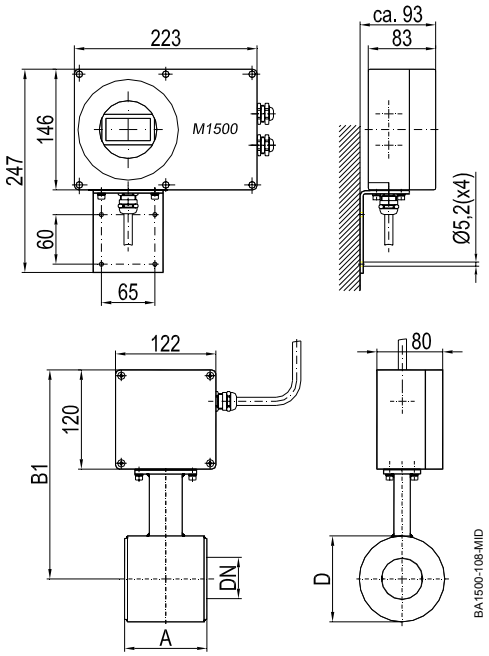
Dimensions (mm) type food Tri-Clamp®					
DN	Size	A	B1	B2	D
10	3/8	145	228	254	74
15	1/2“	145	228	254	74
20	3/4““	145	228	254	74
25	1“	145	228	254	74
40	1 1/2“	145	238	264	94
50	2“	145	243	269	104
65	2 1/2“	200	256	282	129
80	3“	200	261	287	140
100	4“	200	269	295	156
Pressure rating PN10					

Dimensions (mm) type food dairy pipe DIN 11851					
DN	Size	A	B1	B2	D
10	3/8“	170	238	264	74
15	1/2“	170	238	264	74
20	3/4“	170	238	264	74
25	1“	225	238	264	74
32	1 1/4“	225	243	269	84
40	1 1/2“	225	248	274	94
50	2“	225	253	279	104
65	2 1/2“	280	266	292	129
80	3“	280	271	297	140
100	4“	280	279	305	156
Pressure rating PN10					

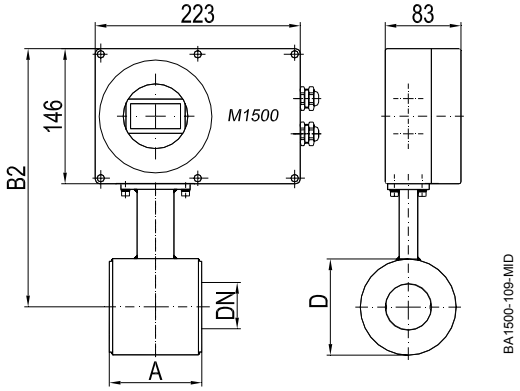
8.3 Detector type III

Technical data		
Size	DN 25 – 100 (1“...4“)	
Process connection	Wafer connection, (in-between flange mounting)	
Nominal pressure	PN 40	
Protection class	IP 65, optional IP 68	
Min. conductivity	5 µS/cm	
Liner materials	PTFE	-40 up to +150°C
Electrodes materials	Hastelloy C (standard) Tantalum Platinum/Gold plated Platinum/Rhodium	
Housing	Steel/optional stainless steel	
Lay length	DN 25 – 50	100 mm
	DN 65 – 100	150 mm

Wafer connection
Wall mounted



Wafer connection
Meter mounted

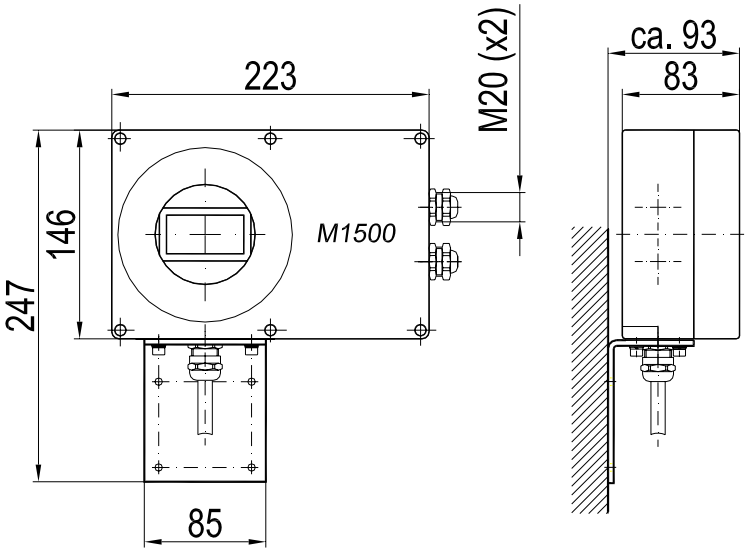


Dimensions (mm)					
DN	Size	A	B1	B2	D
25	1“	100	238	264	74
32	1 1/4“	100	243	269	84
40	1 1/2“	100	248	274	94
50	2“	100	253	279	104
65	2 1/2“	150	266	292	129
80	3“	150	271	297	140
100	4“	150	279	305	156

8.4 Detector type M1500

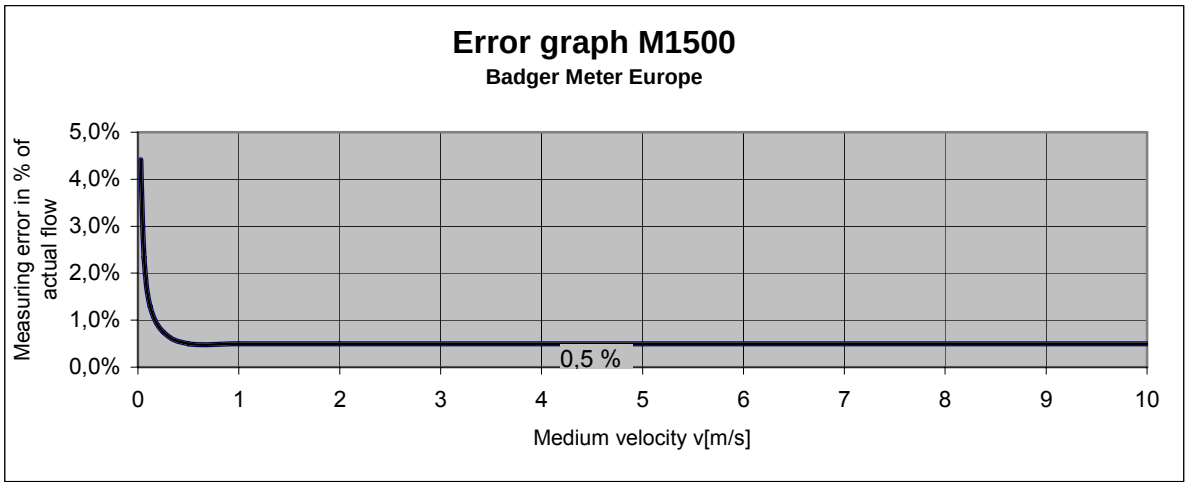
Technical data	
Type	M1500
Power	24 VDC, optional 115 / 230 VAC
Analog output	4 – 20 mA passive, optional active
	Flow direction is displayed upon a separate status output
Pulse output	max. 24 VDC, 50 mA, max. 10 kHz passive, optional active
Status output	Freely configurable
Empty pipe detection	Separate electrode
Parameter setting	3 keys or RS 232
Interface	RS 232
Measuring range	0,03 – 12 m/s
Measuring accuracy	≥ 0,5 m/s better ±0,5% of actual flow < 0,5 m/s ±2,5 mm/s of actual flow
Repeatability	0,1%
Flow direction	Bidirectional
Pulse length	Programmable up to 10 s
Outputs	Short-circuit proof
Low flow cut off	0 – 10%
Display	LCD, 4 lines/16 digits backlight Actual flow, 2 totalizers, status display
Housing	Varnish aluminium die cast
Protection class	IP 65
Cable insertion	Supply and signal cable (outputs) 2 x M20
Signal cable	From detector M20
Ambient temperature	-20 up to + 60°C

Dimensions



8.5 Error limits

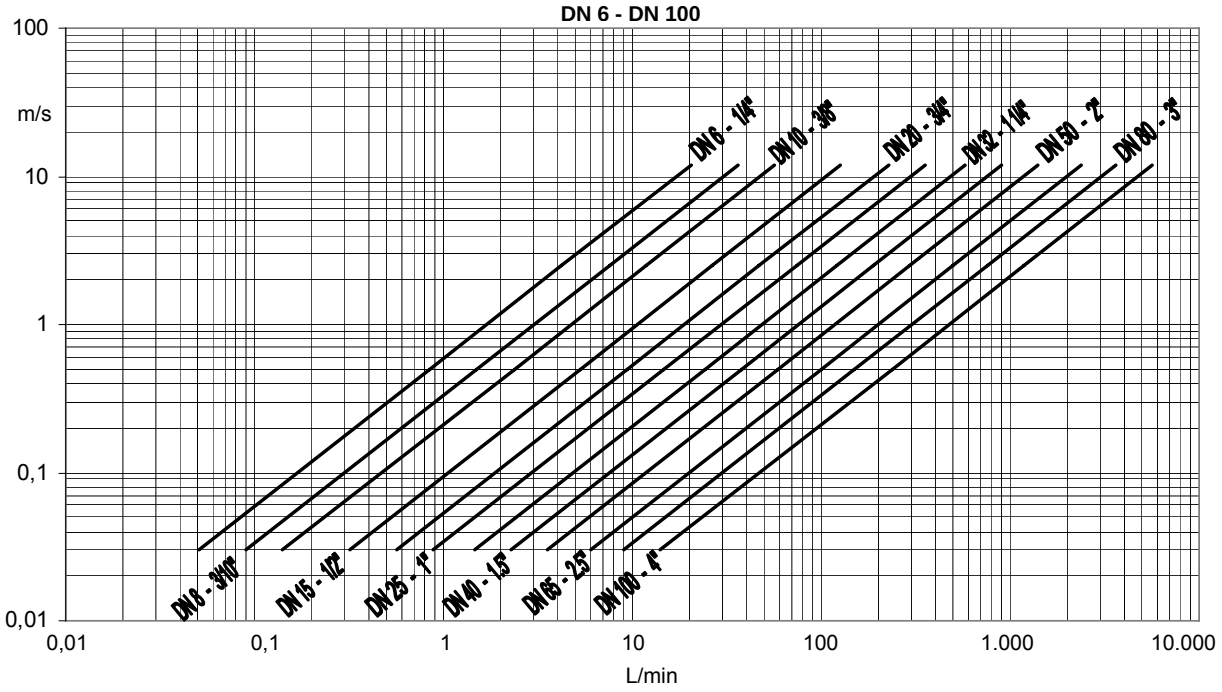
Measuring range	:	0,03 m/s up to 12 m/s
Pulse output	:	≥ 0,5 m/s ±0,5% of actual flow < 0,5 m/s ± 2,5 mm/s of actual flow
Analog output	:	Like pulse output plus ±0,01 mA
Repeatability	:	±0,1% of actual flow

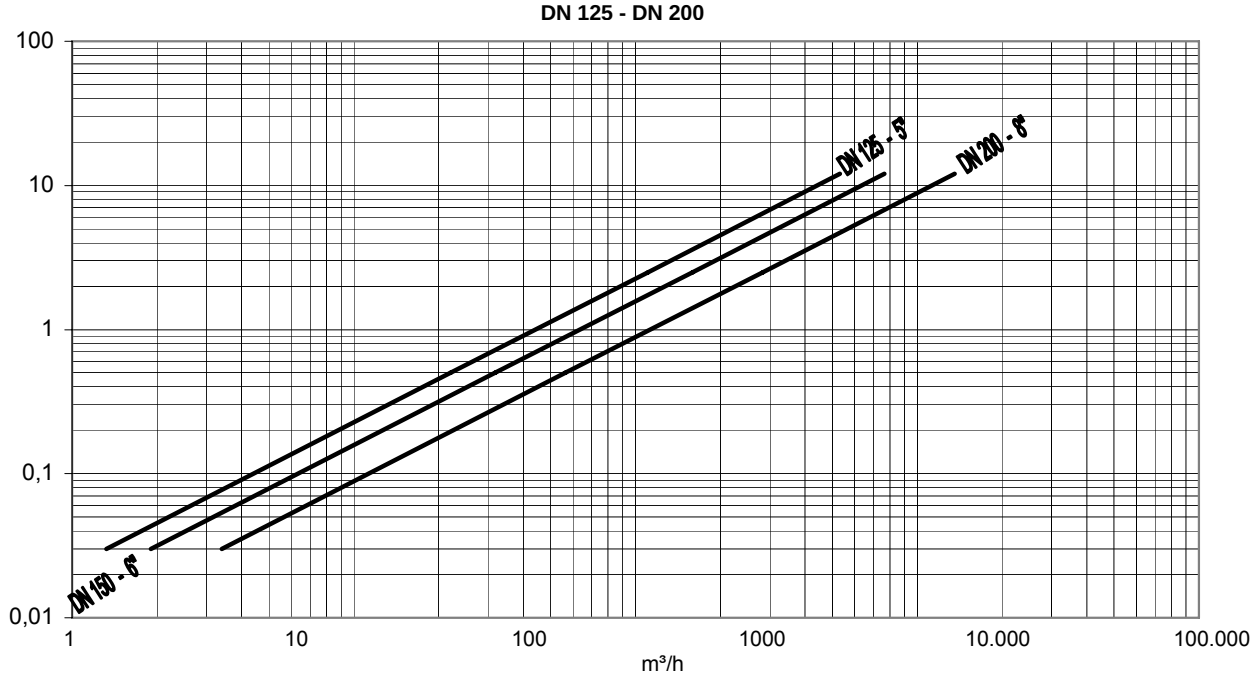


Reference conditions:

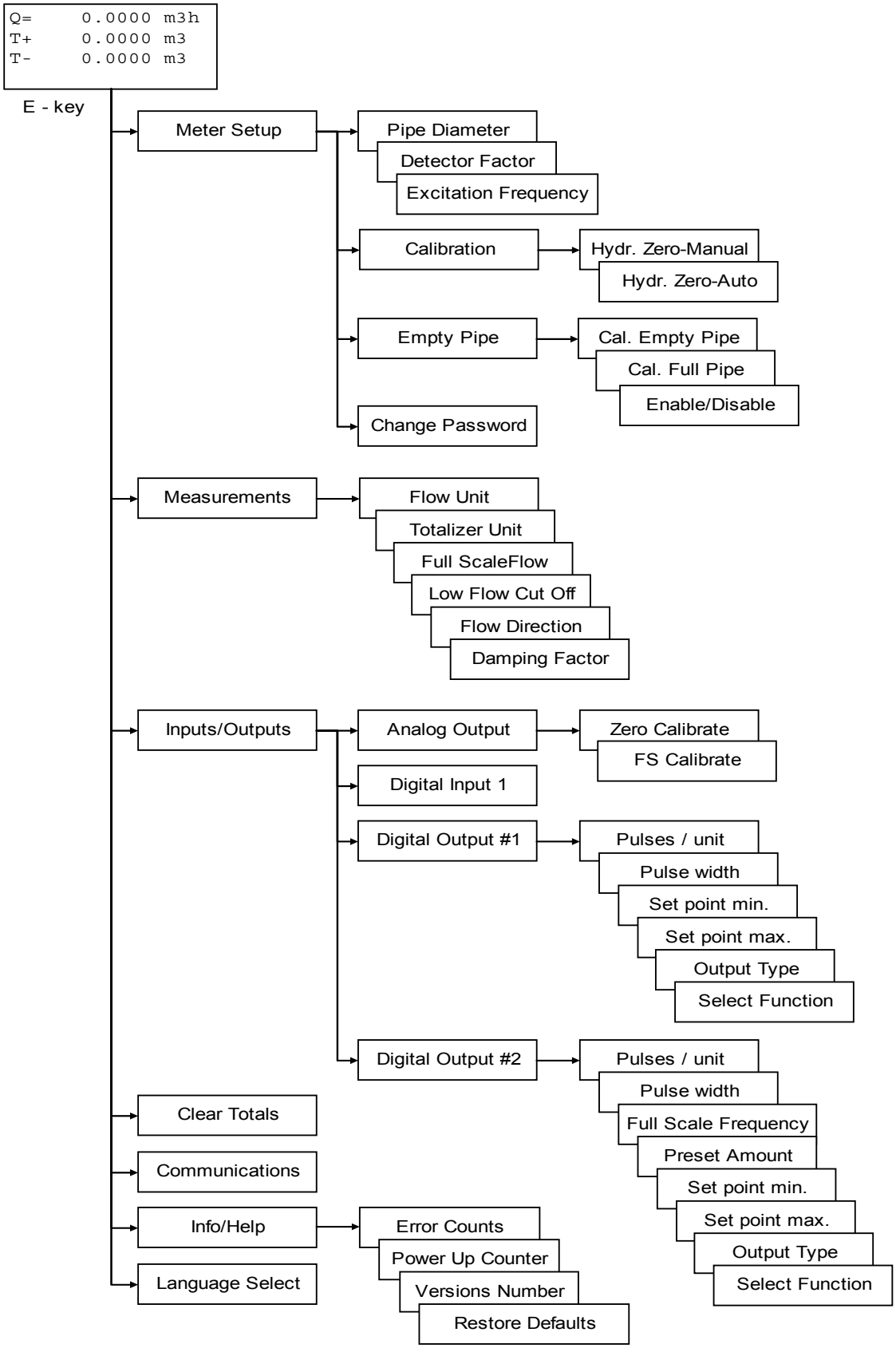
Ambient and medium temperature	:	20°C
Electr. conductivity	:	> 300 µS/cm
Warm up time	:	60 min
Mounting conditions	:	> 10 DN inlet distance > 5 DN outlet distance Detector correctly grounded and centred.

8.6 Size selection





9. Program structures



10. Return of goods for repair

Please copy, fill in and sign hereafter harmlessness declaration and enclose it for any return of goods you may send back for repair.

No repair will be performed prior to receiving the harmlessness declaration duly filled and signed.

Harmlessness declaration

To : _____

Attn. : _____

From : _____

Dept. : _____

Please note that no repair will be performed prior to receiving of this declaration duly signed by you!

Please send all parts clean from medium and inform us about possible medium wastes remaining in the part. For this purpose, please use this form. A security specification sheet of the medium must accompany this declaration in the following cases: Toxical, dangerous or objectionable media, or media belonging to any dangerous materials class. We inform you that uncleaned parts lead to additional costs. Extra clean costs will be charged to you. Furthermore, we reserve us the right to send the parts back to you for cleaning!

Declaration

We herewith confirm that the part(s) sent for repair has/have been cleaned and is/are free of any liquid and/or solid wastes of the medium and/or cleaning medium: Any eventually remaining wastes are:

❍ harmless

❍ dangerous, toxic, etc. – Security specifications are attached

Signature of person in charge: _____

Name of the person in charge in capital letters: _____

Date: _____

Company stamp: _____

Hotline

Tel. +49-7025-9208-0 or -30

Fax +49-7025-9208-15

Badger Meter Europa GmbH
Subsidiary of Badger Meter, Inc., USA

Nürtinger Strasse 76
72639 Neuffen (Germany)
E-mail: badger@badgermeter.de
www.badgermeter.de