Operating Instructions

Liquid Meter

with electronic digital display unit

explosion-proof to II 2 G EEx ia IIB T6

acc. to Directive 94/9/EC-ATEX100

Type FMC

as from Serial No. 38000

Type FMO

as from Serial No. 102000

Contents

1 General safety advice

- **Keep organic solvents away from the keys and the LCD facia.**
- **The interface amplifier and other external equipment should only be installed, operated and maintained by suitably trained and qualified personnel.**
- **The electrical power supply should be switched on only if all the equipment and devices have been installed and live parts cannot be touched.**

2 Safety instructions for use in hazardous areas

- **Observe EC-Type Examination Certificate, certificate of conformity and operating instructions of liquid meter and other equipment used in hazardous area (Zone 1).**
  Comply with all national and local regulations regarding the selection, installation and use of equipment in hazardous areas.
- **Avoid electrostatic charging when installing and during use.**
  Clean with a damp cloth only.
- **Only use certified interface amplifiers for automatic operation.**
- **Within the hazardous are, use with battery only.**

Are the interface amplifier and the electronic display unit in the hazardous area (ZONE 1) ?

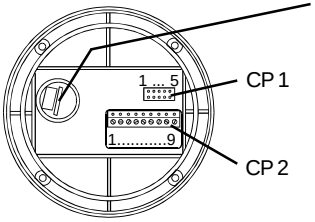
Only interface amplifiers certified according to category 2 and marked EEx de [ia] ... may be used.

Is the interface amplifier located outside of the hazardous area, and the liquid meter together with the electronic display unit in the hazardous area (ZONE 1) ?

Only interface amplifiers with a control circuit certified according to category 2 and marked [EEx ia] ... may be used.

3 Replacement of battery

- **To replace the battery, the electronic display unit must be removed from the liquid meter or mounting plate.**
- **Do not replace the battery in hazardous area.**



Battery (service life approx. 1 year) **:**
use only lithium 3V CR 2032 (VARTA) batteries.

Order new battery using part number:
940 04 026
(battery complete with cover)

"BAT" is flashing : a further 1-3 weeks normal use is still possible.

"BAT" static : the battery can be replaced without any data loss.

Replace the battery within a period of a minute.

If the battery is removed in excess of this time period, the following will occur :

- all calibration constants will be reset to zero.
- all preset volumes will be reset to zero.
- all counters will be reset to zero.

If the one minute time period has been exceeded or the battery totally exhausted, then the following electronics restart procedure must be used : remove the battery. On connector panel CP 2 connect PIN 8 and 9 together (short circuit) for at least 3 minutes.
Following this, a new battery can be fitted.

4 Main features

4.1 Normal operation mode

The quantity of liquid passing through the liquid meter is measured and displayed (partial volume counter).
No additional devices are necessary for this basic operation.

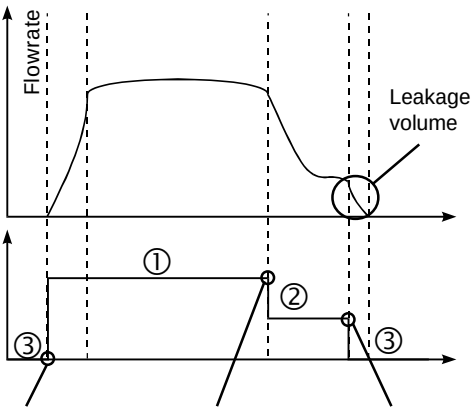
4.2 Automatic operation mode (preset volume)

In automatic mode a preset volume can be transferred.

In order to control magnetic valves, a pump motor and/or other similar devices by the liquid meter, an interface amplifier for NAMUR signals is required (circuit values indicated on the amplifier must be adhered to). This interface amplifier transforms the low level signals of the liquid meter in relay signals.

Filling operations with 2 magnetic valves, e.g. for transferring foaming liquids or if pressure surges are too high :
The liquid meter provides a transfer operation in three stages. Required is an interface amplifier with 2 control signals, 2 magnetic valves and, where applicable, a regulating valve. The sequence operation is :

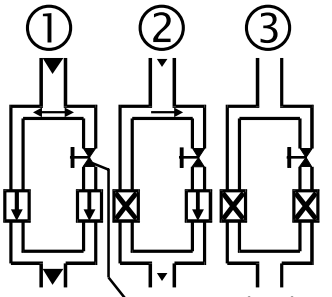
1st stage : both magnetic valves are open
2nd stage : one magnetic valve closes (precision filling starts)
3rd stage : the second magnetic valve closes



START has been pressed. Filling operation is starting. Both valves are open.

The first valve is closed, PRESIGNAL dis appears from the display.

The second valve is closed. ON changes to OFF (main signal).



The flowrate can be adjusted by the regulating valve.

4.2.1 *Valve leakage volume (time lag of the valves)*

When "OFF" (closing) is displayed, there is a finite period of time until the magnetic valve is fully closed. During this time, an undetermined, though small amount of liquid flows through the liquid meter.

This volume is designated as being leakage.

The liquid meter records this leakage volume for each filling operation and takes it into account in the subsequent operation.

- **The actual leakage volume always depends on the previous filling operation.**
- **This function can be switched off (see section 10.3). When switched off, this allows a faster operation cycle.**

4.3 *Calibration (adjusting the accuracy of the display)*

The liquid meter generates pulses. These pulses are in direct proportion to the volume of liquid flowing through the meter. The calibration constants are used to convert the pulses into the unit of display (see example in section 10.4.1).

By changing the calibration constants, the accuracy of the displayed data can be adjusted to take into account the properties of the liquid and the installation system.

The factory setting for the calibration constant is stored in memory location 0 (FMC) or 1 (FMO). This can be changed at any time.

4.4 *Display of flowrate*

Calibration constant	**Display for "L", "kg", "no unit", "IMP GAL"**
<= 0,00300	FLO|h = display unit / hour
> 0,00300	FLO = display unit / minute
Calibration constant	**Display for "US GAL"**
<= 0,00400	FLO|h = display unit / hour
> 0,00400	FLO = display unit / minute

If the maximum reading of 999 display units per hour or per minute is exceeded, three lines "---" are displayed.

5 Summary of settings and functions

- ***Display unit (measuring unit) :***
  Can be set to L, kg, US-GAL, IMP-GAL or " " (no unit)
  "IMP GAL" = Imperial gallons (4,5460 litres)
  "US GAL" = American gallons (3,7854 litres)

- ***Number of decimal places :***
  Up to 3 decimal places can be selected.
  This setting applies to the following readings :
  Partial volume counter, totalizer and range of presetting for automatic mode.

- ***Valve leakage volume :***
  This function can be switched on or off.

- ***Calibration constant :***
  Ten different calibration constants can be stored.
  Each constant can be set within the range 0,00000 to 0,99999.
  Calibration constants are only shown with the five digits after the decimal point.

- ***Partial volume counter (display in normal operation mode) :***
  7-digit display.
  No overflow warning (the counter is reset to zero).
  The partial volume counter adds all the pulses generated and displays the calculated volume. This counter is displayed in the "NORM" operation mode.

- ***Totalizer :***
  7-digit display.
  The total volume display is with the user defined number of decimal places.
  If the total volume is too high to be displayed, the decimal place is automatically reduced, until the displayed volume reads 9999999.
  No overflow warning (the conter resets to zero).
  Can be adjusted back using a specific combination of keys (see section 8.3).

  The totalizer is running in the background and adds the partial volumes.
  Display using the "TOTAL" key.

- ***Flowrate :***
  The display of flowrate depends on the unit selected by the user and the calibration constant set.

In automatic operation mode only :

- ***Main signal (preset volume, ON / OFF) :***
  Ten different preset volumes can be stored.

  The main signal switches on with "START" and off at 0,0.
  With this signal, a magnetic valve can be opened and closed in conjunction with an interface amplifier.

- ***Presignal volume :***
  The set presignal applies to all preset volumes.
  The presignal can be set to a figure between 0,00 and 9,99
  (regardless of the user defined number of decimal places).

  The presignal switches on with "START" (like the main signal),
  but switches off when the measured volume is equal to total preset volume minus the presignal volume is reached.

- **Cycle counter (counts complete dispense cycles)**
  3-digit display : max. 999 cycles.
  No overflow warning (the counter resets to zero).
  When the preset volume is changed, this counter will reset to zero automatically.

  The cycle counter displays the number of operations already completed with the currently preset volume.

6 Overview of display

Memory location 0 ... 9
for setting a calibration constant or preset volume

Number of cycles 0 ... 999
used when filling in automatic mode

Set unit

Normal operation mode

Automatic operation mode

Main signal
ON / OFF

"TOT":
the total volume is displayed

"CAL" flashes :
"Select and set a calibration constant" mode of operation is switched on

"CAL" static :
display of the set calibration constant

"BAT" flashes :
still 1 to 3 weeks of normal use possible

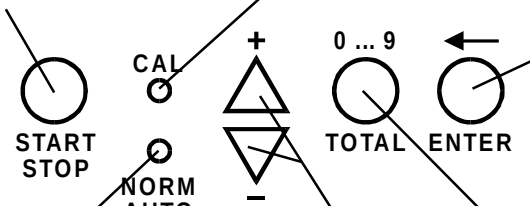
"BAT" static :
no further action possible, all data saved to memory

"COUNT" flashes,
as soon as the sensor records pulses

Measurement of valve leakage volume ON / OFF

Presignal ON / OFF

7 Overview of keys



In automatic operation mode only : Statring operation. Stop or interrupt operation.

Display of "Select and set a calibration constant" mode of operation (press for 5 seconds)

Cancel display
in normal operation mode
(press for 1 second)

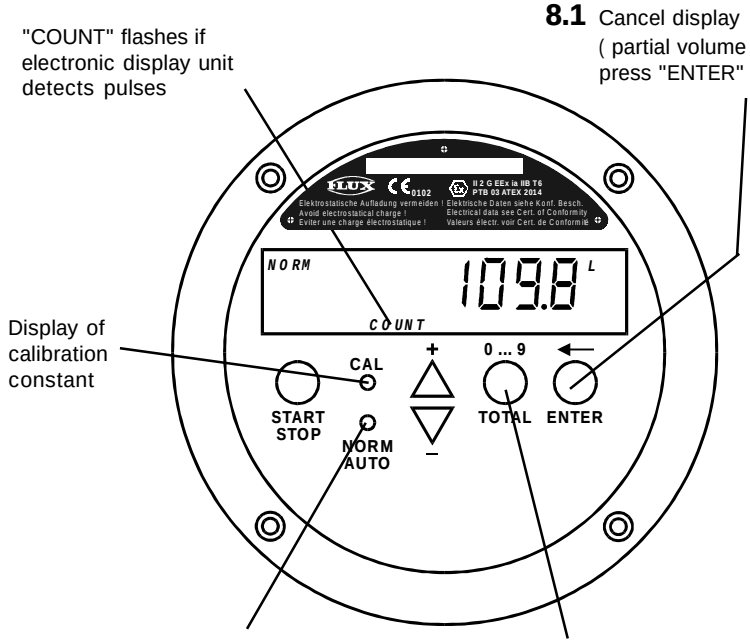
Entering of the
- preset volume
- presignal volume
- fault indicator
- display unit
- vlave leakage volume
- number of decimal places
- calibration constants
- change digit number

Change over from
Normal tl automatic operation mode
(press for 5 seconds)

Setting of the
- preset volume
- presignal volume
- display unit
- valve leakage volume
- number of decimal places
- calibration constants

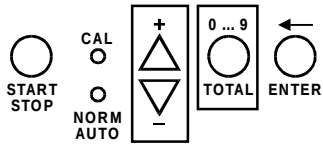
Display of total volume.
Selection of memory locations.
calibration constants 0 ... 9
preset volumes 0 ... 9

8 Summary of normal operation mode



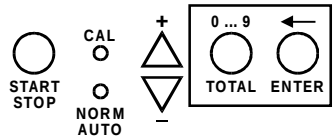
8.3 Cancel total volume :

Hold down the "TOTAL" key until the total volume appears in the display.
Then simultaneously press "+" and "-" .
Press all 3 keys together until the display clears (this will take approx. 5 seconds).

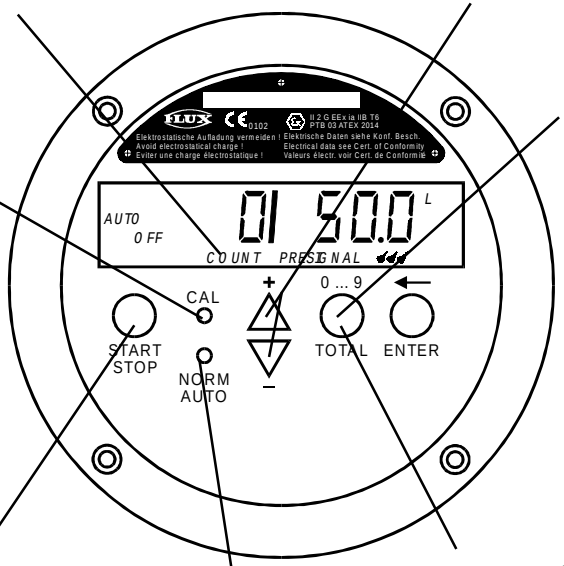


8.4 Display of instantaneous flowrate :

Press "TOTAL" and "ENTER" together.
The instantaneous flowrate per minute is displayed.
Press both keys again to return to normal operation mode.



9 Summary of automatic operation mode



Filling operation :
start / stop / reset to zero.
If the filling process is interrupted, it is possible to reset to the initial value by pressing the "ENTER" key.

Press the "START/STOP" key to temporarily pause or restart the automatic dispense cycle.

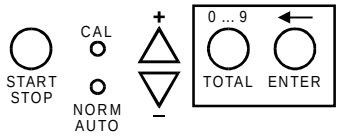
Press "TOTAL" key for approx. 1 second for display of partial volume.
After pressing "TOTAL" for approx. 5 seconds, the total volume is displayed.

The remaining of volume is displayed for 5 seconds after the key has been released.

Change over to normal operation mode :
press "NORM/AUTO" for 5 seconds.

- You must change over into normal operation mode in order to switch off the display of the total volume.
  Press "NORM/AUTO" for more than 5 seconds.

- Display of instantaneous flowrate.
  Press the "TOTAL" and "ENTER" keys together.
  The flowrate is displayed until the keys will be released.



9.1 Setting the preset volume and presignal volume

For one-off or repetitive filling of a preset volume, enter the volume in automatic operation mode. If you are using a one valve system and this valve is controlled by the main signal, then inputting a presignal volume will have no effect.

An example of the use of the presignal :
You wish to fill a 200 litres container. In order to fill in the shortest possible filling time you are using two valves. One valve has a large nominal diameter, and the other a small.
The valve with the larger diameter is connected to presignal. You specify, for example, that 5 litres before the total volume of 200 litres is reached, the large valve closes and the remaining 5 litres is filled using the small valve. To achieve this set the volume to 200 litres and the presignal to 5 litres. This will reduce the filling rate for the last 5 litres and prevent the over filling of the container through foaming or swirling. It will also improve the accuracy of the system.

Setting a preset volume :

Press the key "+" or "-"

The flashing figure can be changed using the "+" or "-" key.
The cycle counter is reset when the preset volume, the main signal, is changed.

Briefly press the "ENTER" key

Briefly press the "ENTER" key, this allows the next figure to be chosen.

Memory location Preset volume

Press the "ENTER" key for a longer period of time

By pressing the "ENTER" key for a longer period of time, the circuits automatically switch to entry of the presignal.

Entering the presignal volume :

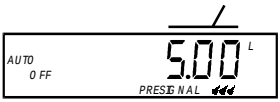
Press the key "+" or "-"

To change the presignal, you must first confirm the setting of the preset volume.
If only the presignal is changed, the cycle counter does not reset.

Briefly press the "ENTER" key

Briefly pressing "ENTER" allows the next figure to be chosen and then changed using the "+" or "-" keys.

Presignal



Press the "ENTER" key for a longer period of time

By pressing the "ENTER" key for a longer period of time, the preset volume will be automatically displayed. If the presignal is set to 0,00 "PRESIGNAL" disappears from the display.

9.2 *Entering the preset volumes into memory locations*

The memory chip can store up to 10 different preset volumes.

Entering the preset volume :

Press the key "+" or "-"

After pressing the "+" or "-" key, you can, by again pressing one of these keys, change the chosen volume, or can select the memory location by pressing the "TOTAL" key.

Memory location Preset volume

0 ... 9

Press the "TOTAL" key

The memory location number is increased by 1, each time you press the "TOTAL" key. Memory location 0 follows memory location number 9.

If you change to the next memory location, by pressing the "TOTAL" key, the previously shown chosen volume is automatically stored.

Press the "ENTER" key for a longer period of time

The currently shown chosen preset volume is used for filling.

Press the "ENTER" key for a longer period of time

Press the "ENTER" key again to adopt the set presignal volume.

After you have pressed the "ENTER" key, the circuits switch automatically to displaying the preset volume.

9.3 *Filling operations : start / stop / reset to zero*

After you have set the chosen volume, you can start the filling with the "START/STOP" key. You can interrupt the filling process and start again, at any time, by pressing the "START/STOP" key again. Repeatedly opening and closing the valves during filling, affects the accuracy of filling. If you have interrupted filling, you can switch back to the preset volume by pressing the "ENTER" key.
The cycle counter only counts fully completed fillings.

9.4 *Error display in automatic operation mode*

When used in automatic mode, 3 errors can be displayed.

Display	Cause	Remedy
"Err 1"	The presignal volume is larger that the total filling volume.	Increase the overall filling volume or reduce the presignal volume. *Press the "ENTER" key twice*
"Err 2"	The presignal volume plus the valveleakage volume is larger than the total filling volume.	Increase the overall filling volume or reduce the presignal volume, or use faster valves (i.e. reduce leakage volume). ! Pressure surges *Press "ENTER" key*
"Err 3"	No pulse was determined within 5 seconds after pressing the "START/STOP" key	Fill up the liquid. Check the interface amplifier, pump and/or magnetic valves. Nutating disk / oval rotors not moving (e.g. because of soiling, wear, etc.). The sensor is defective. *Press the "ENTER" or "START / STOP" key. The volume remaining to be filled is shown* *Fill the remaining volume using the "START / STOP" key or press the "ENTER" key again to switch back to the preset volume.*

10 Basic settings

The basic settings change the unit of display, the number of decimal places, the valve leakage volume functions and the calibration constants.

10.1 Selecting the unit of display

You can choose from 5 different units of display :

- L Litres
- US GAL American gallons (3,7854 Liter)
- IMP GAL English gallons (4,5460 Liter)
- kg Kilograms
- " " no unit

When changing the unit of display, no conversions are made.
The volume information in the total volume memory is cleared.
The partial volume memory is cleared.
All stored preset volumes, and the presignal, are cleared.

Changing the basic settings :

First press CAL then press both, the + − keys, holding all three keys for approx. 5 seconds, until the display changes.

Press the "+" or "-" key

Each time you press the "+" or "-" key, the unit of display changes through the sequency.

Press the "ENTER" key

With the "ENTER" key, you confirm the selected unit of display. The circuits switch utomatically to the selection of the number of decimal places.

10.2 Decimal places

You can choose between 4 different settings :

Setting	Partial volume counter Total volume counter	Maximum preset volume (automatic mode)	Accuracy of setting	recommended for
9999999	9999999	9999	1	FMO 50
999999.9	999999.9	999.9	0,1	FMC, FMO 10, FMO 40
99999.99	99999.99	99.99	0,01	FMO 2, FMO 4, FMO 7
9999.999	9999.999	9.999	0,001	FMO 1, FMO 2

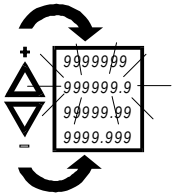
When you change the number of decimal places, all preset volumes are reset to zero.

Selecting the number of decimal places :

First press CAL then, in addition, press both, the + and − keys, holding all three keys for approx. 5 seconds, until the display changes, and the unit of display information flashes.

Press the "ENTER" key

If you wish to keep the unit of display shown, press the "ENTER" key.



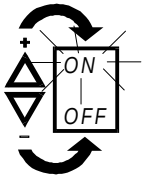
Press the "+" or "-" key

Each time you press the "+" or "-" key, the next given choice in the series of these is shown.

Press the "ENTER" key

With the "ENTER" key, you confirm the chosen number of decimal places. The circuits switch automatically to selection of the valve leakage volume.

10.3 Valve leakage volume



A pictogram " " is shown in the display. The valve leakage volume can be switched ON or OFF, with the "+" or "-" keys (in automatic mode only). You confirm your choice with the "ENTER" key. The circuits automatically switch to setting the calibration constants.

10.4 Calibration constant

The electronic digital display unit uses pulses to calculate the volume. The number of pulses must be dirtctly proportional the volume of liquid, e.g. 1 litre = 20 pulses and 2 litres = 40 pulses. For example on FMC 100 this equates to 0,05 litres per pulse (= 1 litre divided by 20 pulses; = 2 litres divided by 40 pulses...). Therefore, to calculate the volume of liquid in litres, which has passed through the meter, the number of pulses must now be multiplied by 0,05.

As a formula : total volume = number of pulses X constant

The constant, in this formula, is the calibration constant. The calibration constant allows the electronics to display the correct volume that has passed through the meter. The accuracy of the meter is not affected by this.

10.4.1 An example of calculation of a calibration constant

The display unit FMC 100 shows a volume of 20 litres. Measurement in a graduated cylinder indicates a volume of 22,5 litres passed through the meter. The currently used calibartion constant is, for example, 0.0488 litres/pulse. Since the display shows 20 litres, this means that 409 pulses have been recorded (20 litres / 0,0489 litres/pulse = 409 pulses). The electronic digital display unit should however show a volume of 22,5 litres for these 409 pulse. Therefore this results in a new calibration constant of 22,5 litres / 409 pulses = 0,05501litres/pulse.

Simplified calculation :

$$C_{NEW} = C_{OLD} \times \frac{\text{measured volume}}{\text{reading on the FMC}}$$

C_{NEW} = the calibration constant which will be used after filling a known volume
C_{OLD} = the temporarily used calibration constant

Measured volume = the volume recorded with, for example, a graduated measuring cylinder
Reading on the FMC = the volume shown on the meter's LCD

$$C_{NEW} = 0{,}04890 \times \frac{22{,}5\ L}{20\ L} = 0{,}05501$$

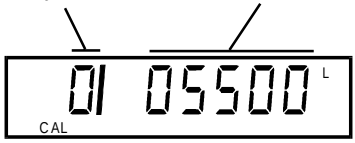
This gives the new calibration constant C_{NEW} = 0,05501.

10.4.2 Setting the calibration constants

If you arrive to the setting of the calibration constant within the "basic settings mode", you do not have to press the "CAL" key again.

CAL Press the "CAL" key

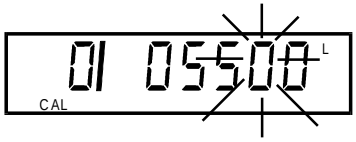
Memory location Calibration constant



CAL Press the "CAL" key for more than 5 seconds

Press the "+" or "-" key

ENTER Briefly press the "ENTER" key



ENTER Press the "ENTER" key for a longer period of time

After you have pressed the "CAL" key, the display for the calibration constant, and the associated memory location, immediately appears. If you release the key within 5 seconds, the LCD will revert to the previous display. This enables you to quickly check the current calibration constants, without having to change the mode of operation.

When the display starts to flash, the calibration constant or the memory location can be selected.

The flashing number will be changed by pressing the "+" or "-" key.

The individual digits can be selected by briefly pressing the "ENTER" key.

If the "ENTER" key is held down for a longer period of time, you confirm the calibration constant which has been set. The display automatically changes to normal or automatic operation mode.

10.4.3 Entering calibration constants into different memory locations

If your metering application involves several liquids with differing physical properties or metering in both, the automatic and normal modes, the meter can store all the data. Up to 10 different calibration constants can be stored in locations 0 to 9. You can select the memory location, and relevant constant, quickly and easily.

Setting a calibration constant in the memory location :

CAL Press the "CAL" key for more than 5 seconds

When display flashes, the constant can be changed or the memory location selected.

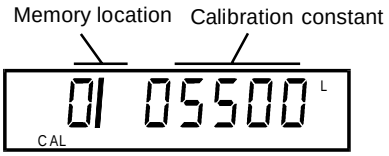
Press the "+" or "-" key

You set the calibration constant by pressing the "+" or "-" keys, as described in section 10.4.2.

Press the "TOTAL" key

You select the memory location by pressing the "TOTAL" key.

Each time you press the "TOTAL" key, the memory location number is increased by 1. After memory location 9, the LCD automatically displays memory location 0.



Each time you switch to the next memory location by pressing the "TOTAL" key, the calibration constant previously set will be automatically stored.

Press the "ENTER" key

The currently shown calibration constant is used for filling operation.

After you have pressed the "ENTER" key, the circuits automatically revert to the previous mode of operation (automatic or normal mode).

10.4.4 What affects the accuracy of measurement ?

In order to achieve an exact measurement, the pump, the liquid meter as well as the flexible hose and/or pipeworkshave to be filled with liquid.

The following points should be taken into account, in order to achieve the maximum accuracy for each model of FLUX liquid meter :

- fill without interruptions
- the flowrate must be kept constant (applies to FMC only)
- the minimum and maximum permissable flowrate of the meter may not be exceeded (applies to FMC only)
- the opening and closure time of valve must be constant
- the temperature must be constant
- the viscosity must be constant (applies to FMC only).
- the liquid must not contain air bubbles

10.5 Protecting the calibration

It is possible to provide additional protection against inadvertent change to the calibration constants. This feature is only accessible in the normal operation mode. To lock the calibration mode, press the "START/STOP" key and then press the "CAL" key for more than 3 seconds. The calibration mode is now locked. To unlock, repeat the key sequence.
With CAL ON changing to CAL OFF, the lock is switched off and recalibration is possible.
With CAL OFF changing to CAL ON, the lock is on and the calibration mode protected from unauthorized or inadvertent changes.

10.6 Software reset

The software reset clears all the memory locations, allowing re-entry of data when input errors have occured during set-up.
To start a software rest, the "ENTER" + "TOTAL" + "START" keys have to be pressed together, for at least 5 seconds.
This can be done at any time.

11 Checking the electronic digital display unit without a liquid meter

- Only carry out the test outside of a zoned hazardous area.

You can check all the functions without using a liquid meter.

- In order to produce individual pulses, connect a pulse generator between the grey (CP 2/6) and the brown (CP 2/9) wires.
  The electronics count one digit each time a pulse is generated between CP 2/6 and CP 2/9.

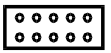
- To test an external Start/Stop, apply a pulse generator between CP 2/7 and CP 2/9.
  OFF changes to ON, and vice versa, with each pulse generated between CP 2/7 and CP 2/9.
  If the interface amplifier is connected this will switch on and off relative to the received pulse.

If you connect an unscreened cable or wire, or one which is longer than 12 m, this can lead to false inputs to sensor and external Start/Stop circuits. The NAMUR output signals to the interface amplifier are not affected.

12 Connecting diagram of electronic display unit

Connection of the sensor
to CP 1

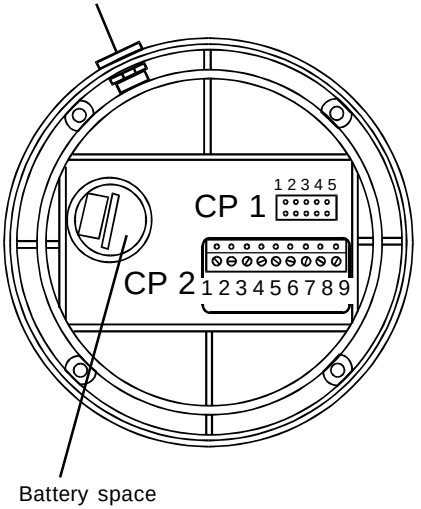
1 2 3 4 5



CP 1 (connector panel 1)

1/1 Internal sensor connection
1/2 to 1/5 no function

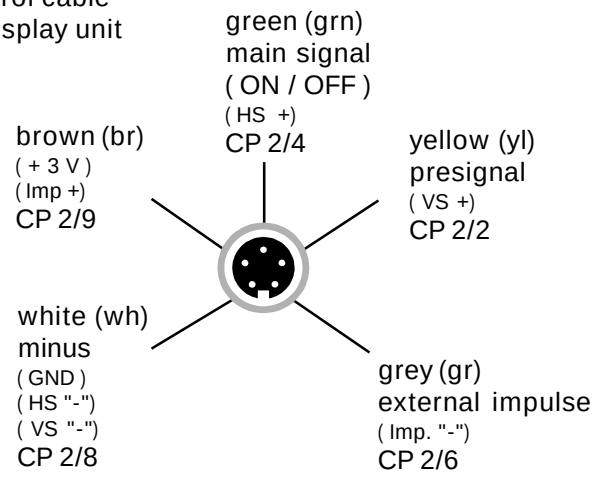
Rear view of the electronic display unit



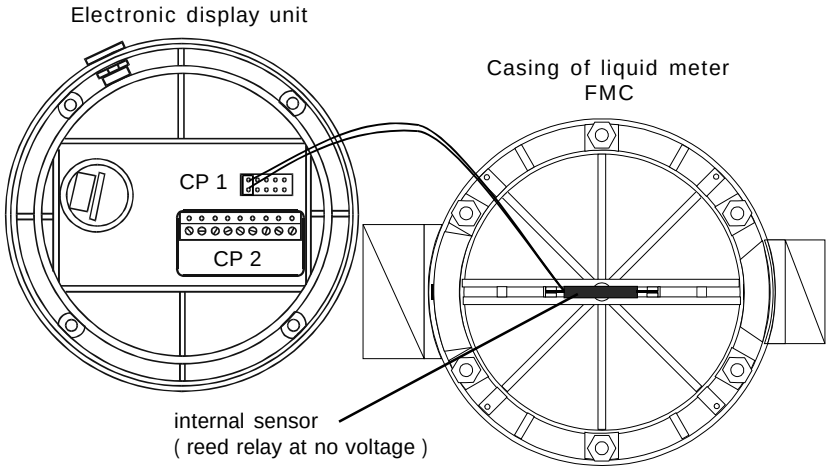
CP 2 (connector panel 2)

2/1 no function
2/2 presignal (VS +)
output to the interface amplifier
2/3 no function
2/4 ON / OFF (main signal) (HS +)
output to the interface amplifier
2/5 no function
2/6 external impulse
input for external sensor.
The connector to the internal sensor must be taken out.
Pulses of + 3V are used for switching (CP 2/9)
2/7 external Start/Stop (CP 2/9)
2/8 minus (GND)
2/9 + 3 Volt
when using an external voltage supply, the battery must be removed

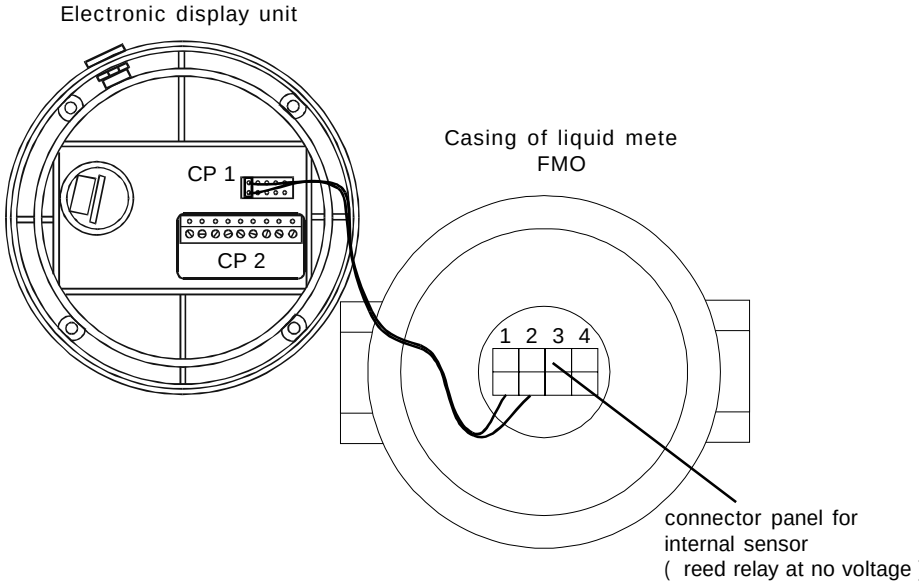
Socket for control cable
on electronic display unit



13 Connection of electronic display unit to liquid meters FMC



14 Connection of electronic display unit to liquid meters FMO 4 to FMO 50



15 Connection of electronic display unit to liquid meters FMO 1 and FMO 2

The electronic display unit of these two models are intended for wall mounting.
The connection between the liquid meter and the separate electronic display unit is made by a control cable, 5 m long, included in the electronic display unit p/n 001 42 016.

16 Use of an interface amplifier

To control pump motors and/or magnetic valves by a FLUX liquid meter, you require an interface amplifier type FSV to reinforce the low level pulses emitted by the electronic display unit. The use of the electronic display unit in hazardous areas requires an interface which is certified for use in hazardous areas. Not all interface amplifiers do meet this requirement. The **NAMUR*** interface definitely meets these requirements. If you are using other interface amplifiers, please comply with the Certificate of Conformity of the FLUX electronic display unit as well as with the one supplied with the interface amplifier.

(* **NAMUR** = **N**ormen **A**usschuss **M**ess- und **R**egeltechnik = Standards Committee measuring and control engineering)

17 The FLUX FMC liquid meter (nutating disk type)

The measuring chamber is separated into two halves by a disk. The flow of liquid through the measuring chamber causes the disk to nutate. This oscillating movement results, by pressures from the liquid, in the disk rotating. The sensor detects this rotation and generates two pulses for each revolution, i.e. one pulse corresponds to 1/2 volume of the measuring chamber (0,5 l/puluse on FMC 100 and 0,125 l/pulse on FMC 250). The sensor consists of an encapsulated magnet located on the disk's shaft and a reed relay bonded on the casing on the outside of the measuring chamber. Each time the magnet passes the reed relay, a pulse is generated. This method of construction achieves contactless transmission from the liquid filled measuring chamber to the electronic digital display unit on the facia.

17.1 Before starting operation

Ensure inlet/outlet pipework is correctly aligned. Stress due to misalignment will damage the liquid meter.

Check for chemical compatibility with both, the liquid to be measured and any cleaning agents.

Pressure surges which are greater than the nominal pressure, stated on the name plate, can damage the liquid meter.
Important :
Pressure surges can be result of several factors. A common source is the inertia of the liquid whithin the pipework system. High pressures can be developed when valves are rapidly opened or closed on systems with long runs of pipework.

FMC 100/PP and FMC 100/ETFE **PN 4** (4 bars nominal pressure)

FMC 100/S and FMC 250 PP/PVDF **PN 6** (6 bars nominal pressure)

Check all connections for tightness !

Factory settings :
Factory calibration has been made on each FLUX FMC liquid meter with water at 20 °C and an average flowrate of 50 l/min (FMC 100) or 120 l/min (FMC 250).

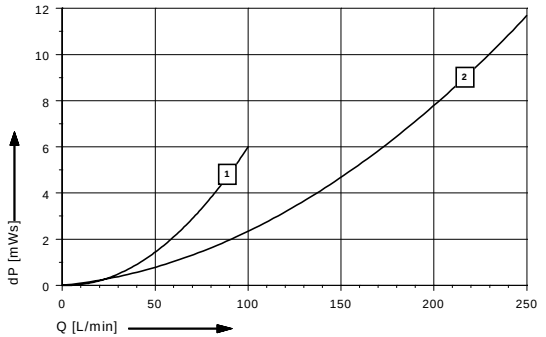
The factory calibration is stored in memory location 0. The factory calibration can be changed at any time and is not protected against change.

Check the accuracy of the display if the liquid meter is used with viscous liquids or small flowrates (5 to 15 l/min on FMC 100 and 10 - 30 l/min on FMC 250).

17.2 Use of FLUX FMC liquid meters in hazardous area

When using a FLUX liquid meter in PP, ETFE or PVDF in hazardous area, the inlet and outlet connections must be bonded together. This bonding must be with an earthing lead which complies with all relevant regulations.

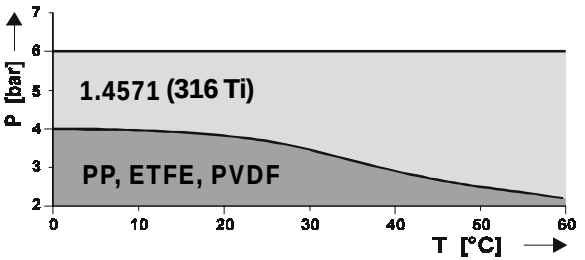
17.3 Pressure loss FMC 100, FMC 250



1 FMC 100
2 FMC 250

Test made with water at 20°C
Tolerance ± 5%

17.4 The relationship between nominal pressure and temperature



17.5 Technical data

		FMC 100/PP	FMC 100/ETFE	FMC 100/S	FMC 250/PP	FMC 250/PVDF
Flowrate		10 - 100 l/min *			30- 250 l/min	
Pressure		0,1 - 4 bar (with water at 20°C)		0,1 - 6 bar	0,1- 6 bar	
Viscosity		up to max. 2500 mPas / cP				
Temperature of liquid		up to 60°C at max. 2 bar		up to 80°C	up to 60°C	
Accuracy		± 1%			±1% between Q=50l/min and Q= 250 l/min)	
Weight		1,1 kg	1,4 kg	1,7 kg	4,5 kg	9,0 kg
Material	meter body	PP	ETFE	St.steel 316 Ti	PP	PVDF
	measuring chamber	PPS	ETFE	PPS	PE	PVDF

* smaller flowrates on request

18 The FLUX FMO liquid meter (oval rotor type)

This design consists of two oval shaped gearwheels positioned in a precisely dimensioned housing. The liquid flows into a chamber formed by the gears and the housing. The inlet pressure of the liquid forces the gearwheels to rotate. The rotating gears contain a sensor. The sensor detects this rotation and generates pulses. The sensor consists of an encapsulated magnet and a reed relay bonded on the casing on the outside of the measuring chamber. Each time the magnet passes the reed relay a pulse is generated. This method of construction achieves contactless transmission from liquid inside of the meter to the electronic digital display unit on the meter's facia. The volume of the measuring chamber and the gears are precisely machined to contain a specific swept volume. From this known volume and the number of revolutions it is possible to calculate the volume that has passed through the liquid meter.

18.1 Before starting operation

Ensure inlet/outlet pipework is correctly aligned. Stress due to misalignment will damage the liquid meter.

Check for chemical compatibility with the liquid and any cleaning agent.

Pressure surges which are greater than the nominal pressure, stated on the nameplate, can damage the liquid meter.

Important :
Pressure surges can be result of several factors. A common source is the inertia of the liquid within the pipework system. High pressures can be developed when valves are rapidly opened or closed on systems with long runs of pipework !

Check all connections for tightness !

Factory settings :

The calibration constant of each FLUX FMO liquid meter (see section 19.4) is stored in memory location 1. The factory calibration can be changed at any time, and is not protected against change.

18.2 Use of FLUX FMO liquid meters in hazardous areas

When using a liquid meter with a PPS housing (models FMO 1 P/... , FMO 2 P/... and FMO 7 P/...) in hazardous area, the inlet and outlet connections must be bonded together. This bonding must be with an earthing lead which complies with all relevant regulations.

18.3 Pressure loss

In the case of pressure loss of 1 bar, a max. of X litres/minute can flow through. X = figures in table

Type	Viscosity in [mPas / cP]								
	< 1000	< 3000	< 4000	< 5000	<10000	<25000	<50000	< 100000	< 500000
FMO 1	1,7	-	-	-	-	-	-	-	-
FMO 2	8,3	-	-	-	-	-	-	-	-
FMO 4	30	27	24	21	15	12	9	6	3
FMO 7	80	-	-	-	-	-	-	-	-
FMO 10	120	108	96	84	60	48	36	24	12
FMO 40	240	215	195	170	120	95	70	45	20
FMO 50	350	315	280	245	175	140	105	70	35

18.4 Technical data

Type	Flowrate		Particles max. in [mm]	Calibration constant [Litre / Pulse]
	< 5 mPas	> 5 mPas, < 1000 mPas		
FMO 1 *[1]...	15-100 L/h	10-100 L/h	0,12	0,00100
FMO 2 *[1]...	40-500 L/h	30-500 L/h	0,12	0,00250
FMO 4 ...	4-25 L/min	2-30 L/min	0,28	0,00893
FMO 7 *[1]...	8-70 L/min	3-80 L/min	0,28	0,01923
FMO 10...	10-100 L/min	6-120 L/min	0,28	0,02778
FMO 40...	15-220 L/min	10-240 L/min	0,28	0,06897
FMO 50...	30-300 L/min	15-350 L/min	0,46	0,14925

*[1] Models FMO 1 and FMO 2 up to max. 1000 mPas / cP

Type	Accuracy	Viscosity
FMO 1; FMO 2	± 1,0%	up to 1000 mPas / cP
FMO 7	± 0,5%	up to 1000 mPas / cP
FMO 4 to FMO 50 *[2]	± 0,5%	up to 500.000 mPas / cP

*[3] for viscosity as from 1000 mPas with special oval rotors

Type	Material Meter body	Material Oval rotors	Temperature of liquid	Operating pressure				
				FMO 1; FMO 2	FMO 7	FMO 4 to FMO 50	FMO 40 .../FL	FMO 50 .../FL
FMO .../P/P	PPS	PPS	up to 80 °C	5 bar	10 bar	-	-	-
FMO .../S/P	St.steel 316 L	PPS	up to 80 °C	10 bar	-	55 bar	16 bar	16 bar
FMO .../S/S	St.steel 316 L	St.steel 316 L	up to 120 °C	10 bar	-	55 bar	16 bar	-
FMO .../AL/P	Aluminium	PPS	up to 80 °C	-	-	55 bar	16 bar	16 bar

Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

(1) # EC-TYPE-EXAMINATION CERTIFICATE

(Translation)

(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres - **Directive 94/9/EC**

(3) EC-type-examination Certificate Number:

PTB 03 ATEX 2014

(4) Equipment: FLUX-liquid flow meter type FM../../../..

(5) Manufacturer: Flux-Geräte GmbH

(6) Address: 75433 Maulbronn, Germany

(7) This equipment and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.

(8) The Physikalisch-Technische Bundesanstalt, notified body No. 0102 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.

The examination and test results are recorded in the confidential report PTB Ex 03-22066.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 50014:1997+A1+A2 **EN 50020:1994**

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-type-examination Certificate relates only to the design, examination and tests of the specified equipment in accordance to the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment. These are not covered by this certificate.

(12) The marking of the equipment shall include the following:

Ex II 2 G EEx ia IIB T6

Zertifizierungsstelle Explosionsschutz
By order:

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor

Braunschweig, February 25, 2003

(13) # SCHEDULE

(14) ## EC-TYPE-EXAMINATION CERTIFICATE PTB 03 ATEX 2014

(15) Description of equipment

The Flux-liquid flow meter type FM../../../.. is a component of a flow measuring system and consists of the electronic housing. The Flux-liquid flow meter type FM../../../.. serves for the detection and display of the amount of substances of flowing media. The surface of the electronic housing of the liquid flow meter fulfils the conditions of electrostatic safety for equipment of group IIB.

The permissible ambient temperature range is: -20°C to +50°C.

Electrical data

Internal supply	3 V (DC); for voltage supply approved battery type: VARTA Mangandioxid / Lithium, Type 6032, resp. IEC CR2032, 3.0 V changing of battery only permissible outside the hazardous area.
Measuring input STA/STO (teminal St2/9, St2/7)	in type of protection Intrinsic Safety EEx ia IIC/IIB; maximum values: U_o = 8 V I_o = 2 mA P_o = 2,8 mW C_i negligible small L_i negligible small
Measuring input IMPULS (terminal St2/9, St2/6 resp. St1/9, St1/10)	in type of protection Intrinsic Safety EEx ia IIC/IIB; maximum values for each input: U_o = 8 V I_o = 2 mA P_o = 2,8 mW C_i negligible small L_i negligible small
Output MVEN (terminal St2/4, St2/8-GND)	in type of protection Intrinsic Safety EEx ia IIC/IIB; maximum values: U_i =13,5 V I_i = 32 mA P_i = 125 mW R_i =1568 Ohm

	C_i negligible small L_i negligible small
Output KRIECH (terminal St2/2, St2/8-GND)	in type of protection Intrinsic Safety EEx ia IIC/IIB; maximum values: U_i =13,5 V I_i = 32 mA P_i = 125 mW R_i =1568 ohms C_i negligible small L_i negligible small

The output circuits MEVN and KRIECH are safely connected with each other. The common internal ground connection is infallible.

(16) Test report PTB Ex 03-22066

(17) Special conditions for safe use
none

(18) Essential health and safety requirements

met by compliance with the standards mentioned above.

Zertifizierungsstelle Explosionsschutz
By order:

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor

Braunschweig, February 25, 2003

Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

1. SUPPLEMENT

according to Directive 94/9/EC Annex III.6

to EC-TYPE-EXAMINATION CERTIFICATE PTB 03 ATEX 2014

(Translation)

Equipment: FLUX-liquid flow meter type FM../../../..

Marking: ⟨Ex⟩ **II 2 G EEx ia IIB T6**

Manufacturer: Flux-Geräte GmbH

Address: Talweg 12, 75433 Maulbronn, Germany

Description of supplements and modifications

The Flux-liquid meter type FM../../../.. may also be manufactured with the modifications in accordance with the determinations in the test report. The modifications concern the internal structure. All other statements and determinations remain valid without changes.

Test report: PTB Ex 04-24307

Zertifizierungsstelle Explosionsschutz
By order:

Dr.-Ing. U. Johannsmeier
Regierungsdirektor

Braunschweig, September 10, 2004

Sheet 1/1

FLUX-GERÄTE GMBH
Talweg 12 · D-75433 Maulbronn

EG-Konformitätserklärung

EC Declaration of Conformity

Déclaration de Conformité CE

Hiermit erklären wir, daß die Bauart der **FLUX Flüssigkeits-Mengenmesser** in den verschiedenen Werkstoffen und Bauarten in der gelieferten Ausführung der folgenden einschlägigen Bestimmung entspricht:

We herewith confirm that the construction of **FLUX Liquid Meters** in different materials and versions corresponds to the following EC-rules:

Nous confirmons que la construction des **Compteurs de Débit FLUX** de matériaux et versions différents est conforme aux dispositions règlementaires suivantes:

(1) EG-Richtlinie EMV 89/336/EWG 92/31/EWG (1. Änderung) 93/68/EWG (2. Änderung)	**EC Electromagnetic Compatiblity Directive 89/336/EEC 92/31/EEC (1st Amendment) 93/68/EEC (2nd Amendment)**	**Directive CE Compatibilité Electromagnétique d'Appareils 89/336/CEE 92/31/CEE (1ère Modification) 93/68/CEE (2ème Modification)**
(2) EG-Richtlinie betreffend Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen 94/9/EG	**EC Directive concerning equipment and protective systems intended for use on potentially explosive atmospheres 94/9/EC**	**Directive CE concernant les appareils et les systèmes de protection destinés à être utilisés en atmosphères explosibles 94/9/CE**

Bei den nachstehend aufgeführten Typen gelten die jeweils genannten Richtlinien:
The directives mentioned apply to the following types:
Les directives mentionnées s'appliquent aux types suivants:

FMC (1), (2)
FMJ (1)
FMO (1), (2)

Maulbronn, 28.02.2003

FLUX-GERÄTE GMBH

Klaus Hahn
Geschäftsführer

Summary tables for normal mode

Memory No.		Memory No.	
0		**5**	
1		**6**	
2		**7**	
3		**8**	
4		**9**	

Summary tables for automatic mode

Presignal

Calibration constant: memory location no. 0 to 9				**Preset volume: memory location no. 0 to 9**			
Memory No.		Memory No.		Memory No.		Memory No.	
0		**5**		**0**		**5**	
1		**6**		**1**		**6**	
2		**7**		**2**		**7**	
3		**8**		**3**		**8**	
4		**9**		**4**		**9**	

Summary tables for normal mode

Memory No.		Memory No.	
0		**5**	
1		**6**	
2		**7**	
3		**8**	
4		**9**	

Summary tables for automatic mode

Presignal

Calibration constant: memory location no. 0 to 9				**Preset volume: memory location no. 0 to 9**			
Memory No.		Memory No.		Memory No.		Memory No.	
0		**5**		**0**		**5**	
1		**6**		**1**		**6**	
2		**7**		**2**		**7**	
3		**8**		**3**		**8**	
4		**9**		**4**		**9**	

FLUX-GERÄTE GMBH

Talweg 12 · D-75433 Maulbronn
Telefon: 07043 / 101-0 · Telefax: 07043/101-444
Fax International: · ++ 49 7043/101-555
info@flux-pumpen.de · www.flux-pumpen.de