

# AR control unit

Installation and operating instructions, supplement



Other languages

<http://net.grundfos.com/qr/i/91834764>

## Original installation and operating instructions

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**Warning**

These installation and operating instructions are also available on [www.grundfos.com](http://www.grundfos.com).

Prior to installation, read these installation and operating instructions. Installation and operation must comply with local regulations and accepted codes of good practice.

## 1. Symbols used in this document

**Warning**

If these safety instructions are not observed, it may result in personal injury.

**Caution**

If these safety instructions are not observed, it may result in malfunction or damage to the equipment.

**Note**

Notes or instructions that make the job easier and ensure safe operation.

## 2. General information

### 2.1 Introduction

These installation and operating instructions form a supplement to the instructions for the DMX 221, DMX 226, DMH 25X and DMH 28X dosing pumps when used with an AR control unit. The AR control unit is considered part of the pump. All Information not given in this manual is equivalent to the information in the pump manual.

**Note**

Also observe the installation and operating instructions for the dosing pump.

If you require further information or if any problems arise, which are not described in detail in this manual, please contact the nearest Grundfos company.

### 2.2 Service documentation

If you have any questions, please contact the nearest Grundfos company or service workshop.

## 3. Information about the product

### 3.1 Mounting variants

The AR control unit is available in two versions:

- standard version mounted on the terminal box of the dosing pump.
- version for wall mounting: The control unit is mounted on a wall mounting plate.

All mounting variants can only be ordered together with a dosing pump. The AR control unit is considered part of the pump. The control unit cannot be retrofitted!

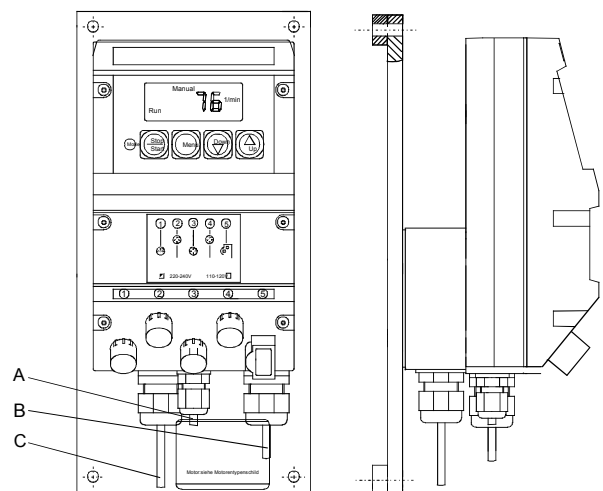
**Note**

Fig. 1 AR control unit for wall mounting

Pos.	Components
A	Hall sensor cable
B	Power supply cable
C	Motor cable

TM03 7193 4506

### 3.2 Connecting cables and plugs

If there is a large distance between the dosing pump and an AR control unit mounted on the wall, the power supply cable and the motor cable can be extended up to 20 metres (cable cross-section: 1 mm<sup>2</sup>).

**Note**

### 3.3 Enclosure class



Warning

The enclosure class is only met if the sockets are protected! The data regarding the enclosure class applies to AR control units with correctly inserted plugs or screwed-on caps.

- IP65 (maximum).

### 3.4 EMC protection

Tests according to

DIN EN 50081-1

DIN EN 50082-2

DIN ENV 50140

DIN EN 50141

DIN V ENV 50204

DIN EN 55022 class B

DIN EN 61000-4-2

DIN EN 61000-4-5.

#### 3.4.1 Required energy

**Power supply for AC voltage, mains frequency 50/60 Hz**

Rated voltage	Permissible deviation from rated value
220-240 V	± 5 %
110-120 V	± 5 %

#### Maximum permissible mains impedance

(0.084 + j 0.084) Ohm (testing according to DIN EN 61000-3-11).  
These details apply to 50 Hz.

### 3.5 Ambient and operating conditions

- Permissible ambient temperature: 0 °C to +40 °C.
- Permissible storage temperature: -20 °C to +70 °C.
- Permissible air humidity: max. relative humidity:  
70 % at +40 °C, 90 % at +35 °C.



Warning

The AR control unit is NOT approved for operation in potentially explosive areas!

**Caution**

Pumps with AR control unit are only suitable for indoor use! Do not install outdoors!

3.6 Dimensional sketches

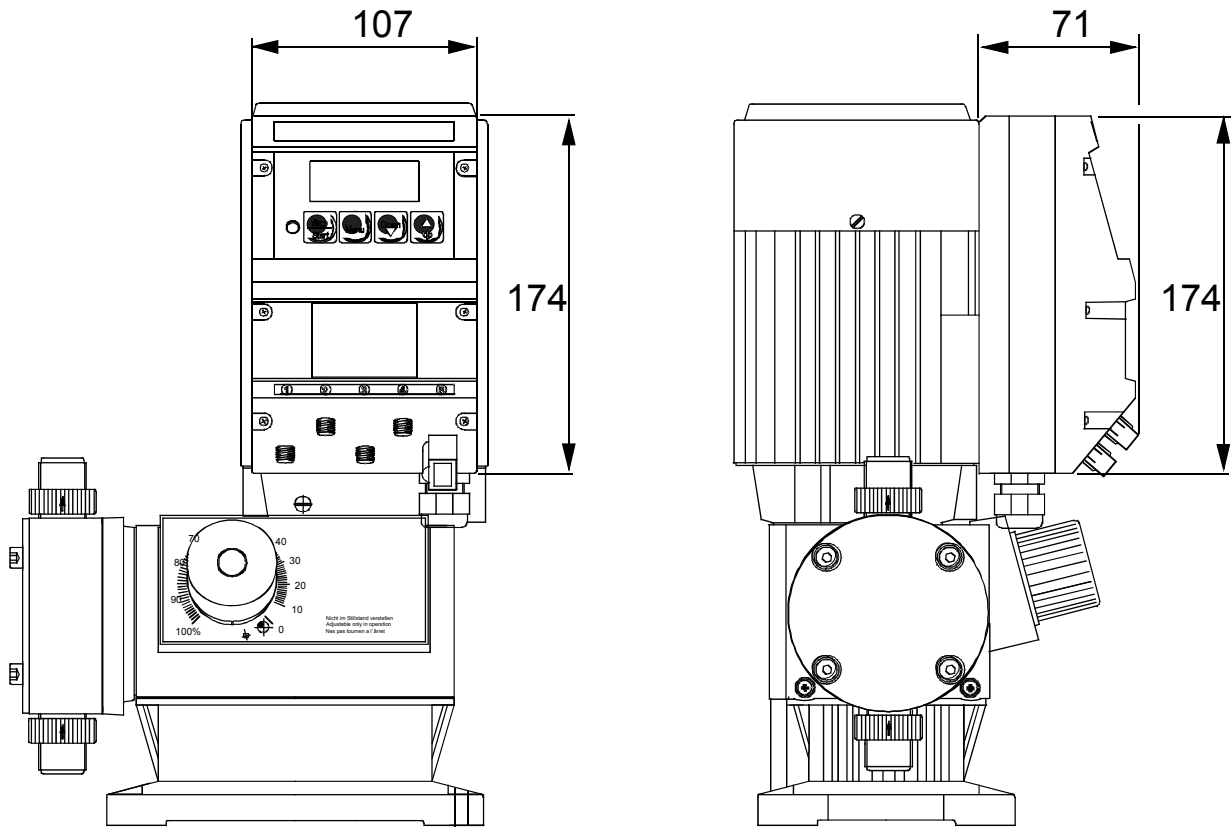


Fig. 2 AR control unit mounted on a pump terminal box

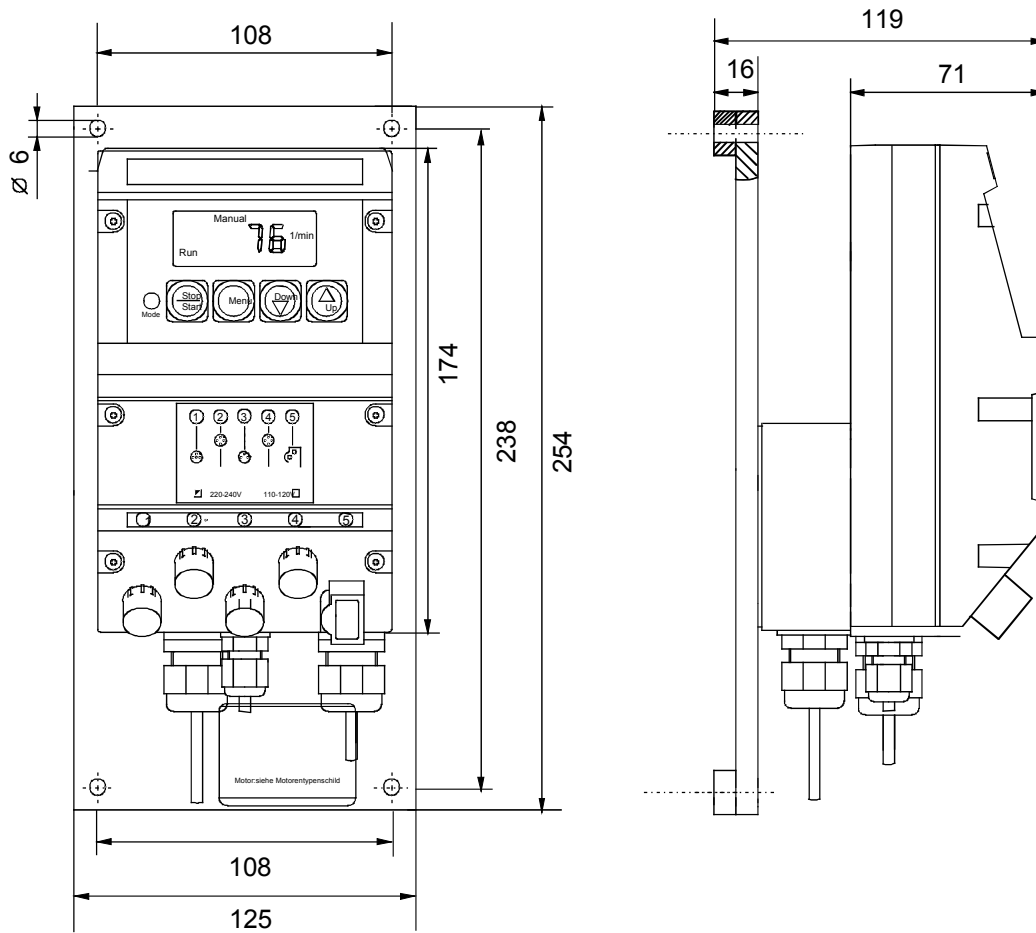


Fig. 3 AR control unit for wall mounting

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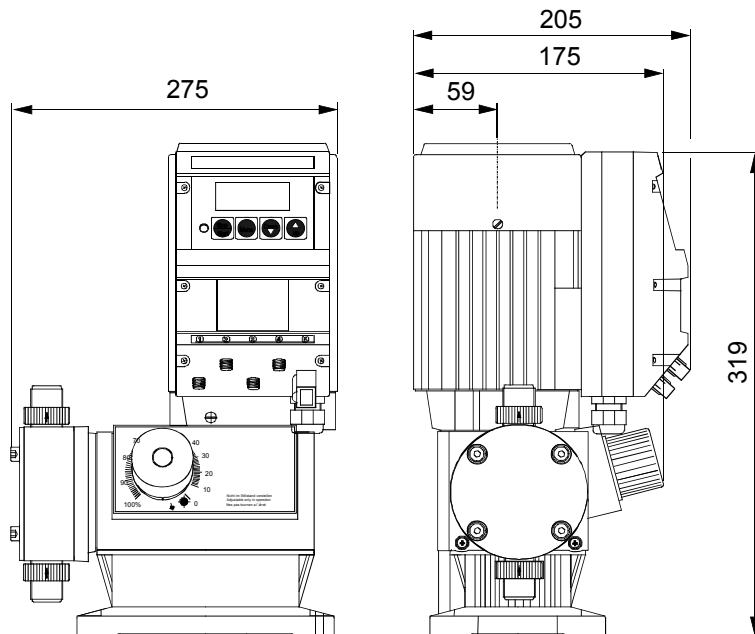


Fig. 4 AR control unit mounted on a DMX 221

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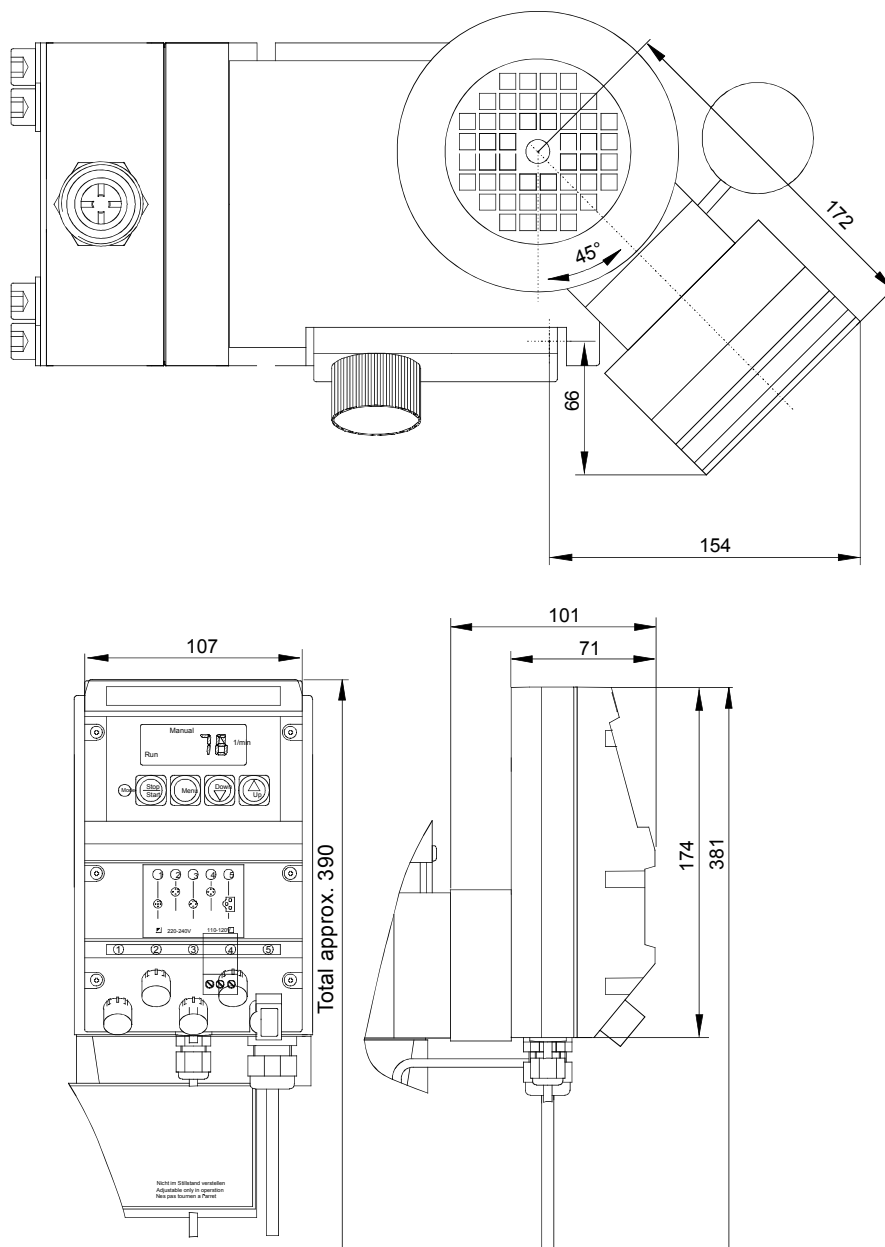


Fig. 5 AR control unit mounted on a DMX 226

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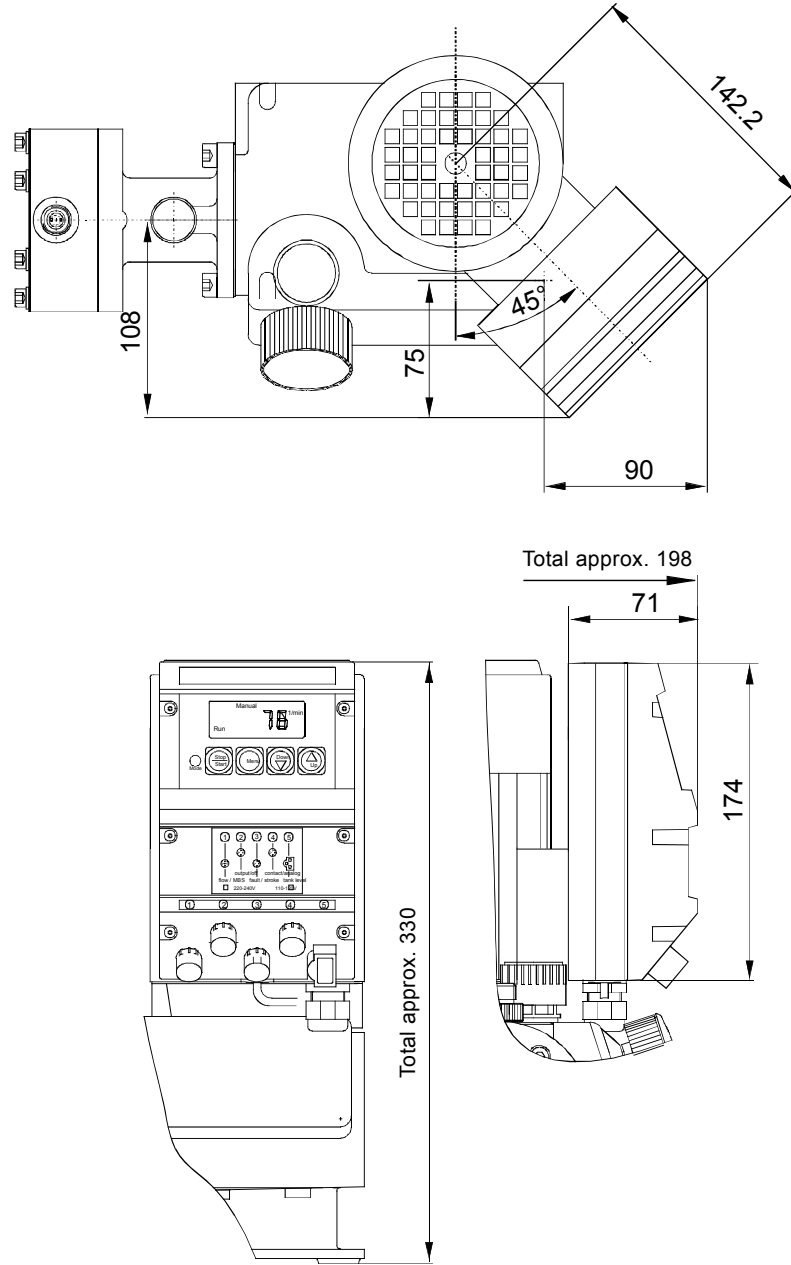


Fig. 6 AR control unit mounted on a DMH

### 3.7 Weight

Weight of AR control unit: 0.5 kg.

### 3.8 Materials

#### AR control unit enclosure

- Upper part of enclosure: PPO blend
- Lower part of enclosure: aluminium.

### 3.9 Sensors

#### Stroke control

Dosing pumps operated via a AR control unit must be provided with a Hall sensor.

Without Hall sensor the linear deviation will deteriorate to more than 10 %!

**Caution**

With Hall sensor, the linear deviation will be less than 2 %.

Length of Hall sensor cable for all pump types (depending on mounting variant): 0.4 m or 5 m.

If there is a large distance between the dosing pump and an AR control unit mounted on the wall, the Hall sensor cable can be extended up to 20 metres (cable cross-section: 0.25 mm<sup>2</sup>).

**Note**

For DMX 226 and DMH dosing pumps, a stroke sensor must be installed in the bearing cover.

- Dosing controller: DMX 221.
- Diaphragm leakage sensor: DMX 221 and DMX 226.

If there is a large distance between the dosing pump and an AR control unit mounted on the wall, the extension cables for the dosing controller and the diaphragm leakage sensor have to be ordered separately!

**Note**

Product number 96609032 (321-223)  
5-core cable with coupler socket/plug.

## 4. Installation

### 4.1 General information on installation



**Warning**

Observe the specifications for the range of applications and installation location described in sections [2. General information](#) and [4.2 Installation location](#).

Carefully tighten the screws. Otherwise the plastic housing may be damaged.

**Caution**

The function of the finally mounted control unit must be tested together with the dosing pump!

The nameplate must be stuck to the mounting plate or to the upper part of the control unit!

## 4.2 Installation location

### 4.2.1 Space required for operation and maintenance

**Note**

The pump must be installed in a position where it is easily accessible during operation and maintenance work.

The control elements must be easily accessible during operation.

### 4.2.2 Permissible ambient influences

- Permissible ambient temperature: 0 °C to +40 °C.
- Permissible air humidity: max. relative humidity: 70 % at +40 °C, 90 % at +35 °C.

The installation site must be under cover!  
Ensure that the enclosure class of motor and pump is not affected by the atmospheric conditions.  
Pumps with AR control unit are only suitable for indoor use! Do not install outdoors!

**Caution**

## 5. Electrical connections

**Note**

Also observe the installation and operating instructions for the dosing pump.

Make sure that the control unit and pump are suitable for the electricity supply on which they will be used.

**Warning**

Electrical connections must only be carried out by qualified personnel!

Disconnect the power supply before connecting the power supply cable and the relay contacts!

Before connecting the power supply cable, check that the rated voltage stated on the pump nameplate corresponds to the local conditions!

Do not make any changes to the power supply cable or plug!

Observe the local safety regulations!



**Warning**

The pump housing must only be opened by personnel authorised by Grundfos!



**Warning**

Protect the cable connections and plugs against corrosion and humidity.

Only remove the protective caps from the sockets that are being used.

**Caution**

The power supply must be electrically isolated from the signal inputs and outputs.

**Caution**

The pump can be automatically started by connecting the power supply!

### 5.1 Switching on/off

- Do not switch on the power supply until you are ready to start the pump.

**Caution**

Before switching on the pump, check that it is installed correctly. See section [4. Installation](#).

The control unit needs a booting time of minimum 5 seconds. Therefore, start the pump by pressing the "Start/Stop" button. Do not start the pump via the mains.

**Note**

In case of mains interruptions or disturbances, the pump may stop.

## 6. Mounting

### 6.1 Mounting on the pump terminal box

The control unit is factory-mounted on the pump terminal box by Grundfos!

**Caution** At each intervention in the control unit, the e.s.d. (electrostatic discharge) protection must be observed!

General conditions:

- Pump with AC motor (Grundfos motor)
- Pump with Hall sensor (stroke indication)
- Pump types:
  - DMX 221
  - DMX 226 up to 400 l/h and 3.5 bar maximum counter-pressure
  - DMH.

### 6.2 Wall mounting

- Fasten the control unit to the wall by means of the enclosed fastening material.
- Connect the power supply cable to a protective motor switch (for size, see nameplate).
- Connect the control line.

## 7. Connecting signal lines for AR control unit

Warning



Electrical connections must only be carried out by qualified personnel!

Disconnect the power supply before connecting the power supply cable and the relay contacts!

Observe the local safety regulations!



Warning

The pump housing must only be opened by personnel authorised by Grundfos!



Warning

Protect the cable connections and plugs against corrosion and humidity.

Only remove the protective caps from the sockets that are being used.



Warning

The enclosure class is only met if the sockets are protected! The data regarding the enclosure class applies to AR control units with correctly inserted plugs or screwed-on caps.

**Caution** The power supply must be electrically isolated from the signal inputs and outputs.

There is a risk that the unit connected to the current output could be destroyed!

If the pump connected to the current output has a GND-PE reference, the current output may increase to a multiple of 20 mA!

**Caution** If this is the case, connect an isolating amplifier between the current output and the unit.

## 7.1 Control data (AR control unit)

### Functions for electronic control

Continuous-operation button for function test and dosing head deaeration
Memory function (stores a maximum of 65,000 pulses)
Two-stage tank-empty signal (e.g. via Grundfos tank-empty sensor)
Stroke signal/pre-empty signal (adjustable)
Dosing controller function (only with sensor - optional)
Diaphragm leakage detection (only with sensor - optional)
Access-code-protected settings
Remote on/off
Hall sensor (for motor monitoring)
Operating hours counter (cannot be reset)

### Operating modes for electronic control

Manual
Stroke frequency: manually adjustable
Contact signal control
Multiplier (1:n) and divisor (n:1) (optional)
Current signal control 0-20 mA / 4-20 mA
Adjustment of stroke frequency proportional to the current signal
Weighting of current input

### Inputs and outputs

#### Inputs

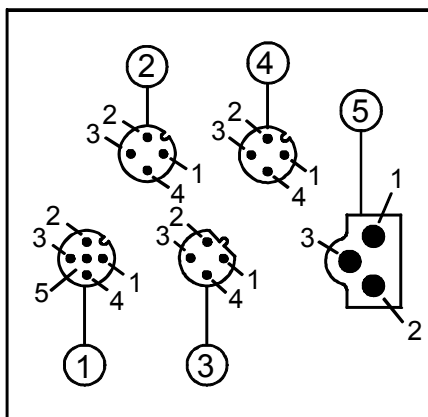
Contact signal	Maximum load: 12 V, 5 mA Minimum pulse length: 10 ms Minimum pause time: 10 ms
Current 0-20 mA	Maximum load: 22 Ω
Remote on/off	Maximum load: 12 V, 5 mA
Tank-empty signal	Maximum load: 12 V, 5 mA
Dosing controller and diaphragm leakage sensor	

#### Outputs

Current 0-20 mA	Maximum load: 350 Ω
Error signal	Maximum ohmic load: 50 VDC / 75 VAC, 0.5 A
Stroke signal	Contact time/stroke: 200 ms
Pre-empty signal	Maximum ohmic load: 50 VDC / 75 VAC, 0.5 A



## 7.2 Connection diagram for the AR control unit



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Fig. 7 Connection diagram

### 7.2.1 Diaphragm leakage detection / dosing controller

#### Socket 1

For diaphragm leakage detection (MBS) and/or dosing controller (DC).

The diaphragm leakage detection and dosing controller are pre-assembled with an M12 plug for socket 1.

If the diaphragm leakage sensor and the dosing controller are to be used at the same time, both cables must be assembled in one plug.



#### Warning

For the connection of one cable, use a plug adapter with simple cable entry, for the connection of two cables, use a plug adapter with double cable entry, otherwise the protection will be lost!

- Connect the cables according to the following table.

Socket 1		Used for / wire colour		
		Diaphragm leakage detection (MBS)*		Dosing controller
Pin	Assignment	Cable 0.8 m	Cable 3 m (without plug)	
1	+12 V			Brown
2	MBS/GND	White	White	
3	MBS supply	Blue	Yellow	
4	Dosing controller output			Blue
5	MBS output	Green/yellow	Green	

\* MBS is an abbreviation of the function in German language "Membranleckagesignalisierung" = diaphragm leakage detection

### 7.2.2 Current output / remote on/off

#### Caution

The current output is not designed for controlling secondary pumps in master/slave operation.

#### Socket 2

For the remote on/off input and current output.

Socket 2		Cable	Used for	
Pin	Assignment	Wire colour	+/- current output	Remote on/off
1	+5 V	Brown	+	
2	Remote on/off input	White		x
3	GND	Blue		x
4	Current output	Black	-	

### 7.2.3 Stroke signal / pre-empty signal / error signal

**Note** Use the stroke signal according to section [8.10 Creating a master/slave application](#) to control secondary pumps.

#### Socket 3

Electrically isolated output for stroke signal or pre-empty signal and error signal.

Socket 3		Cable	Used for	
Pin	Assignment	Wire colour	Stroke signal / pre-empty signal	Error signal
1	Error signal contact	Brown		x
2	Stroke signal or pre-empty signal contact	White	x	
3	Stroke signal or pre-empty signal contact	Blue	x	
4	Error signal contact	Black		x

### 7.2.4 Remote on/off / contact input / current input

The current input is not designed for controlling a preceding pump in master/slave operation. Instead, use the contact input that controls socket 3 according to section [8.10 Creating a master/slave application](#).

#### Socket 4

For the remote on/off input and contact input or current input. If remote on/off and contact input are to be used at the same time, wire 1 is assigned twice.

**Caution** For the connection of one cable, use a plug adapter with simple cable entry, for the connection of two cables, use a plug adapter with double cable entry, otherwise the protection will be lost!

Socket 4		Cable	Used for		
Pin	Assignment	Wire colour	Remote on/off input	Contact input	+/- current input
1	GND	Brown	x	x	-
2	Current input	White			+
3	Remote on/off	Blue	x		
4	Contact input	Black		x	

### 7.2.5 Empty signal only / pre-empty and empty signal

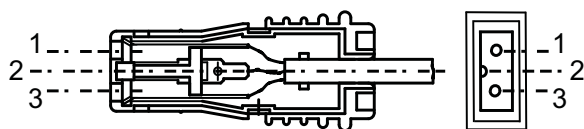
#### Socket 5

For the empty signal only or pre-empty and empty signal input. The suction lines with empty signal or pre-empty and empty signal are pre-assembled with a plug for socket 5.

Socket 5		Used for	
Pin	Assignment	Empty signal	Pre-empty signal
1	Empty signal	x	
2	GND	x	x
3	Pre-empty signal		x

**Flat plug**

The flat plug is connected to socket 5.



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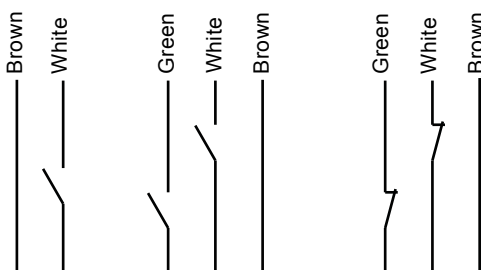
**Fig. 8** Flat plug

The cables and flat plugs are colour-coded as follows:

Coding		
No.	Empty signal	Pre-empty signal / empty signal
1	White	Brown
2	-	White
3	Brown	Green

**Cable assignment of plugs**

Empty signal	Pre-empty signal / empty signal	Pre-empty signal / empty signal
NO	NO / NO	NC / NC



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**Fig. 9** Cable assignment of plugs

**7.3 Accessories: cable and plug for the AR control unit**

Description	Product number
4-pole M12 plug, suitable for sockets 2 and 4, with 2 m signal cable	96609014 / 321-205
4-pole M12 plug, suitable for sockets 2 and 4, with 5 m signal cable	96609016 / 321-207
4-pole M12 plug, suitable for socket 3, with 2 m signal cable	96609017 / 321-206
4-pole M12 plug, suitable for socket 3, with 5 m signal cable	96609019 / 321-208
5-pole M12 plug, suitable for sockets 1, 2 and 4, screwed, without cable, with double cable entry	96609030 / 321-210
5-pole M12 plug, suitable for sockets 1, 2 and 4, screwed, without cable, with single cable entry	96609031 / 321-217
Extension cable, 5 m with 5-pole coupling for M12 plug	96609032 / 321-223
Opto-sensor with 0.8 m cable with plug	96609033 / 10.6270-420
Opto-sensor with 3 m cable without plug	96609034 / 10.6270-402

## 8. Using the pump electronics

**Note** See the installation and operating instructions for the pump. This section only describes the additional functions.

### 8.1 Control and display elements

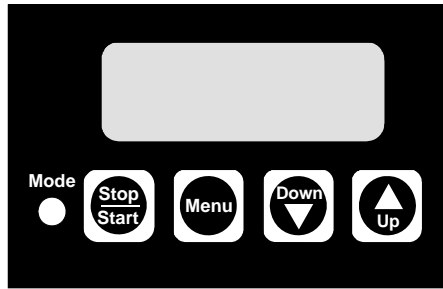







Fig. 10 Display of the AR control unit

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Element	Description
	<p>Light-emitting diode (LED)</p> <ul style="list-style-type: none"> <li>Lights up red when the pump is stopped.</li> <li>Lights up green when the pump is started and briefly turns off during a suction stroke.</li> <li>Lights up yellow when the pump is switched off remotely.</li> <li>Flashes red if an error signal is present.</li> <li>Turns off when the pump is in menu mode.</li> </ul>
	<p>"Start/Stop"</p> <ul style="list-style-type: none"> <li>Use this button to start or stop the pump.</li> <li>Error signals can be acknowledged by pressing the "Start/Stop" button.</li> </ul>
	<p>Use the "Menu/Info" button to switch between the operating modes.</p>
 	<p>Use the "Down" and "Up" buttons to change values in the display.</p>

### 8.2 Display test

A display test is performed when the pump is switched on. All the segments of the display are switched on for 3 seconds and the software version number is then displayed for 2 seconds.

### 8.3 Menu levels

Various menu levels are used in the electronics

- **First function level:** for selecting and setting the operating modes of the pump (Manual, Contact, Analog) and starting the pump.
- **Second function level:** for setting and viewing additional functions and setting the access code to protect the pump against unauthorised access to pump settings.
- **Service level:** for setting the inputs and outputs, thus modifying the version of the AR control unit. It is possible to revert to the default settings.

#### Saving user settings

The pump settings are automatically saved approximately every 10 minutes and remain as they are even after the power supply has been switched off.

## 8.4 General functions of the electronics

### 8.4.1 Deaeration and suction

If the "Start/Stop" button is pressed for more than 1 second, the pump switches to continuous operation for as long as the button is held down (e.g. for suction or deaeration).

This happens regardless of the selected operating mode.

### 8.4.2 Locking "run"

The pump can be locked to avoid manual stopping.

When activating this function (service level), the pump starts running with the present settings and cannot be stopped using the "Start/Stop" button.

It is still possible to acknowledge error messages using the "Start/Stop" button.

#### Stopping the pump when the locking "run" is activated

- If remote on/off is connected, use remote off.
- Disconnect the pump from the power supply.

### 8.4.3 Two-stage tank-empty signal

This function is used to provide a warning when the tank is almost empty and to switch off the pump when the tank is empty. To use the pre-empty signal, ensure that the suction line is equipped with two float switches.

#### Pre-empty signal

The pre-empty signal can be an error signal or a pre-empty signal at socket 3. For a pre-empty signal, relay 1 must be set to "Pre-empty signal". See sections [7.2 Connection diagram for the AR control unit](#) and [8.8.1 Modifying the switch assignment](#).

When the contact of the corresponding float switch closes,

- The error signal relay or pre-empty signal relay switches on, but the pump is not switched off.
- The LED flashes red.
- The empty-signal symbol flashes in the display.

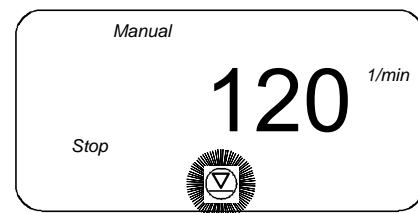


Fig. 11 Display: pre-empty signal

Once the error has been corrected,

- The error signal relay or pre-empty relay switches off.
- The pump returns to the state it was in before the error occurred.

#### Empty signal

When the contact of the corresponding float switch closes,

- The pump is switched off.
- The error signal relay switches on.
- The LED flashes red.
- The empty-signal symbol lights up in the display.

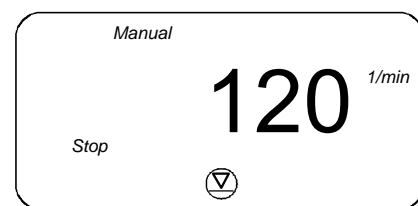


Fig. 12 Display: empty-signal symbol

Once the error has been corrected,

- The pump starts running again (if it was running before).
- The error signal relay switches off.
- The pump returns to the state it was in before the error occurred.

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#### 8.4.4 Diaphragm leakage detection (MBS)

As an option, the pump can be equipped with a sensor for diaphragm leakage detection.

The electronics automatically detects whether a sensor is connected. The following appears in the display.

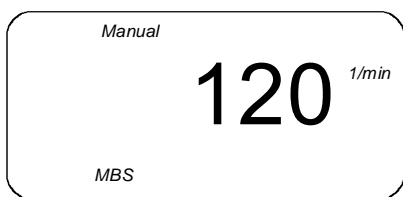


Fig. 13 Display: MBS sensor is connected

When a diaphragm leakage is detected by the sensor,

- The pump is switched off.
- The error signal relay switches on.
- The LED flashes red.
- "MBS" and "ERROR" flash in the display.

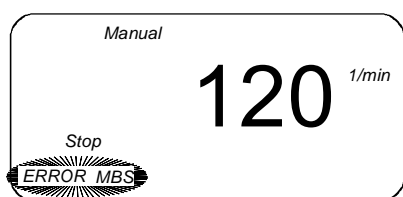


Fig. 14 Display: diaphragm leakage detected

Once the error has been corrected (the contact is no longer closed),

- Press the "Start/Stop" button to acknowledge the error.
- The pump starts running again (if it was running before).
- The error signal relay switches off.
- The pump returns to the state it was in before the error occurred.

#### 8.4.5 Hall sensor / motor monitoring

If the pump has existing strokes to process, the Hall sensor checks whether the drive is turning. If the drive motor is blocked, e.g. due to excess counter pressure in the dosing system, this is detected and indicated by the integrated motor monitoring function.

- The error signal relay switches on.
- "1/min", "bar" and "ERROR" flash in the display.
- The motor is not switched off.

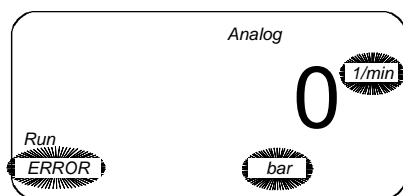


Fig. 15 Display: motor monitoring

For possible errors and their correction, see the fault finding chart in the installation and operating instructions for the pump.

- When the pressure has dropped to a certain level, the pump will restart automatically.

Once the error has been corrected,

- Press the "Start/Stop" button to acknowledge the error.

The motor monitoring function does not provide protection for the motor as power is still supplied to the motor. Therefore, the motor should be protected by a motor protector.

**Caution**

#### 8.4.6 Remote on/off

The pump can be switched off remotely (e.g. from a control room).

- If switched off remotely, the pump does not respond to any input signals or to operator input.
  - Exception:** The pump can still be stopped and deaerated manually.
    - "Stop" lights up in the display.
    - The yellow LED lights up.
      - If the pump was switched off remotely, the colour of the LED may vary for the different pump modes.
- When it is switched on remotely, the pump returns to the state it was in before it was switched off. If, for example, the pump was previously in "Stop" mode, it returns to this mode once it is switched on.

#### 8.4.7 Dosing controller

As an option, a dosing controller can be connected to the pump. The dosing controller monitors the dosing process and emits a pulse for each dosing stroke.

- The dosing controller is enabled and disabled in the second function level. See section [8.7 Second function level](#).
- During start-up or after 5 seconds of downtime, the electronics automatically detects whether a dosing controller is connected. The following appears in the display.

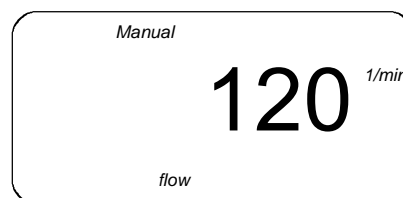


Fig. 16 Display: dosing controller is connected

#### Start-up operation

After starting the pump, 60 strokes are performed even if no signal is received from the dosing controller.

If the dosing controller emits a pulse, "flow" is briefly turned off in the display.

#### The start-up operation is triggered as follows:

- By pressing the "Start/Stop" button
- By switching the operating mode
- The lower stop point not being reached during current signal control
- By actuating the remote on/off contact
- By switching on the power supply.

**Note**

The start-up operation cannot be started in "contact signal control" mode.

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### Setting the dosing controller position

During the start-up operation, the dosing controller can be set according to the operating conditions.

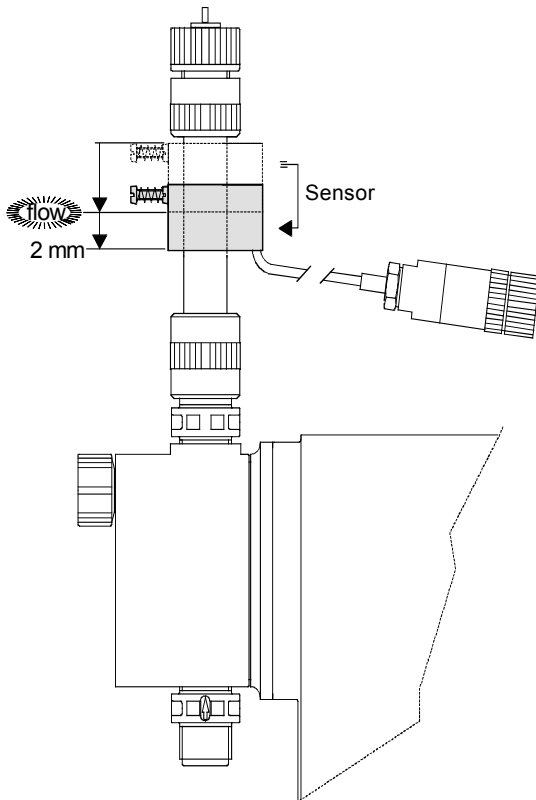


Fig. 17 Setting the dosing controller

1. Place the sensor at the top.
2. Set the desired stroke length.
3. Switch the pump to continuous operation.
4. Move the sensor down until "flow" starts flashing in the display.
5. Move the sensor down another 2 mm. Otherwise very slight deviations may be incorrectly interpreted as an error.

**Note** The dosing controller can only be used if the stroke length remains constant during operation. Otherwise it will emit an incorrect signal.

#### After start-up operation

If, after 40 continuous strokes, the dosing controller does not emit a signal, this is recognised as an error:

- The error signal relay switches on, but the pump is not switched off.
- The LED flashes red.
- "flow" and "ERROR" flash in the display.

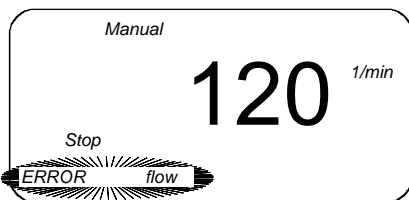


Fig. 18 Display: flow error detected

Once the error has been corrected,

- press the "Start/Stop" button to acknowledge the error.
  - The error signal relay switches off.
  - The pump returns to the state it was in before the error occurred.

## 8.5 Signal outputs

The electronics has the following signal outputs, e.g. in order to return a signal to the control room.

### 8.5.1 Current signal output

**Note** To use the control signal output, see section [8.7.5 Current input - weighting](#).

There is a risk that the connected evaluation unit could be destroyed!

**Caution** If the unit connected to the current output has a GND-PE reference, the current output may increase to a multiple of 20 mA!

If this is the case, connect an isolating amplifier between the current output and the unit.

The current stroke frequency of the pump is output as a current signal.

- Current control 0-20 mA in mode "current output 0-20 mA"
- Current control 4-20 mA in mode "current output 4-20 mA" and in manual mode.

The current output is linear between 4 (0) mA at stroke frequency = 0 and 20 mA at maximum stroke frequency of the pump. The current output cannot be weighted.

**Note**

### 8.5.2 Error signal

Used to return various error states to the control room.

### 8.5.3 Stroke signal / pre-empty signal

Depending on the relay setting, the contact output emits a signal in these cases:

- for each complete stroke of the pump, or
- a pre-empty signal input.

To set the relay, see section [8.8.1 Modifying the switch assignment](#).

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## 8.6 First function level

### 8.6.1 Setting the operating modes

The operating modes are selected in the first function level, and settings can be made for the modes.

This function level can be opened while the pump is running (LED lights up green) or when the pump is stopped (LED lights up red).

1. Press the "Menu/Info" button.
  - The first function level is opened and the pump is stopped.
2. Navigate in the first function level by repeatedly pressing the "Menu/Info" button.
3. Use the "Up" and "Down" buttons to modify the settings in the relevant menu as shown in fig. 19.
4. Use the "Start/Stop" button to confirm the settings and to exit the first function level.
  - The pump is running (LED lights up green).

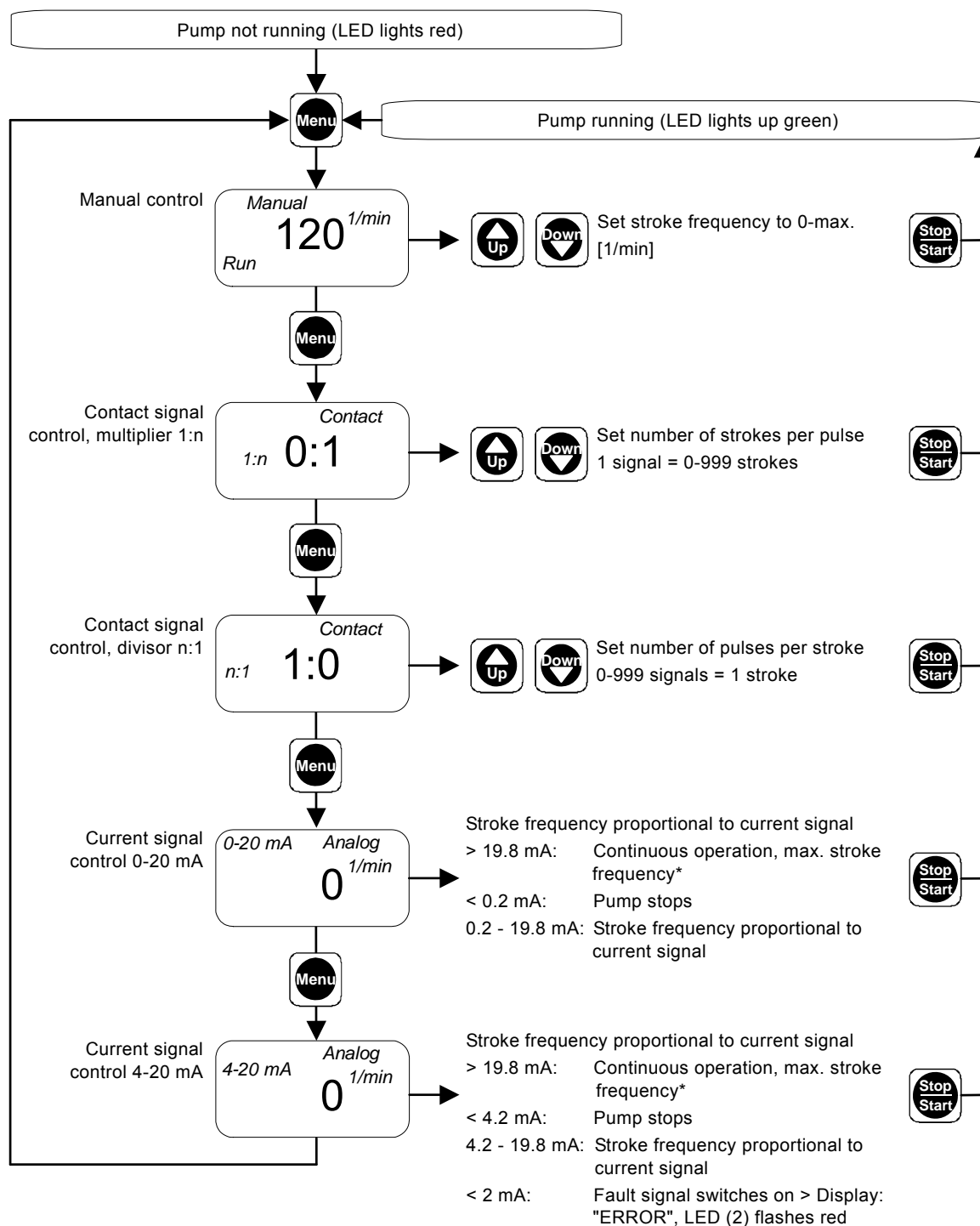


Fig. 19 First function level

\* You can modify the assignment between the current input and the stroke frequency. See section 8.7 Second function level.

### 8.6.2 Manual control

#### Dosing with manual on/off and manually adjustable dosing flow

In this operating mode, all the settings are entered on the pump by the operator.

Use the "Start/Stop" button to start or stop the pump.

Use the "Up" and "Down" buttons to increase or decrease the stroke frequency. This can be done when the pump is stopped or when it is running.

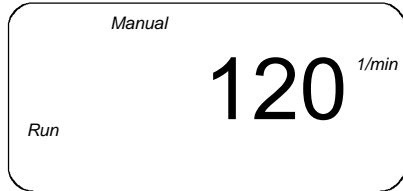


Fig. 20 Display: stroke frequency

The maximum displayed stroke frequency is automatically set according to the mains frequency and the gear ratio.

### 8.6.3 Contact signal control with multiplier 1:n

**Note**

The pump must be started first in this operating mode (LED lights up green, "Run" appears in the display).

Use the "Start/Stop" button to start or stop the pump.

Use the "Up" and "Down" buttons to increase or decrease the multiplier setting in the first function level.

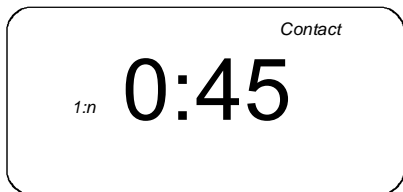


Fig. 21 Display: 45 strokes per pulse

- When the pump receives a signal (e.g. from a water meter with reed contact output), it performs the set number of dosing strokes.

In the example  $n = 45$ , i.e. 45 strokes per contact.

$n$  can be set between 0 and 999.

- If the pump receives more contact signals than the number corresponding to the maximum stroke value, it runs in continuous operation with maximum stroke frequency. The maximum stroke frequency must not be exceeded.

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### 8.6.4 Contact signal control with divisor n:1

**Note**

The pump must be started first in this operating mode (LED lights up green, "Run" appears in the display).

Use the "Start/Stop" button to start or stop the pump.

Use the "Up" and "Down" buttons to increase or decrease the divisor setting in the first function level.



Fig. 22 Display: 45 strokes per pulse

- When the pump receives the set number of pulses via the contact input (e.g. from a water meter with reed contact output), it performs a dosing stroke.

In the example  $n = 45$ , i.e. 45 contacts per pulse.

$n$  can be set between 0 and 999.

- If the pump receives more pulses than the number corresponding to the maximum stroke value, it runs in continuous operation with maximum stroke frequency. The maximum stroke frequency must not be exceeded.

#### Memory function / excess contact signals

Contact signals, which cannot be processed immediately, can be stored and subsequently made available to the pump for processing. A maximum of 65,000 contact signals can be stored.

- **Without memory:** If the pump is running when a contact signal is received, the signal is ignored. The pump performs the current dosing, then it is again ready to receive new contact signals, i.e. it rejects excess contacts.
- **With memory:** If the pump is running when a contact signal is received, the signal is stored in the memory. First, the pump performs the current dosing, then it processes the contact signals from the memory.

The contents of the memory are deleted:

- by switching off the power supply
- by switching the operating mode.

The contents of the memory are not deleted:

- by actuating the remote on/off contact
- by pressing the "Start/Stop" button
- by continuous operation.

**Note**

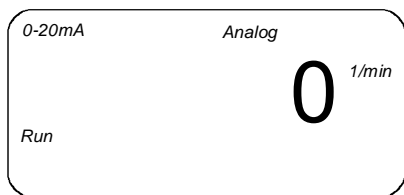
The memory function can be enabled and disabled in the second function level.

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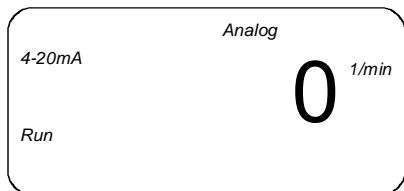
### 8.6.5 Current signal control 0-20 mA / 4-20 mA

For controlling the dosing pump via an external current signal of 0-20 mA (4-20 mA)



TM03 6368 4506

Fig. 23 Input signal: 0-20 mA



TM03 6369 4506

Fig. 24 Input signal: 4-20 mA

- The stroke frequency is proportional to a current input signal of 0-20 mA (4-20 mA).
- Above 19.8 mA, the pump runs in continuous operation at maximum stroke frequency.
- Below 0.2 (4.2) mA, the pump switches off.

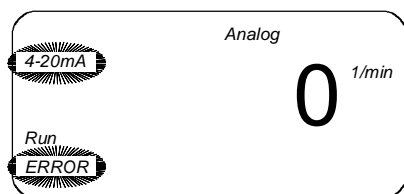
**Note** The pump must be started first in this operating mode (LED lights up green, "Run" appears in the display).

- Use the "Start/Stop" button to start or stop the pump.

#### 4-20 mA current signal control

If the current input signal falls below 2 mA, the error relay is switched, as an error has probably occurred at the signal source or on the cable.

- The error signal relay switches on, the LED flashes red.
- "4-20 mA" and "ERROR" flash in the display.



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Fig. 25 Display: current input signal < 2 mA

## 8.7 Second function level

### 8.7.1 Opening / exiting the second function level

Open the second function level to set the access code, to enable or disable the memory functions, to display the operating hours, or to modify the assignment between the current input and stroke value.

This function level can only be opened when the pump is stopped (LED lights up red).

### 8.7.2 Setting the access code

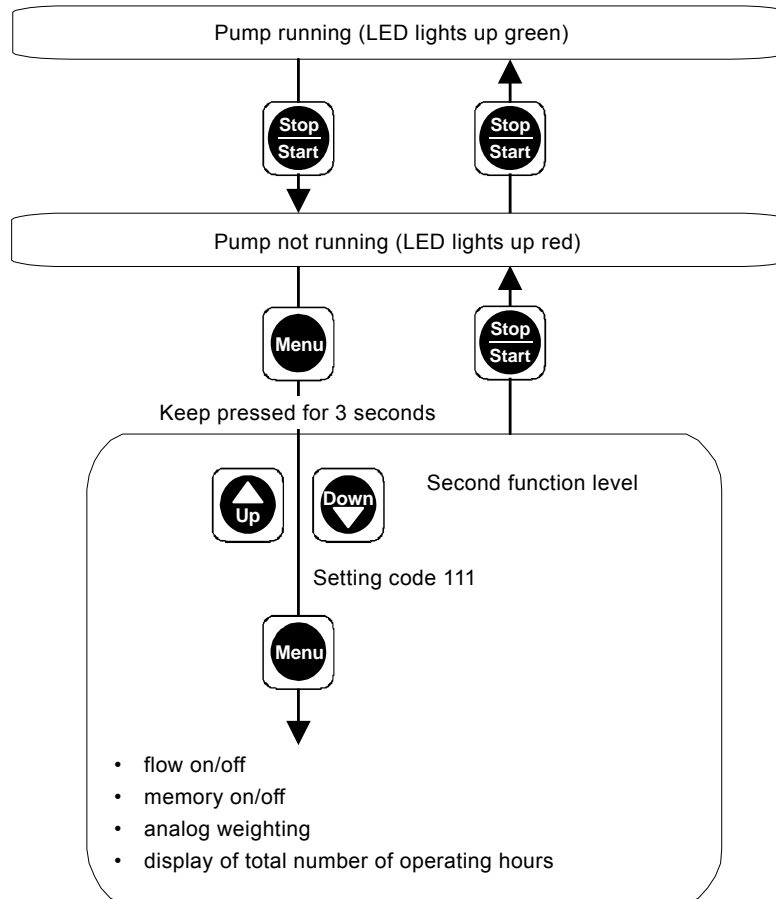
The access code is used to protect the pump against unauthorised access to pump settings.

The default setting is 111. Code 111 gives access to all settings described in sections [8.6 First function level](#) and [8.7 Second function level](#).

**Note** The "Start/Stop" button for stopping the pump is active with any code.

1. Press the "Start/Stop" button while the pump is running (LED lights up green).
  - The pump is stopped (LED lights up red).
2. Press and hold down the "Menu/Info" button for 3 seconds.
  - The second function level is opened.
  - "C:111" (default setting is "111") or a user-defined code appears in the display.
3. Use the "Up" and "Down" buttons to set the code in the range between 1 and 999.

Code 111 is required to open the second function level.



**Fig. 26** Setting the access code

1. Navigate in the second function level by repeatedly pressing the "Menu/Info" button.
2. Use the "Up" and "Down" buttons to modify the settings in the relevant menu as shown in [fig. 27](#).
3. Press the "Start/Stop" button to exit the second function level.

You can only change the parameters in the shown order. When the "Menu/Info" button is pressed again (after one run), the first function level opens automatically.

**Note**

Figure for the second function level

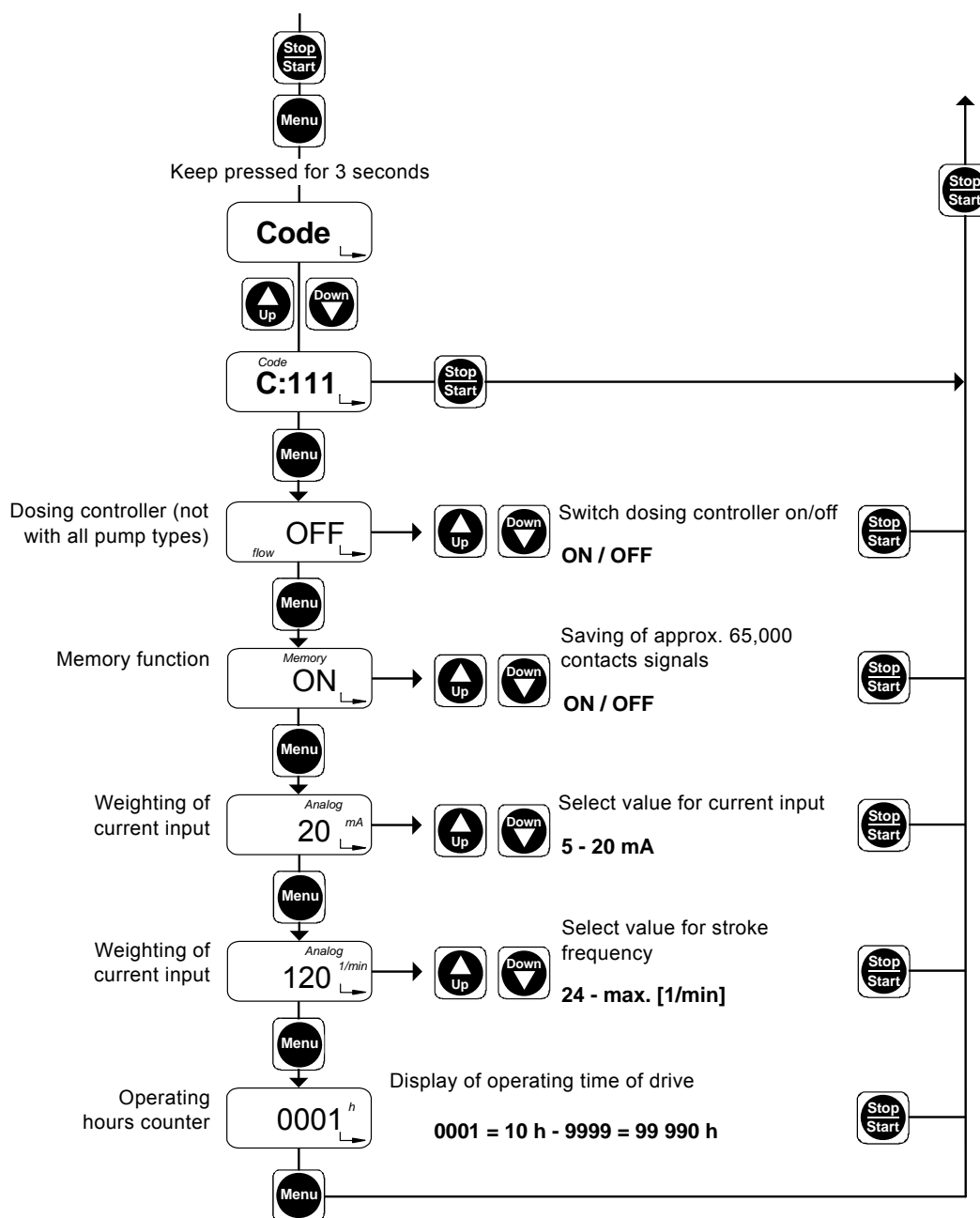


Fig. 27 Second function level

### 8.7.3 Dosing controller

If installed, the dosing controller can be switched on and off.

### 8.7.4 Memory function

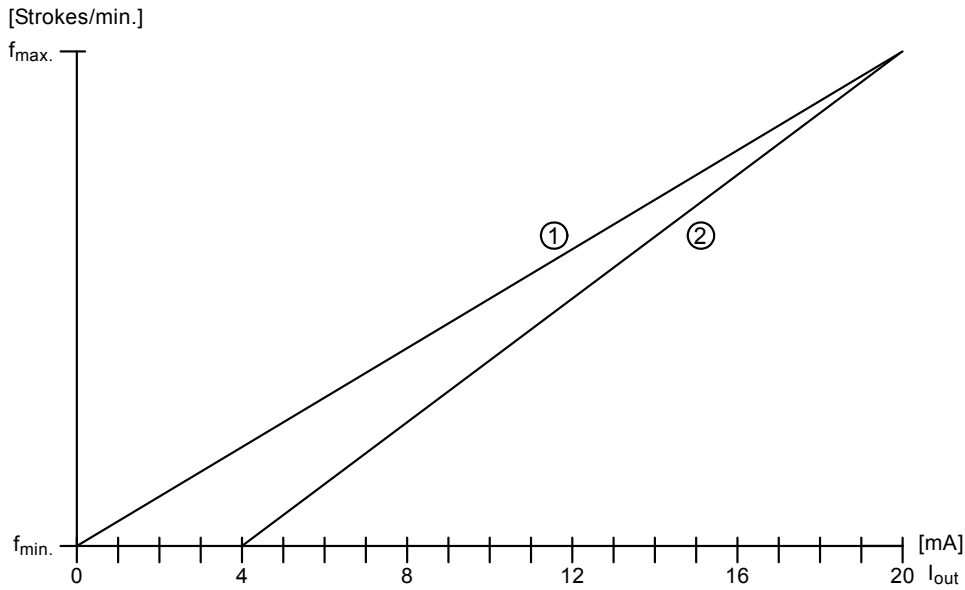
Used to store excess contact inputs for later processing.

### 8.7.5 Current input - weighting

In current input/output operation, the dosing capacity is controlled via the current signal. The pump emits a current signal as a feedback to the control room or master/slave applications.

**Current signal control without weighting (default)**

Current input and current output without weighting

**Fig. 28** Current signal/stroke frequency

The assignment between the current signal and stroke frequency is linear by default between 0 and the maximum stroke frequency (depending on pump type) for a current input signal of 0 mA to 20 mA (curve 1) or 4 mA to 20 mA (curve 2).

The current output corresponds to the following:

- curve 1 for current signal control 0-20 mA
- curve 2 for current signal control 4-20 mA and manual mode.

**Current signal control with weighting**

You can modify the pump response by setting a specific assignment between the current input and stroke frequency.

In the second function level, first set the current value and then the stroke frequency in the menu items for current weighting for a reference point.

In the example, a stroke frequency of 60 1/min has been set for a current input of 6 mA, see curve 3. The curve now passes through 0 mA and the selected point. The maximum stroke frequency of the pump must not be exceeded!

**Note**

The current output applies to the maximum stroke frequency of the pump (curve  $I_{out}$ ), and is 10 mA in the example.

## Current input and current output with weighting

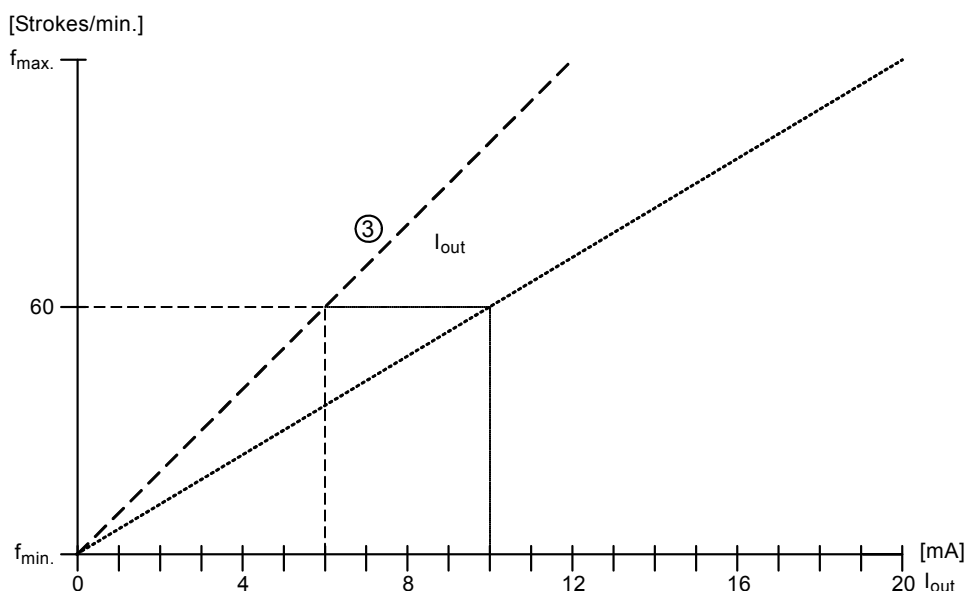


Fig. 29 Current signal control with weighting

### Setting the weighting (in the second function level)

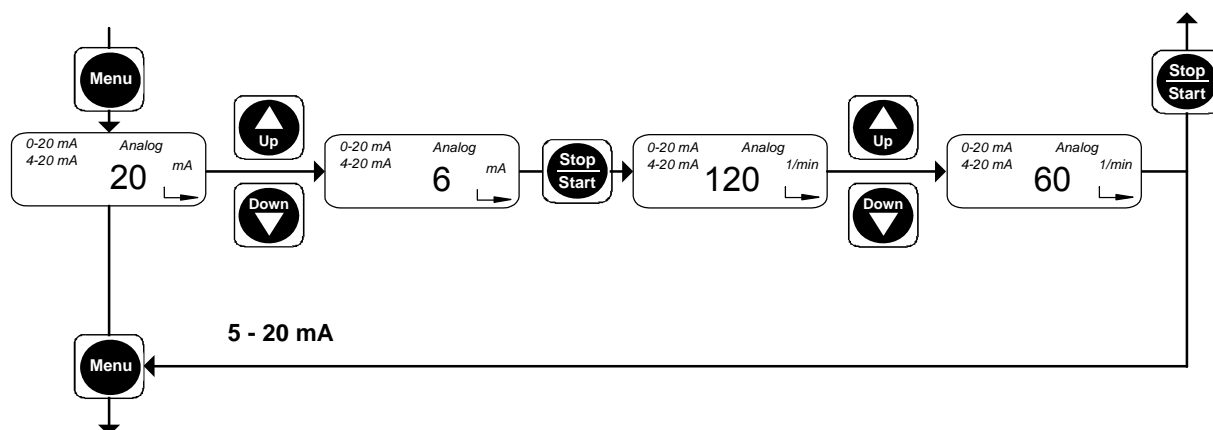


Fig. 30 Setting the weighting

The set value for the current input of the reference point (default is maximum current input of 20 mA) appears in the display.

1. Use the "Up" and "Down" buttons to set the current input for the reference point mA select between 5 and 20 mA (e.g. 6 mA).
2. Press the "Start/Stop" button.
  - The set stroke frequency of the reference point (default is  $f_{max.}$ ) appears in the display.
3. Use the "Up" and "Down" buttons to set the desired stroke frequency  $f_{select}$  (e.g.  $f = 60$  1/min).
  - Press the "Menu/Info" button.
    - Confirm the setting and move on to the next menu item, or
  - press the "Start/Stop" button.
    - Confirm the setting and close the second function level.

#### 8.7.6 Displaying the total number of operating hours

The operating hours counter indicates the total operating time of the drive, e.g. to check maintenance intervals. The maximum number of operating hours that can be displayed is 99990 h (display = 9999).

The operating hours counter cannot be reset.

**Note**

Multiply the number displayed by 10 to determine the total number of operating hours.

## 8.8 Service level

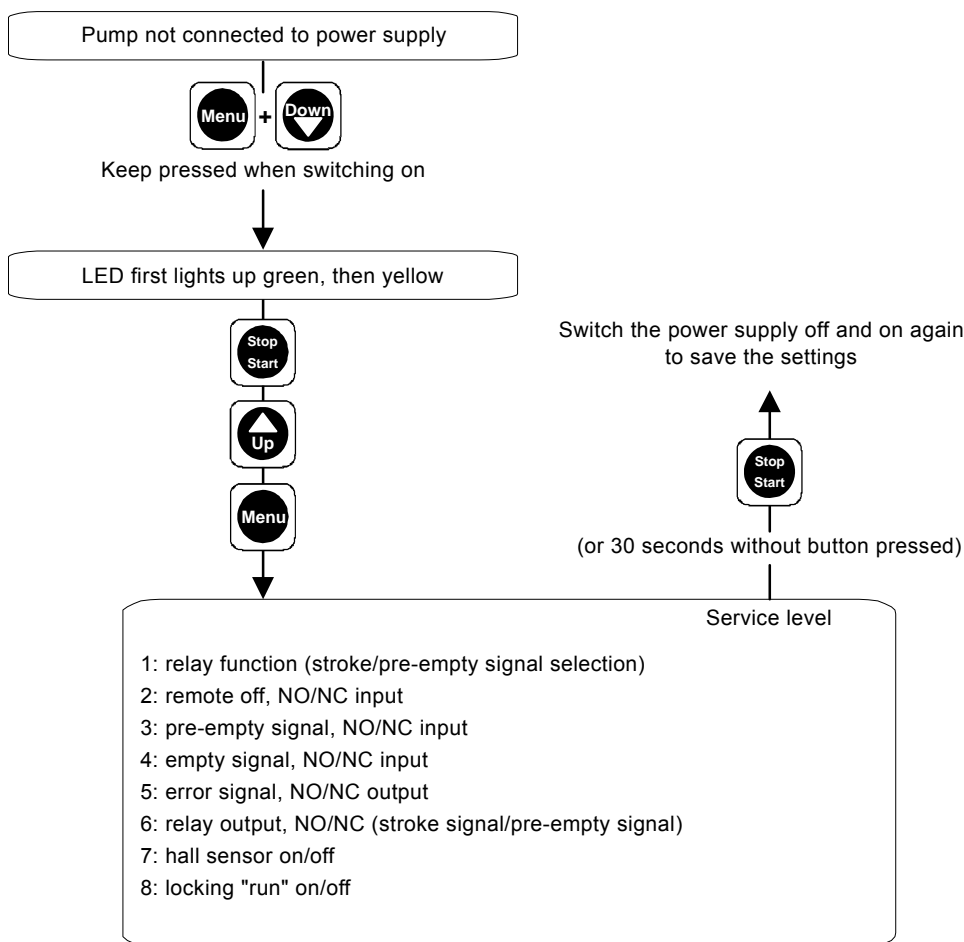
Open the service level to modify the switch assignments of the electronics.

### 8.8.1 Modifying the switch assignment

**Note** You are modifying the default settings of your AR control unit. They will therefore differ from the technical data.

The service level can only be accessed when the power supply is being switched on.

1. Simultaneously press the "Menu/Info" and "Down" buttons, and hold them down.
2. Switch on the power supply.
  - The LED lights up green for approximately 3 seconds and turns yellow.
3. Release the "Menu/Info" and "Down" buttons.
4. Press the "Start/Stop" button.
5. Press the "Up" button.
  - "Func" appears in the display.
6. Press the "Menu/Info" button.
  - The service level is opened.



**Fig. 31** Service level

1. Navigate in the service level by repeatedly pressing the "Menu/Info" button.
2. Use the "Up" and "Down" buttons to modify the switch assignment in the relevant menu.
3. Press the "Start/Stop" button
  - to confirm the new settings
  - to exit the service level
  - to open the first function level.

**Note** If no button is pressed for approximately 30 seconds, the service level is exited and the first function level is opened.

### 1. Relay function (stroke/pre-empty signal selection)

"1:OFF" or "1:ON" appears in the display.

- Use the "Up" and "Down" buttons to switch between:
  - "1:OFF" relay function = stroke signal ("1/min" flashes in the display), and
  - "1:ON" relay function = pre-empty signal (empty-signal symbol flashes in the display).
- Press the "Menu/Info" button.  
Confirm the setting and move on to the next menu item, or
- press the "Start/Stop" button and switch the power supply off, then on again.  
Close the service level and confirm the setting.

### 2. Remote off, NO/NC input

"2:NO" or "2:NC" appears in the display ("Run" and "Stop" flash in the display).

- Use the "Up" and "Down" buttons to switch between:
  - "2:NO" remote off = normally open contact, and
  - "2:NC" remote off = normally closed contact.
- Press the "Menu/Info" button.  
Confirm the setting and move on to the next menu item, or
- press the "Start/Stop" button and switch the power supply off, then on again.  
Close the service level and confirm the setting.

### 3. Pre-empty signal, NO/NC input

"3:NO" or "3:NC" appears in the display (empty-signal symbol flashes in the display).

- Use the "Up" and "Down" buttons to switch between:
  - "3:NO" pre-empty signal = normally open contact, and
  - "3:NC" pre-empty signal = normally closed contact.
- Press the "Menu/Info" button.  
Confirm the setting and move on to the next menu item, or
- press the "Start/Stop" button and switch the power supply off, then on again.  
Close the service level and confirm the setting.

### 4. Empty signal, NO/NC input

"4:NO" or "4:NC" appears in the display (empty-signal symbol lights up in the display).

- Use the "Up" and "Down" buttons to switch between:
  - "4:NO" empty signal = normally open contact, and
  - "4:NC" empty signal = normally closed contact.
- Press the "Menu/Info" button.  
Confirm the setting and move on to the next menu item, or
- press the "Start/Stop" button and switch the power supply off, then on again.  
Close the service level and confirm the setting.

### 5. Error signal, NO/NC output

"5:NO" or "5:NC" appears in the display ("ERROR" flashes in the display).

- Use the "Up" and "Down" buttons to switch between:
  - "5:NO" error signal relay = normally open contact, and
  - "5:NC" error signal relay = normally closed contact.
- Press the "Menu/Info" button.  
Confirm the setting and move on to the next menu item, or
- press the "Start/Stop" button and switch the power supply off, then on again.  
Close the service level and confirm the setting.

### 6. Relay output, NO/NC (stroke signal/pre-empty signal)

"6:NO" or "6:NC" appears in the display ("1/min" and empty-signal symbol flash in the display).

- Use the "Up" and "Down" buttons to switch between:
  - "6:NO" stroke/pre-empty signal relay = normally open contact, and
  - "6:NC" stroke/pre-empty signal relay = normally closed contact.
- Press the "Menu/Info" button.  
Confirm the setting and move on to the next menu item, or
- press the "Start/Stop" button and switch the power supply off, then on again.  
Close the service level and confirm the setting.

### 7. Hall sensor on/off

"7:ON" or "7:OFF" appears in the display ("bar" flashes in the display).

- Use the "Up" and "Down" buttons to switch between:
  - "7:ON" Hall sensor = connected, and
  - "7:OFF" Hall sensor = not connected.
- Press the "Menu/Info" button.  
Confirm the setting and move on to the next menu item, or
- press the "Start/Stop" button and switch the power supply off, then on again.  
Close the service level and confirm the setting.

### 8. Locking "run" on/off

The locking of the "Start/Stop" button to prevent manual stopping of the pump can be enabled and disabled.

The display indicates "8:ON" or "8:OFF" (the "Run" symbol is displayed).

- Use the "Up" and "Down" buttons to switch between:
  - "8:ON" locking "run" on, and
  - "8:OFF" locking "run" off.
- Press the "Menu/Info" button or
- press the "Start/Stop" button and switch the power supply off, then on again.  
Close the service level and confirm the setting.

## 8.9 Resetting to default settings

You can reboot the AR control unit when you connect the power supply. The electronics is then reset to the default settings in the technical data.

The pump is disconnected from the power supply.

1. Simultaneously press the "Up" and "Down" buttons and hold them down.
2. Switch on the power supply.
  - "boot" appears in the display.
3. Release the "Up" and "Down" buttons.
  - All modified settings are reset to the default settings.

## 8.10 Creating a master/slave application

You can connect several secondary pumps and control the secondary pumps (slaves) via the first pump (master).

Risk of damage to secondary pump!

The current signal is not electrically isolated and can damage slave pumps.

### Caution

Do not control slave pumps with the current signal. Only control them with the electrically isolated contact input signal!

### 8.10.1 Master

All operating modes in manual, contact, or current control are available for the master pump:

- Manual
- Contact with multiplier or divisor
- Current control.

Select the output signal of the master pump in the service level (relay 1) (output socket 3):

- Stroke signal (emits one output signal per stroke).

### 8.10.2 Slave

The following operating modes are available for slave pumps in contact control (input socket 4):

- Contact with multiplier or divisor.

### Note

The slave pump settings are implemented independently of the master pump settings.

### Caution

Risk of malfunction or damage to the pump!  
Do not throw or drop the pump.

### Caution

Unused contact inputs from the master pump are forwarded to the slave pumps. They are processed on the slave pumps according to the slave pump settings!

## 9. Disposal

This product or parts of it must be disposed of in an environmentally sound way:

1. Use the public or private waste collection service.
2. If this is not possible, contact the nearest Grundfos company or service workshop.

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Subject to alterations.



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