CRE, CRNE, 11-22 kW
with pressure sensor

GB Installation and operating instructions

TM02 1963 2701

GRUNDFOS

Declaration of Conformity

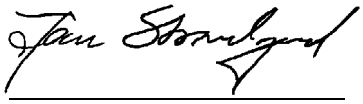
We **GRUNDFOS** declare under our sole responsibility that the products **CRE** and **CRNE with pressure sensor**, to which this declaration relates, are in conformity with the Council Directives on the approximation of the laws of the EEC Member States relating to:

— Machinery (98/37/EEC).
Standard used: EN 292.

— Electromagnetic compatibility (89/336/EEC).
Standard used: EN 61 800-3.

— Electrical equipment designed for use within certain voltage limits (73/23/EEC).
Standards used: EN 60 335-1 and EN 60 335-2-51.

Bjerringbro, 1st January 2002



Jan Strandgaard
Technical Manager

CONTENTS

Before beginning installation procedures, these installation and operating instructions should be studied carefully. **Furthermore, the enclosed installation and operating instructions for the standard pump should be studied carefully.** The installation and operation should also be in accordance with local regulations and accepted codes of good practice.

1. General

GRUNDFOS E-pumps are pumps fitted with frequency-controlled standard motors with built-in PI controller for three-phase mains connection. The pumps incorporate a pressure sensor enabling control of the pressure after the pump.
The pumps are typically used as booster pumps in systems with variable demands.

The desired setpoint can be set directly on the pump control panel via an input for external setpoint signal or by means of the GRUNDFOS wireless remote control R100.

All other settings are made by means of the R100.
Important parameters such as actual value of control parameter, power consumption, etc. can be read via the R100.

The pump incorporates inputs for external potential-free contacts for start/stop and digital function. The digital function enables external setting of max. curve, min. curve, external fault function or flow switch.
The pump incorporates an output for a potential-free fault signal.

Furthermore, the pump has an input for bus communication. Via the bus communication input, the pump can be controlled and monitored by a building management system or another external control system.

2. Installation

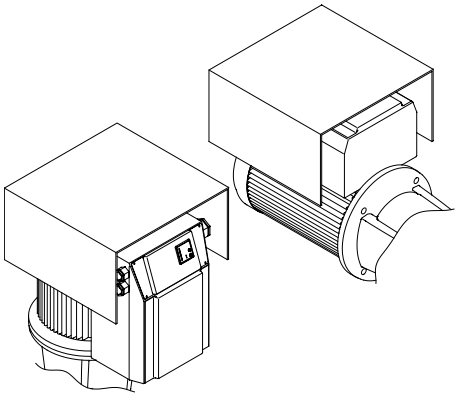
To ensure cooling of motor and electronics, the following must be observed:

- Place the pump in such a way that sufficient cooling is ensured.
- The temperature of the cooling air must not exceed 40°C.
- Motor cooling fins and fan blades must be kept clean.

In the case of outdoor installation, it must be ensured that the motor is protected against climatic influences, such as rain, snow and ice.

Fig. 1 shows an example of an outdoor installation. To protect the motor against condensation on the electronic components, a cover has been fitted to the motor. In other cases, the specific operating conditions determine the protection solution.

Fig. 1



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For further installation, see installation and operating instructions for the standard pump.

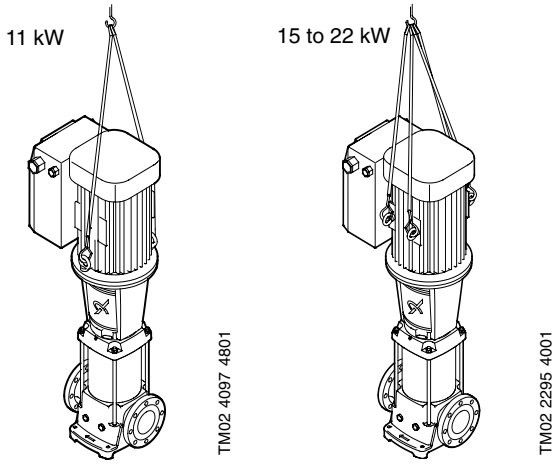
2.1 Handling

When the entire pump is to be lifted, observe the following:

- CRE, CRNE 32, 45, 64 and 90 pumps fitted with MMGE motors of 11 kW should be lifted by means of the eye bolts fitted to the pump head.
- CRE, CRNE 32, 45, 64 and 90 pumps fitted with MMGE motors of 15 kW and up to 22 kW should be lifted by means of the eye bolts fitted to the motor.

Handling examples are shown in fig. 2.

Fig. 2



2.2 Electrical connection

Note: The user or the installer is responsible for the installation of the correct earthing and protection according to valid national and local standards. All operations must be carried out by a qualified electrician.

Never make any connections in the pump terminal box unless the electricity supply has been switched off for at least 5 minutes.

2.2.1 Mains switch

The pump must be connected to an external all-pole mains switch with a contact separation of at least 3 mm in each pole according to IEC 364.

2.2.2 Protection against electric shock - indirect contact

The pump must be earthed and protected against indirect contact in accordance with national regulations.

Protective earth conductors must always have a yellow/green (PE) or yellow/green/blue (PEN) colour marking.

Note: As the leakage current is > 10 mA, these motors must be connected to *especially reliable/sturdy earth connections*.

The leakage current of the pump can be found in section *12.2 Leakage current*.

EN 50 178 and BS 7671 specify the following:

The pump must be stationary and installed permanently. Furthermore, the pump must be connected permanently to the electricity supply or may be connected via an industrial type of plug (CEE). The plug must comply with EN 60 309 or IEC 309. This plug must incorporate an additional earthing contact which must be connected to an additional protective earth conductor having a minimum cross-sectional area of 4 mm².

In addition, tightened precautions as regards earth connection must be observed.

One of the following installation examples must be used:

- A single protective earth conductor having a cross-sectional area of 10 mm².
- Separate duplicate conductors each having a minimum cross-sectional area of 4 mm².
- Duplicate (protective earth) conductors in a multicore cable. One of the conductors may be the metallic armour or sheath of the cable.
- A protective earth conductor contained in a cable conduit, trunking or cable tray so forming a duplicate conductor.

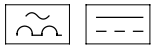
2.2.3 Additional protection

If the pump is connected to an electric installation where an earth leakage circuit breaker is used as additional protection, this circuit breaker must be of the type:

- which is suitable for handling leakage currents and cutting-in with short pulse-shaped leakage.
- which trips out when alternating fault currents and fault currents with DC content, i.e. pulsating DC and smooth DC fault currents, occur.

For these pumps an earth leakage circuit breaker **type B** must be used.

This circuit breaker must be marked with the following symbols:



Note: When an earth leakage circuit breaker is selected, the total leakage current of all the electrical equipment in the installation must be taken into account.

The leakage current of the pump can be found in section *12.2 Leakage current*.

2.2.4 Motor protection

The pump requires no external motor protection. The motor incorporates thermal protection against slow overloading and blocking.

2.2.5 Protection against mains voltage transients

The pump is protected against mains voltage transients in accordance with EN 61 800-3.

2.2.6 Supply voltage

3 x 380-415 V ±10%, 50/60 Hz, PE.

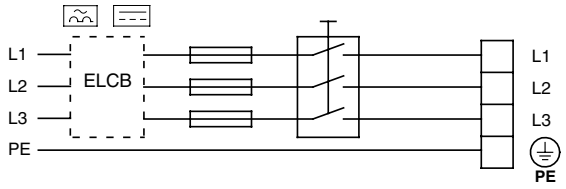
The supply voltage and frequency are marked on the pump nameplate. Please make sure that the motor is suitable for the electricity supply on which it will be used.

The wires in the motor terminal box must be as short as possible. Excepted from this is the protective earth conductor which must be so long that it is the last one to be disconnected in case the cable is inadvertently pulled out of the cable entry.

Figure 3 shows an example of a mains-connected pump with mains switch, back-up fuses and additional protection.

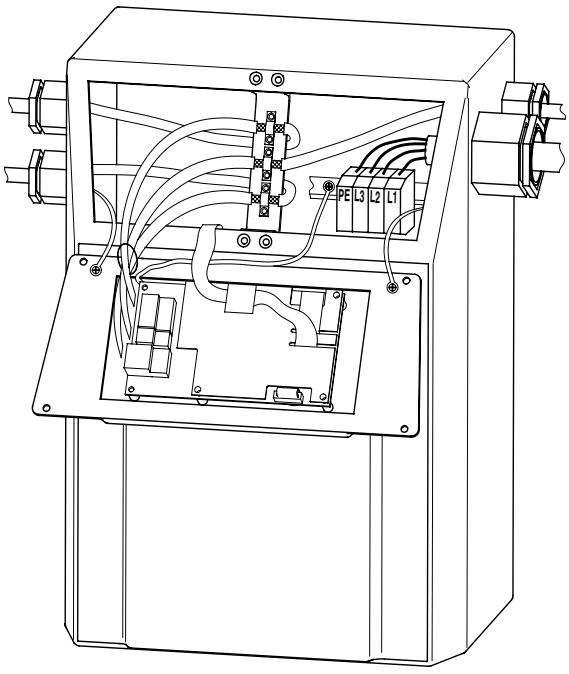
For maximum backup fuse, see section *12.1 Supply voltage*.

Fig. 3



Actual mains connection is shown in fig. 4.

Fig. 4



2.2.7 Start/stop of pump via mains supply

The number of starts and stops via the mains voltage must not exceed 4 times per hour.

If a higher number of starts and stops is desired, the input for external start/stop must be used when starting/stopping the pump.

When the pump is switched on via the mains, the pump will start after approx. 5 seconds.

2.3 Other connections

The connection terminals of external potential-free contacts for start/stop and digital function, external setpoint signal, sensor signal, GENIbus and fault signal relay are shown in fig. 5.

Note: If no external on/off switch is connected, short-circuit terminals 2 and 3 using a short wire.

Note: As a precaution, the wires to be connected to the following connection groups must be separated from each other by reinforced insulation in their entire lengths:

1. **Inputs** (external start/stop, digital function, setpoint and sensor signals, terminals 1-8, and bus connection, A, Y, B).

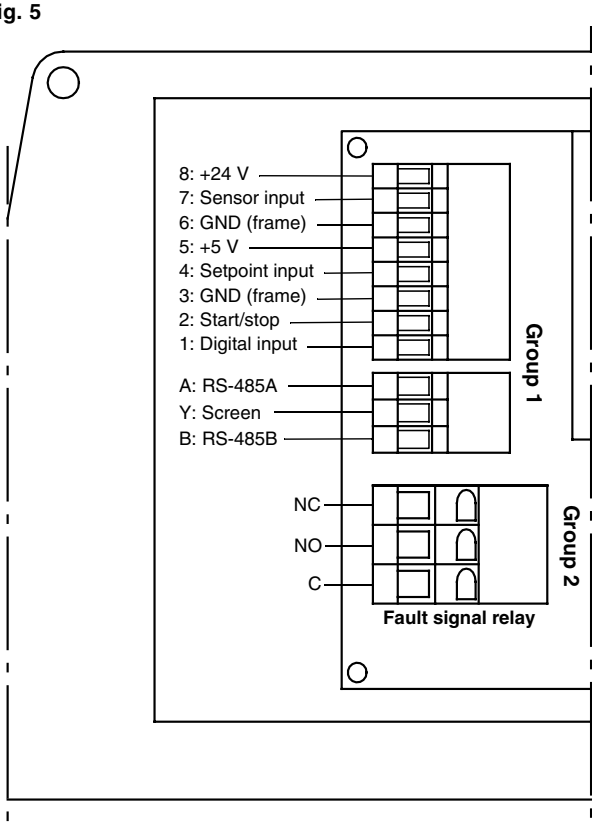
   All inputs (group 1) are internally separated from the mains-conducting parts by reinforced insulation and galvanically separated from other circuits.
   All control terminals are supplied by protective extra-low voltage (PELV), thus ensuring protection against electric shock.

2. **Output** (fault signal relay, terminals NC, NO, C).

   The output (group 2) is galvanically separated from other circuits. Therefore, the supply voltage or protective extra-low voltage can be connected to the output as desired.

A galvanically safe separation must fulfil the requirements for reinforced insulation including creepage distances and clearances specified in EN 50 178.

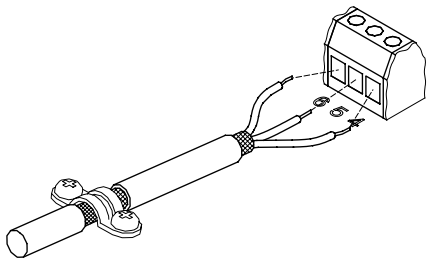
Fig. 5



2.4 Signal cables

- Use screened cables having a cross-sectional area of min. 0.5 mm² and max. 1.5 mm² for external on/off switch, digital input, setpoint and sensor signals.
- The screens of the cables must be connected to frame at both ends with good frame connection. They must be as close as possible to the terminals, fig. 6.

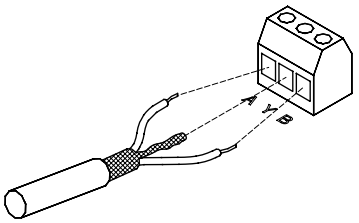
Fig. 6



- Screws for frame connections must always be tightened whether a cable is fitted or not.
- The wires in the motor terminal box must be as short as possible.

For the bus connection a screened 2-core cable must be used. Connect the screen to terminal Y at both ends, fig. 7.

Fig. 7



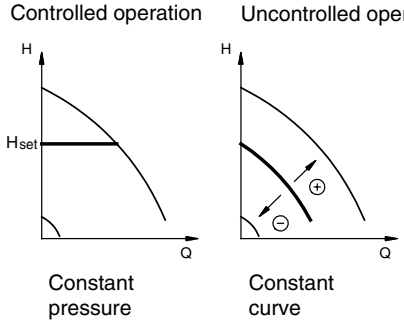
3. Setting the pump

E-pumps with pressure sensor can be set to two control modes, i.e. constant pressure and constant curve.

In **constant pressure** mode, the pump will maintain a constant pressure after the pump, irrespective of the flow, fig. 8.

In **constant curve** mode, the pump is not controlled. The curve can be set within the range from min. curve to max. curve.

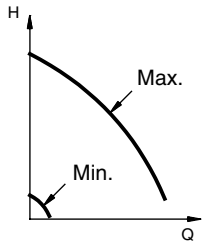
Fig. 8



The pumps have been factory-set to constant pressure, see section *3.1 Factory setting.*

In addition to normal operation (constant pressure and constant curve), the following operating modes can be selected, **Stop**, **Min**. or **Max**., fig. 9.

Fig. 9



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The max. curve can for instance be used in connection with the venting procedure during installation.
The min. curve can be used in periods in which a minimum flow is required.

The operating modes (Stop, Normal, Min., Max.) can all be set on the pump control panel.

If the electricity supply to the pump is disconnected, the pump setting will be stored.

The remote control R100 offers additional possibilities of setting and status displays, see section *5. Setting by means of R100.*

3.1 Factory setting

The pumps have been factory-set to constant pressure. The setpoint value corresponds to 50% of the sensor measuring range (see sensor nameplate).

Other pump settings are marked with ***bold***-faced type under each individual display in sections *5.1 Menu OPERATION* and *5.3 Menu INSTALLATION.*

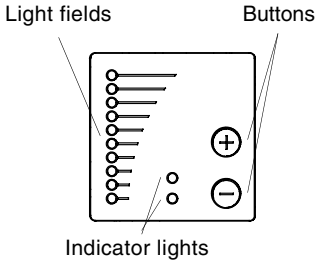
4. Setting by means of control panel

At high system temperatures, the pump may be so hot that only the buttons should be touched to avoid burns.

The pump control panel, fig. 10, incorporates the following:

- Buttons, “+” and “–”, for setpoint setting.
- Light fields, yellow, for indication of setpoint.
- Indicator lights, green (operation) and red (fault).

Fig. 10



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4.1 Setpoint setting

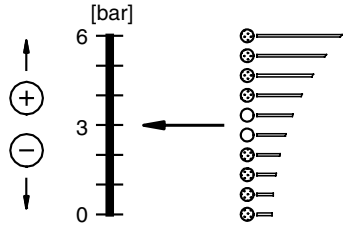
The setpoint of the pump is set by pressing the button “+” or “–”.

The light fields on the control panel will indicate the setpoint set.

4.2 Pump in constant pressure control mode

Figure 11 shows that the light fields 5 and 6 are activated, indicating a desired setpoint of 3 bar with a sensor measuring range from 0 to 6 bar. The setting range is equal to the sensor measuring range (see sensor nameplate).

Fig. 11



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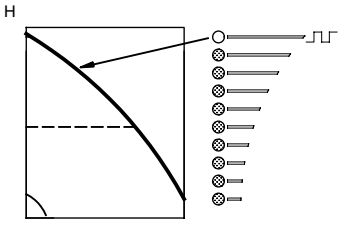
4.3 Setting to max. curve duty

Press “+” continuously to change over to the max. curve of the pump (top light field flashes). When the top light field is on, “+” must be pressed for 3 seconds before the light field starts flashing.

To change back, press “–” continuously until the desired setpoint is indicated.

Fig. 12



Max. curve

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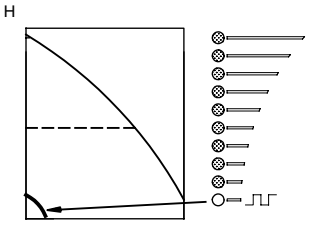
4.4 Setting to min. curve duty

Press “–” continuously to change over to the min. curve of the pump (bottom light field flashes). When the bottom light field is on, “–” must be pressed for 3 seconds before the light field starts flashing.

To change back, press “+” continuously until the desired setpoint is indicated.

Fig. 13



Min. curve

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4.5 Start/stop of pump

Stop the pump by continuously pressing “–” until none of the light fields are activated and the green indicator light flashes.

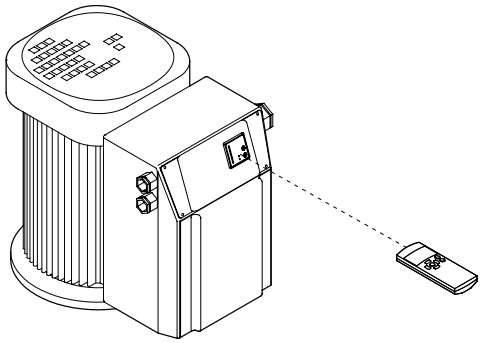
Start the pump by continuously pressing “+” until the desired setpoint is indicated.

5. Setting by means of R100

The pump is designed for wireless communication with the GRUNDFOS remote control R100.

The R100 communicates with the pump via infra-red light. The transmitter and the receiver are incorporated in the pump control panel, fig. 14.

Fig. 14



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During communication, the R100 must be pointed at the control panel.

When the R100 communicates with the pump, the red indicator light will flash rapidly.

The R100 offers additional possibilities of setting and status displays for the pump.

The displays are divided into four parallel menus, fig. 15:

0. GENERAL (see operating instructions for the R100)

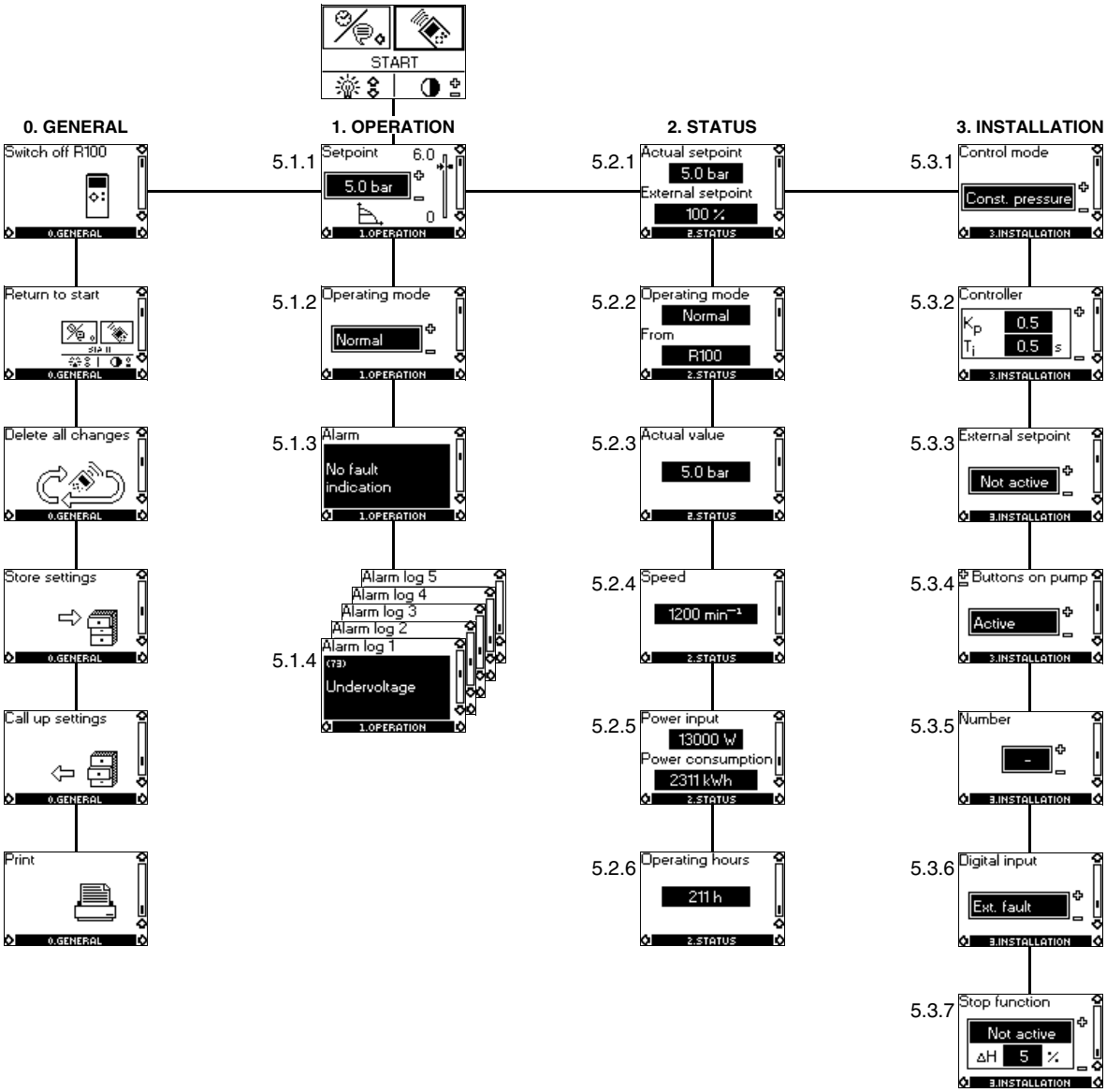
1. OPERATION

2. STATUS

3. INSTALLATION

The number stated at each individual display in fig. 15 refers to the section in which the display is described.

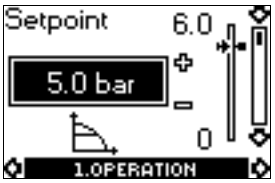
Fig. 15



5.1 Menu OPERATION

When communication between the R100 and the pump has been established, the first display in this menu will appear.

5.1.1 Setpoint setting



- Setpoint set
- Actual setpoint
- Actual value

In this display, the desired pressure is set in [bar].

In **constant pressure** mode, the setting range is equal to the sensor measuring range (in the example 0 to 6 bar).

In **constant curve** mode, the setpoint is set in % of the maximum curve. The curve can be set within the range from min. curve to max. curve.

Select one of the following operating modes:

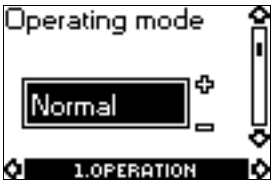
- *Stop*,
- *Min.* (min. curve),
- *Max.* (max. curve).

If the pump is connected to an external setpoint signal, the setpoint in this display will be the maximum value of the external setpoint signal, see section *7. External setpoint signal.*

If the pump is controlled via external signals (Stop, Min. curve or Max. curve) or a bus, this will be indicated in the display if setpoint setting is attempted.

In this case, the number of possible settings will be reduced, see section *9. Priority of settings.*

5.1.2 Setting of operating mode

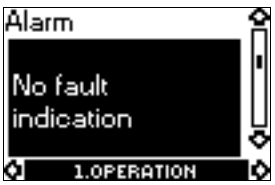


Select one of the following operating modes:

- *Stop*,
- *Min.*,
- ***Normal*** (duty),
- *Max.*

The operating modes can be selected without changing the setpoint setting.

5.1.3 Fault indications



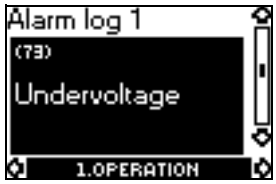
If the pump is faulty, the cause will appear in this display.

Possible causes:

- *Too high motor temperature*
- *Undervoltage*
- *Overvoltage*
- *Phase failure*
- *Mains supply failure*
- *Too many restarts* (after faults)
- *Overload*
- *Sensor signal outside signal range*
- *Setpoint signal outside signal range* (only 4-20 mA)
- *External fault*
- *Dry running*
- *Other fault*

A fault indication can be reset in this display if the cause of the fault has disappeared.

5.1.4 Alarm log



If faults have been indicated, the last five fault indications will appear in the alarm log. “Alarm log 1” shows the newest/latest fault.

The example shows the fault indication “Undervoltage” and the fault code.

5.2 Menu STATUS

The displays appearing in this menu are status displays only. It is not possible to change or set values.

The displayed values are the values that applied when the last communication between the pump and the R100 took place. If a status value is to be updated, point the R100 at the control panel and press “OK”.
If a parameter, e.g. speed, should be called up continuously, press “OK” constantly during the period in which the parameter in question should be monitored.

The tolerance of the displayed value is stated under each display. The tolerances are stated as a guide in % of the maximum values of the parameters.

5.2.1 Display of actual setpoint

Tolerance: ±2%

This display shows the actual setpoint and the external setpoint in % of the range from minimum value to the setpoint set, see section *7. External setpoint signal.*

5.2.2 Display of operating mode

This display shows the actual operating mode (*Stop, Min., Normal* (duty) or *Max.*). Furthermore, it shows where this operating mode was selected (*R100*, *Pump*, *BUS*, *External* or *Stop func.*). For further details about the stop function (*Stop func.*), see section *5.3.7 Setting of stop function.*

5.2.3 Display of actual value

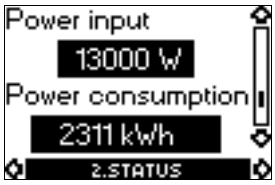
The actually measured value will appear in this display.

5.2.4 Display of actual speed

Tolerance: ±5%

The actual pump speed will appear in this display.

5.2.5 Display of input power and power consumption



Tolerance: ±10%

This display shows the actual pump input power from the mains supply. The power is displayed in W.

The pump power consumption can also be read from this display. The value of power consumption is an accumulated value calculated from the pump's birth and it cannot be reset.

5.2.6 Display of operating hours

Tolerance: ±2%

The value of operating hours is an accumulated value and cannot be reset.

5.3 Menu INSTALLATION

5.3.1 Selection of control mode

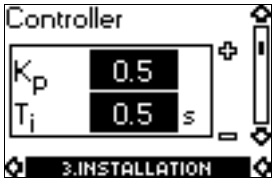
Select one of the following control modes (see fig. 8):

- ***Const. pressure*** (constant pressure),
- *Const. curve* (constant curve).

The desired performance is set in section *5.1.1 Setpoint setting.*

Note: If the pump is connected to a bus (see section *8. Bus signal*), it is not possible to select the control mode via the R100.

5.3.2 Setting of controller



In this display, the gain (K_p) and the integral-action time (T_i) of the built-in PI controller can be set if the factory setting is not the optimum setting:

- The gain (K_p) is set within the range from *0.1* to *20.*
- The integral-action time (T_i) is set within the range from *0.1* to *3600 s*. If *3600 s* is selected, the controller will function as a P controller.

Setting the PI controller:

For most applications, the factory setting of the controller constants K_p and T_i will ensure optimum pump operation.

In some systems, it may be desirable to change the controller setting to optimize the pump operation.

If a quicker pump reaction is required in cases where the pumping requirement changes quickly, reduce T_i.

If a slower reaction is required, increase T_i.

K_p has been factory-set to the optimum value (**0.5**).

5.3.3 Selection of external setpoint signal

The input for external setpoint signal can be set to different signal types.

Select one of the following types:

- *0-5 V,*
- *0-10 V,*
- *0-20 mA,*
- *4-20 mA,*
- ***Not active***.

If *Not active* is selected, the setpoint set by means of the R100 or on the control panel will apply.

The setpoint set is the maximum value of the external setpoint signal, section *7. External setpoint signal*. The actual value of the external setpoint can be read from section *5.2.1 Display of actual setpoint*.

5.3.4 Blocking of the buttons on the pump

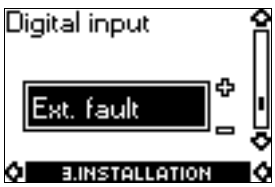
The buttons "+" and "–" on the pump can be set to:

- ***Active***,
- *Not active*.

5.3.5 Allocation of pump number

A number between 1 and 64 can be allocated to the pump. In the case of bus communication, a number must be allocated to each pump.

5.3.6 Selection of function for digital input



The digital input of the pump (terminal 1, fig. 5) can be set to different functions.

Select one of the following functions:

- *Min.* (min. curve),
- *Max.* (max. curve),
- ***Ext. fault*** (external fault),
- *Flow switch*.

The selected function is activated by closing the contact between terminals 1 and 3 (fig. 5).

See also section *6.2 Digital input*.

Min.:
When the input is activated, the pump is operating according to the min. curve.

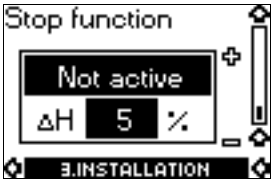
Max.:
When the input is activated, the pump is operating according to the max. curve.

Ext. fault:
When the input is activated, a timer is started. If the input is activated for more than 5 seconds, the pump is stopped and a fault is indicated. If the connection is disconnected for more than 5 seconds, the fault condition will cease and the pump can be restarted manually by resetting the fault indication.
The typical application will be detection of missing inlet pressure or water shortage by means of a pressure switch installed on the suction side of a pump.

Flow switch:
When this function is active, the pump will be stopped when a connected flow switch detects a low flow.

When the input is activated for more than 5 seconds, the stop function incorporated in the pump will take over, see section *5.3.7 Setting of stop function*.

5.3.7 Setting of stop function



When the stop function is active, the pump will be stopped at very low flows to avoid unnecessary power consumption.

The stop function can be set to:

- *Active*,
- ***Not active***.

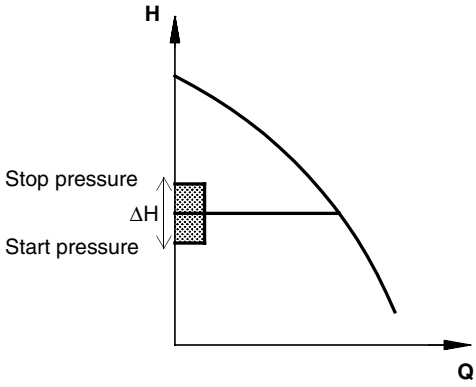
There are two possibilities of low-flow detection:

1. By means of the built-in “low-flow detector” which automatically starts functioning if no flow switch is connected to the digital input. The pump will check the flow regularly by reducing the speed for a short time, thus checking the change in pressure. If there is no or a small change in pressure, the pump will detect a low flow.
2. By means of a flow switch connected to the digital input. When the input is activated for more than 5 seconds, the stop function of the pump takes over. Unlike the built-in low-flow detector, the flow switch measures the minimum flow at which the pump must stop. The pump will not check the flow regularly by reducing the speed.

When the pump detects a low flow, the speed will be increased until the stop pressure (actual setpoint + 0.5 x ΔH) is reached and the pump stops. When the pressure has fallen to the start pressure (actual setpoint – 0.5 x ΔH), the pump will restart.

ΔH indicates the difference between start and stop pressures, fig. 16.

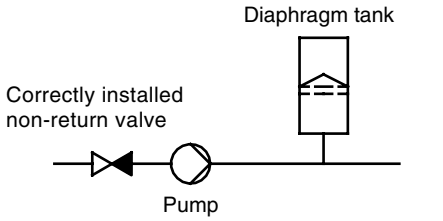
Fig. 16



ΔH is factory-set to **10% of actual setpoint**.
ΔH can be set within the range from 5% to 30% of actual setpoint.

Note: The non-return valve must be fitted immediately before the pump, fig. 17.

Fig. 17



The stop function requires a diaphragm tank of a certain minimum size. The tank must be installed immediately after the pump and the precharge pressure must be 0.7 x actual setpoint.

Recommended diaphragm tank size when no flow switch is connected.

Nominal flow of pump [m³/h]	Diaphragm tank size [litres]
0-6	8
7-24	18
25-40	50
41-70	120
71-100	180

If a diaphragm tank of the above size is installed in the system, the factory setting of ΔH is the correct setting.
If the tank installed is too small, the pump will start and stop too often. This can be remedied by increasing ΔH.

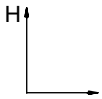
6. External forced-control signals

The pump has inputs for external signals for the forced-control functions:

- Start/stop of pump.
- Digital function.

6.1 Start/stop input

Functional diagram: Start/stop input:

Start/stop (terminals 2 and 3)		
		**Normal duty**
		**Stop**

6.2 Digital input

By means of the R100, one of the following functions can be selected for the digital input:

- Min. curve.
- Max. curve.
- External fault.
- Flow switch.

Functional diagram: Input for digital function:

Digital function (terminals 1 and 3)		
	H Q	**Normal duty**
	H Q	**Min. curve**
	H Q	**Max. curve**
	H 5 s Q	**External fault**
	H 5 s Q	**Flow switch**

7. External setpoint signal

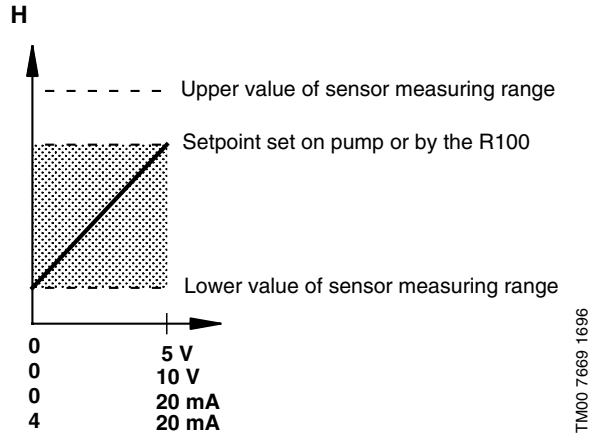
By connecting an analog signal transmitter to the input for the setpoint signal (terminal 4), it is possible to remote-set the setpoint.

The actual external signal *0-5 V*, *0-10 V*, *0-20 mA*, *4-20 mA* must be selected via the R100, see section *5.3.3 Selection of external setpoint signal.*

If constant curve duty is selected by means of the R100, the pump can be controlled by any controller.

In **constant pressure** mode, the setpoint can be set externally within the range from the lower value of the sensor measuring range to the setpoint set on the pump or by means of the R100, fig. 18.

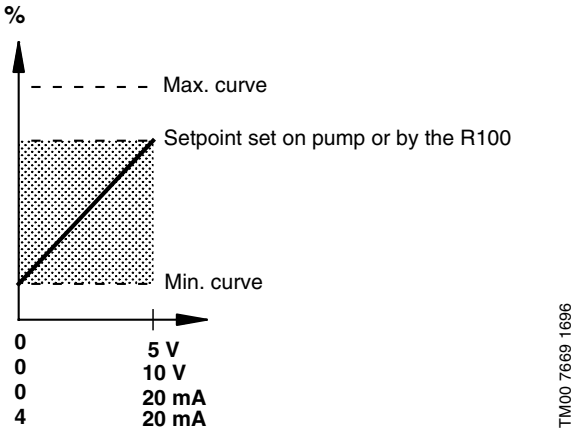
Fig. 18



Example: At a setpoint set of 5 bar and an external setpoint of 80%, the actual setpoint will be 0.80 x 5 bar = 4 bar as the lower value of the sensor measuring range is 0 bar.

In **constant curve** mode, the setpoint can be set externally within the range from the min. curve to the setpoint set on the pump or by means of the R100, fig. 19.

Fig. 19



8. Bus signal

The pump enables serial communication via an RS-485 input. The communication is carried out according to the GRUNDFOS bus protocol, GENIbus protocol, and enables connection to a building management system or another external control system.

Via the bus signal, it is possible to remote-set pump operating parameters, like setpoint, operating mode, etc. At the same time, the pump can provide status information about important parameters, like actual value of control parameter, input power, fault indications, etc.

Contact GRUNDFOS for further details.

Note: If a bus signal is used, the number of settings available via the R100 will be reduced.

9. Priority of settings

The start/stop and digital inputs will influence the number of possible settings.

By means of the R100, the pump can always be set to max. curve duty or to stop.

If two or more functions are activated at the same time, the pump will operate according to the function with the highest priority.

The priority of the settings is as shown in the following tables:

Without bus signal		
Priority	**Possible settings**	
	Control panel on pump or R100	**External signals**
1	Stop	
2	Max. curve	
3		Stop
4		Max.curve
5	Min. curve	Min. curve
6	Setpoint setting	Setpoint setting

Example: If, via the digital input, the pump has been forced to operate according to the max. curve, the pump control panel and the R100 can only set the pump to stop.

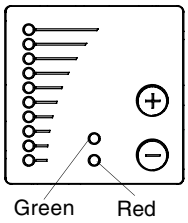
With bus signal			
Priority	Possible settings		
	Control panel on pump or R100	External signals	Bus signal
1	Stop		
2	Max. curve		
3		Stop	Stop
4			Max. curve
5			Min. curve
6			Setpoint setting

Example: If, via the digital input, the pump has been forced to operate according to the max. curve, the pump control panel, the R100 and the bus signal can only set the pump to stop.

10. Indicator lights and fault signal relay

The operating condition of the pump is indicated by the green and red indicator lights on the pump control panel, fig. 20.

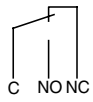
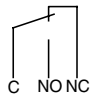
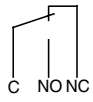
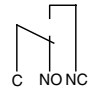
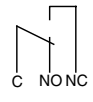
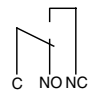
Fig. 20



TM00 7600 1196

The pump incorporates a fault signal relay with a potential-free changeover contact for external fault indication.

The functions of the two indicator lights and the fault signal relay are as shown in the following table:

Indicator lights		Fault signal relay	Description
Fault (red)	Operation (green)		
Off	Off		The electricity supply has been switched off.
Off	Permanently on		The pump is operating.
Off	Flashing		The pump has been set to stop.
Permanently on	Off		The pump has stopped because of a fault. Restarting will be attempted (it may be necessary to restart the pump by resetting the fault indication). In case of the fault causes “dry running” and “external fault”, the pump must be restarted manually by resetting the fault indication.
Permanently on	Permanently on		The pump is operating, but it has been stopped because of a fault. If the cause is “sensor signal outside signal range”, the pump will continue operating according to the max. curve and the fault indication cannot be reset until the signal is inside the signal range. If the cause is “setpoint signal outside signal range”, the pump will continue operating according to the min. curve and the fault indication cannot be reset until the signal is inside the signal range.
Permanently on	Flashing		The pump has been set to stop, but it has been stopped because of a fault.

A fault indication can be reset in one of the following ways:

- By briefly pressing the button “+” or “–” on the pump. This will not change the setting of the pump.
  A fault indication cannot be reset by means of “+” or “–” if the buttons have been locked.
- By switching off the electricity until the indicator lights are off.
- By means of the R100, see section *5.1.3 Fault indications*.

When the R100 communicates with the pump, the red indicator light will flash rapidly.

11. Megging

Note: Megging of an installation incorporating E-pumps is not allowed, as the built-in electronics may be damaged.

12. Technical data

12.1 Supply voltage

3 x 380-415 V ±10%, 50/60 Hz, PE.

See nameplate.

Back-up fuse

Motor output up to [kW]	Max. [A]
11	25
15	35
18.5	50
22	50

Standard as well as quick-blow or slow-blow fuses may be used.

12.2 Leakage current

Leakage current > 30 mA.

The leakage currents are measured in accordance with EN 60 355-1.

12.3 Inputs/output

Start/stop
External potential-free switch.
Voltage: 5 VDC.
Current: < 5 mA.
Screened cable.*

Digital
External potential-free switch.
Voltage: 5 VDC.
Current: < 5 mA.
Screened cable.*

Setpoint signals

- Potentiometer
  0-5 VDC, 10 kΩ (via internal voltage supply).
  Screened cable.*
  Maximum cable length: 100 m.
- Voltage signal
  0-5 VDC/0-10 VDC, R_i > 50 kΩ.
  Tolerance: +0%/–3% at maximum voltage signal.
  Screened cable.*
  Maximum cable length: 500 m.
- Current signal
  DC 0-20 mA/4-20 mA, R_i = 250 Ω.
  Tolerance: +0%/–3% at maximum current signal.
  Screened cable.*
  Maximum cable length: 500 m.

Fault signal relay output
Potential-free changeover contact.
Maximum contact load: 250 VAC, 2 A.
Minimum contact load: 5 VDC, 1 mA.
Screened cable: 0.5 - 2.5 mm².
Maximum cable length: 500 m.

Bus input
GRUNDFOS bus protocol, GENIbus protocol, RS-485.
0.5 - 1.5 mm² screened 2-core cable.
Maximum cable length: 500 m.

* Cross section min. 0.5 mm² and max. 1.5 mm².

13. Other technical data

EMC (electromagnetic compatibility)
EN 61 800-3.

Immunity to electromagnetic disturbance - second environment (industrial areas).

Contact GRUNDFOS for further information.

Enclosure class
Standard: IP 54 (IEC 34-5).

Insulation class
F (IEC 85).

Ambient temperature
During operation: –20°C to +40°C.
During storage/transport: –30°C to +60°C.

Relative air humidity
Maximum 95%.

Sound pressure level

Motor [kW]	Speed stated on nameplate [min^{-1}]	Sound pressure level [dB(A)]
11	2800-3000	69
15	2800-3000	70
18.5	2800-3000	70
22	2800-3000	73

14. Re-lubrication of bearings

The motor bearings are pre-lubricated on delivery. After approx. 3000 operating hours, the bearings must be re-lubricated.
Note: Before re-lubrication, the drain plug in the motor flange and the bearing cover must be removed to ensure that old and excess grease can run out.

When lubricating the first time, use the double quantity of lubricating grease as the lubricating channel is still empty.

Frame size	Quantity of lubricating grease [ml]		Lubricating intervals [hours]
	Drive end (DE)	Non-drive end (NDE)	
MMGE 160	23	20	3000
MMGE 180	23	23	

The recommended grease type is Asonic GHY 72, which is a polycarbamide-based lubricating grease.

15. Disposal

Disposal of this product or parts of it must be carried out according to the following guidelines:

1. Use the local public or private waste collection service.
2. In case such waste collection service does not exist or cannot handle the materials used in the product, please deliver the product or any hazardous materials from it to your nearest GRUNDFOS company or service workshop.

Denmark
GRUNDFOS DK A/S
Poul Due Jensens Vej 7A
DK-8850 Bjerringbro
Tlf.: +45-87 50 50 50
Telefax: +45-87 50 51 51

Argentina
Bombas GRUNDFOS de Argentina S.A.
Ruta Panamericana km. 37.500 Lote 34A
1619 - Garin
Pcia. de Buenos Aires
Phone: +54-3327 414 444
Telefax: +54-3327 411 111

Australia
GRUNDFOS Pumps Pty. Ltd.
P.O. Box 2040
Regency Park
South Australia 5942
Phone: +61-8-8461-4611
Telefax: +61-8-8340 0155

Austria
GRUNDFOS Pumpen Vertrieb Ges.m.b.H.
Grundfosstraße 2
A-5082 Grödig/Salzburg
Tel.: +43-6246-883-0
Telefax: +43-6246-883-30

Belgium
N.V. GRUNDFOS Bellux S.A.
Boomsesteenweg 81-83
B-2630 Aartselaar
Tél.: +32-3-870 7300
Télécopie: +32-3-870 7301

Brazil
GRUNDFOS do Brasil Ltda.
Rua Tomazina 106
CEP 83325 - 040
Pinhais - PR
Phone: +55-41 668 3555
Telefax: +55-41 668 3554

Canada
GRUNDFOS Canada Inc.
2941 Brighton Road
Oakville, Ontario
L6H 6C9
Phone: +1-905 829 9533
Telefax: +1-905 829 9512

China
GRUNDFOS Pumps (Shanghai) Co. Ltd.
22 Floor, Xin Hua Lian Building
755-775 Huai Hai Rd, (M)
Shanghai 200020
PRC
Phone: +86-21-64 67 28 09
Telefax: +86-21-64 67 28 08

Czech Republic
GRUNDFOS s.r.o.
Cajkovského 21
779 00 Olomouc
Phone: +420-68-5716 111
Telefax: +420-68-543 8908

Finland
OY GRUNDFOS Pumput AB
Mestarintie 11
Piispankylä
FIN-01730 Vantaa (Helsinki)
Phone: +358-9 878 9150
Telefax: +358-9 878 91550

France
Pompes GRUNDFOS Distribution S.A.
Parc d'Activités de Chesnes
57, rue de Malacombe
F-38290 St. Quentin Fallavier (Lyon)
Tél.: +33-4 74 82 15 15
Télécopie: +33-4 74 94 10 51

Germany
GRUNDFOS GMBH
Delta Haus
Schlüterstr. 33, 40699 Erkrath
Tel.: +49-211-9296-0
Telefax: +49-9296 531

Greece
GRUNDFOS Hellas A.E.B.E.
20th km. Athinon-Markopoulou Av.
P.O. Box 71
GR-19002 Peania
Phone: +30-1-66 83 400
Telefax: +30-1-6646273

Hong Kong
GRUNDFOS Pumps (Hong Kong) Ltd.
Unit 1, Ground floor
Siu Wai Industrial Centre
29-33 Wing Hong Street &
68 King Lam Street, Cheung Sha Wan
Kowloon
Phone: +852-27861706/27861741
Telefax: +852-27858664

Hungary
GRUNDFOS Hungária Kft.
Park u. 8
H-2045 Törökbalint,
Phone: +36-34 520 100
Telefax: +36-34 520 200

India
GRUNDFOS Pumps India Private Limited
Flat A, Ground Floor
61/62 Chamiers Aptmt
Chamiers Road
Chennai 600 028
Phone: +91-44 432 3487
Telefax: +91-44 432 3489

Indonesia
PT GRUNDFOS Pompa
Jl. Rawa Sumur III, Blok III / CC-1
Kawasan Industri, Pulogadung
Jakarta 13930
Phone: +62-21-460 6909
Telefax: +62-21-460 6910/460 6901

Ireland
GRUNDFOS (Ireland) Ltd.
Unit 34, Stillorgan Industrial Park
Blackrock
County Dublin
Phone: +353-1-2954926
Telefax: +353-1-2954739

Italy
GRUNDFOS Pompe Italia S.r.l.
Via Gran Sasso 4
I-20060 Truccazzano (Milano)
Tel.: +39-02-95838112/95838212
Telefax: +39-02-95309290/95838461

Japan
GRUNDFOS Pumps K.K.
1-2-3, Shin Miyakoda
Hamamatsu City
Shizuoka pref. 431-21
Phone: +81-53-428 4760
Telefax: +81-53-484 1014

Korea
GRUNDFOS Pumps Korea Ltd.
2nd Fl., Dong Shin Building
994-3 Daechi-dong, Kangnam-Ku
Seoul 135-280
Phone: +82-2-5317 600
Telefax: +82-2-5633 725

Malaysia
GRUNDFOS Pumps Sdn. Bhd.
7 Jalan Peguam U1/25
Glenmarie Industrial Park
40150 Shah Alam
Selangor
Phone: +60-3-5569 2922
Telefax: +60-3-5569 2866

Mexico
Bombas GRUNDFOS de Mexico S.A. de C.V.
Boulevard TLC No. 15
Parque Industrial Stiva Aeropuerto
Apodaca, N.L. 66600
Mexico
Phone: +52-81-8144 4000
Telefax: +52-81-8144 4010

Netherlands
GRUNDFOS Nederland B.V.
Pampuslaan 190
NL-1382 JS Weesp
Tel.: +31-294-492 211
Telefax: +31-294-492244/492299

New Zealand
GRUNDFOS Pumps NZ Ltd.
17 Beatrice Tinsley Crescent
North Harbour Industrial Estate
Albany, Auckland
Phone: +64-9-415 3240
Telefax: +64-9-415 3250

Norway
GRUNDFOS Pumper A/S
Strømsveien 344
Postboks 235, Leirdal
N-1011 Oslo
Tlf.: +47-22 90 47 00
Telefax: +47-22 32 21 50

Poland
GRUNDFOS Pompy Sp. z o.o.
ul. Klonowa 23
Baranowo k. Poznania
PL-62-081 Przezmierowo
Phone: +48-61-650 13 00
Telefax: +48-61-650 13 50

Portugal
Bombas GRUNDFOS Portugal, S.A.
Rua Calvet de Magalhães, 241
Apartado 1079
P-2780 Paço de Arcos
Tel.: +351-21-440 76 00
Telefax: +351-21-440 76 90

Russia
OOO GRUNDFOS- Service Center
Shkolnaya, ul., 39
RUS-109544 Moskow
Phone: +7-095 271 00 00
Telefax: +7-095 271 09 39

Singapore
GRUNDFOS (Singapore) Pte. Ltd.
24 Tuas West Road
Jurong Town
Singapore 638381
Phone: +65-865 1222
Telefax: +65-861 8402

Spain
Bombas GRUNDFOS España S.A.
Camino de la Fuentecilla, s/n
E-28110 Algete (Madrid)
Tel.: +34-91-848 8800
Telefax: +34-91-628 0465

Sweden
GRUNDFOS AB
Box 63, Angeredsvinkeln 9
S-424 22 Angered
Tel.: +46-771-32 23 00
Telefax: +46-31 331 94 60

Switzerland
GRUNDFOS Pumpen AG
Bruggacherstrasse 10
CH-8117 Fällanden/ZH
Tel.: +41-1-806 8111
Telefax: +41-1-806 8115

Taiwan
GRUNDFOS Pumps (Taiwan) Ltd.
14, Min-Yu Road
Tunglo Industrial Park
Tunglo, Miao-Li County
Taiwan, R.O.C.
Phone: +886-37-98 05 57
Telefax: +886-37-98 05 70

Thailand
GRUNDFOS (Thailand) Ltd.
947/168 Moo 12, Bangna-Trad Rd., K.M. 3,
Bangna, Phrakanong
Bangkok 10260
Phone: +66-2-744 1785 ... 91
Telefax: +66-2-744 1775 ... 6

Turkey
GRUNDFOS POMPA SAN. ve TIC. LTD. STI
Bulgurlu Caddesi no. 32
TR-81190 Üsküdar Istanbul
Phone: +90 - 216-4280 306
Telefax: +90 - 216-3279 988

United Arab Emirates
GRUNDFOS Gulf Distribution
P.O. Box 16768
Jebel Ali Free Zone
Dubai
Phone: +971-4- 8815 166
Telefax: +971-4-8815 136

United Kingdom
GRUNDFOS Pumps Ltd.
Grovebury Road
Leighton Buzzard/Beds. LU7 8TL
Phone: +44-1525-850000
Telefax: +44-1525-850011

U.S.A.
GRUNDFOS Pumps Corporation
17100 West 118th Terrace
Olathe, Kansas 66061
Phone: +1-913-227-3400
Telefax: +1-913-227-3500

Addresses revised 19.11.2001

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