CRE, CRIE, CRNE
CRKE, SPKE, MTRE, CHIE
1 & 3 phase

(US) **Installation and operating instructions**

LIMITED WARRANTY

Products manufactured by GRUNDFOS PUMPS CORPORATION (Grundfos) are warranted to the original user only to be free of defects in material and workmanship for a period of 24 months from date of installation, but not more than 30 months from date of manufacture. Grundfos' liability under this warranty shall be limited to repairing or replacing at Grundfos' option, without charge, F.O.B. Grundfos' factory or authorized service station, any product of Grundfos' manufacture. Grundfos will not be liable for any costs of removal, installation, transportation, or any other charges which may arise in connection with a warranty claim. Products which are sold but not manufactured by Grundfos are subject to the warranty provided by the manufacturer of said products and not by Grundfos' warranty. Grundfos will not be liable for damage or wear to products caused by abnormal operating conditions, accident, abuse, misuse, unauthorized alteration or repair, or if the product was not installed in accordance with Grundfos' printed installation and operating instructions.

To obtain service under this warranty, the defective product must be returned to the distributor or dealer of Grundfos' products from which it was purchased together with proof of purchase and installation date, failure date, and supporting installation data. Unless otherwise provided, the distributor or dealer will contact Grundfos or an authorized service station for instructions. Any defective product to be returned to Grundfos or a service station must be sent freight prepaid; documentation supporting the warranty claim and/or a Return Material Authorization must be included if so instructed.

GRUNDFOS WILL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOSSES, OR EXPENSES ARISING FROM INSTALLATION, USE, OR ANY OTHER CAUSES. THERE ARE NO EXPRESS OR IMPLIED WARRANTIES, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WHICH EXTEND BEYOND THOSE WARRANTIES DESCRIBED OR REFERRED TO ABOVE.

Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages and some jurisdictions do not allow limit actions on how long implied warranties may last. Therefore, the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from jurisdiction to jurisdiction.

CONTENTS

US

Warning

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.***

US

2. General

Grundfos E-pumps are pumps fitted with frequency-controlled standard motors for single-phase or three-phase mains connection.

Pumps without factory-fitted sensor: The pumps have a built-in PI controller and can be connected to an external sensor enabling control of for instance pressure, differential pressure, temperature, differential temperature or flow in the system in which the pumps are installed.
The pumps have been set to uncontrolled operation, i.e. the pump performance can be set according to the demand.

Pumps with pressure sensor: The pumps incorporate a PI controller and a pressure sensor enabling control of the pump discharge pressure.
The pumps can be set to controlled- or uncontrolled-operation mode.

The pumps are typically used as pressure 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.
- an output for a potential-free fault, operating or ready signal.
- 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.

3. Installation

The pump must be secured to a solid foundation by bolts through the holes in the flange or base plate.

Note ***Pumps 0.37-7.5 kW: In order to maintain the UL/cUL approval, additional installation procedures must be followed, see page 27.***

3.1 Motor cooling

To ensure sufficient 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.
- Cooling fins and fan blades must be kept clean.

3.2 Outdoor installation

When installed outdoors, the pump must be provided with a suitable cover to avoid condensation on the electronic components, fig. 1 or 2.

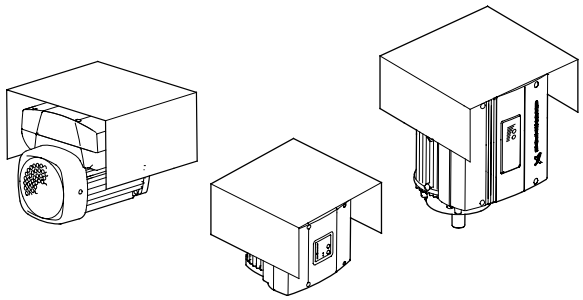


Fig. 1 Examples of covers, 0.37-7.5 kW

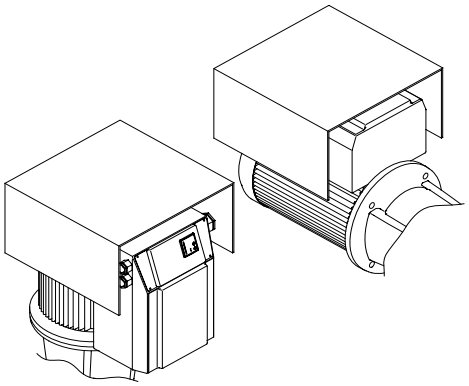


Fig. 2 Examples of covers, 11-22 kW

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

3.3 Electrical connection – single-phase pumps

Caution ***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.***

Warning!
All electric supply circuits must be interrupted before working in the pump terminal box.

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

3.3.1 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.

3.3.2 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.

3.3.3 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 marked with the following symbol:

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 motor can be found in section *13.2 Leakage current*.

3.3.4 Motor protection

The pump requires no external motor protection. The motor incorporates thermal protection against slow overloading and blocking (IEC 34-11: TP 211).

3.3.5 Overvoltage protection

The pump is overvoltage-protected through built-in varistors between phase-neutral and phase-earth.

3.3.6 Supply voltage

1 x 200-240 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 pump 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.

For maximum back-up fuse, see section *13.1 Supply voltage.*

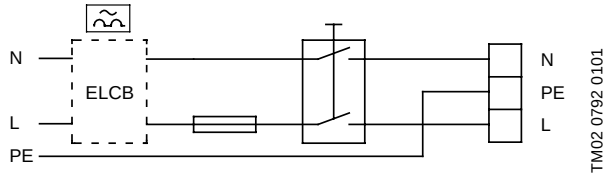


Fig. 3 Example of a mains-connected pump with mains switch, back-up fuses and additional protection

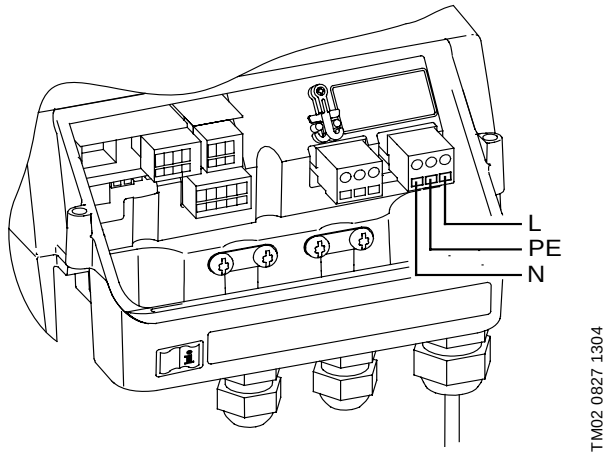


Fig. 4 Mains connection

If the supply cable is damaged, it must be replaced by the manufacturer, the manufacturer's service partner or similarly qualified persons in order to avoid a hazard.

3.3.7 Start/stop of pump

The number of starts and stops via the mains voltage must not exceed 4 times per hour.
When the pump is switched on via the mains, it will start after approx. 5 seconds.

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 started/stopped via an external on/off switch, it will start immediately.

3.4 Other connections

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

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

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 1-9, and bus connection, terminals B, Y, A).

   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** (relay signal, terminals NC, C, NO).

   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.
3. **Mains supply** (terminals N, PE, L).

   A galvanically safe separation must fulfil the requirements for reinforced insulation including creepage distances and clearances specified in EN 60 335.

US

US

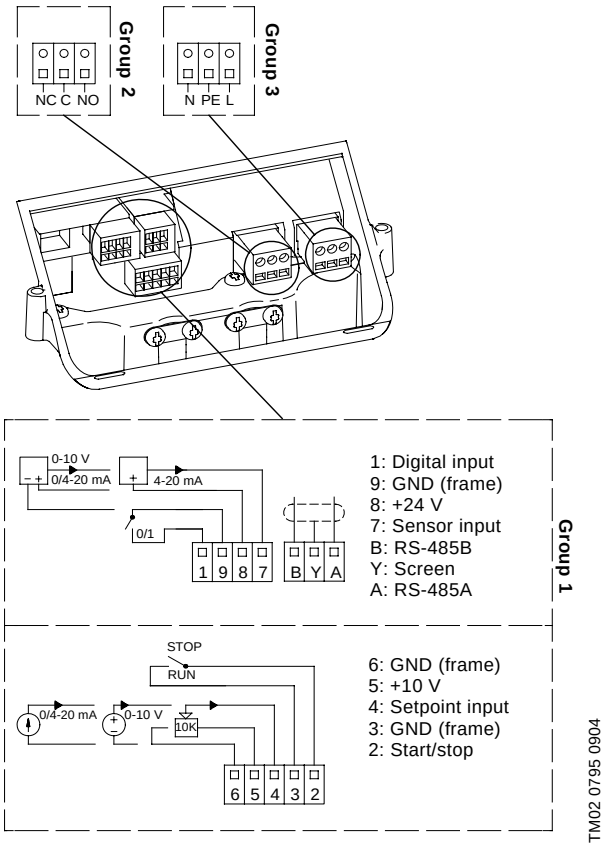


Fig. 5 Connection terminals

3.5 Electrical connection – three-phase pumps, 0.75-7.5 kW

Caution ***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.***

Warning!

All electric supply circuits must be interrupted before working in the pump terminal box.

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

3.5.1 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.

3.5.2 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.

Caution ***As the leakage current of 4 kW to 7.5 kW motors is > 3.5 mA, these motors must be connected to especially reliable/sturdy earth connections.***

The leakage current of the motor can be found in section *13.2 Leakage current*.

EN 50 178 and BS 7671 specify the following:

Leakage current > 3.5 mA:

The pump must be stationary and installed permanently. Furthermore, the pump must be connected permanently to the electricity supply.

- The earth connection must be carried out as duplicate conductors.

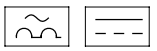
3.5.3 Additional protection

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 motor can be found in section *13.2 Leakage current*

3.5.4 Motor protection

The pump requires no external motor protection. The motor incorporates thermal protection against slow overloading and blocking (IEC 34-11: TP 211).

3.5.5 Overvoltage protection

The pump is overvoltage-protected through built-in varistors between the phases and between phases and earth.

3.5.6 Supply voltage

3 x 380-480 V +-10 %, 50/60 Hz, PE.

3 x 208-230 V +-10 %, 50/60 Hz, PE.

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

The wires in the pump 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.

For maximum back-up fuse, see section *13.1 Supply voltage.*

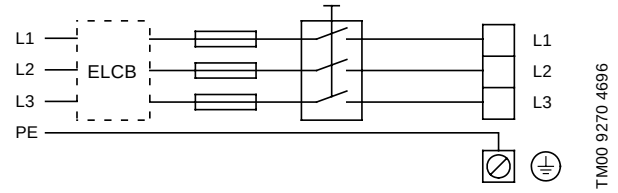


Fig. 6 Example of a mains-connected pump with mains switch, back-up fuses and additional protection

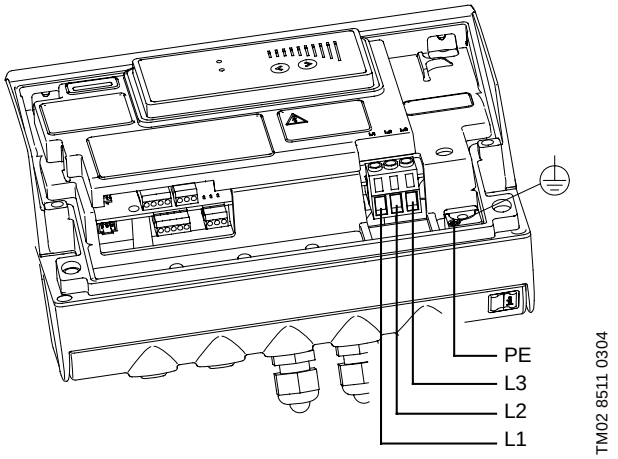


Fig. 7 Mains connection

If the supply cable is damaged, it must be replaced by the manufacturer, the manufacturer's service partner or similarly qualified persons in order to avoid a hazard.

3.5.7 Start/stop of pump

The number of starts and stops via the mains voltage must not exceed 4 times per hour.
When the pump is switched on via the mains, it will start after approx. 5 seconds.

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 started/stopped via an external on/off switch, it will start immediately.

3.6 Other connections

The connection terminals of external potential-free contacts for start/stop and digital function, external setpoint signal, sensor signal, GENIbus and relay signal are shown in fig. 8.

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

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 1-9, and bus connection, terminals B, Y, A).

   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** (relay signal, terminals NC, C, NO).

   The output (group 2) is galvanically separated from other circuits. A maximum supply voltage of 250 V or protective extra-low voltage can be connected to the output as desired.
3. **Mains supply** (terminals L1, L2, L3, PE).

   A galvanically safe separation must fulfil the requirements for reinforced insulation including creepage distances and clearances specified in EN 60 335.

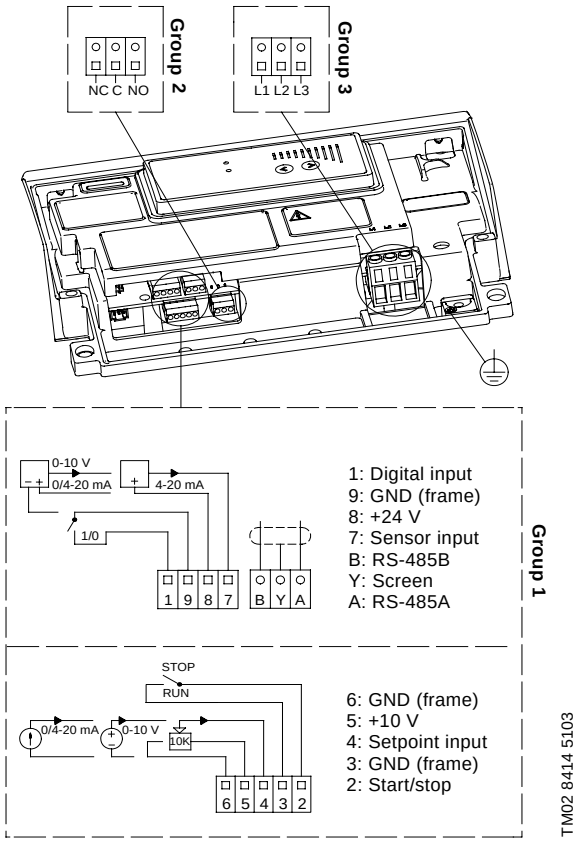


Fig. 8 Connection terminals

US

US

3.7 Electrical connection – three-phase pumps, 11-22 kW

Caution ***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.

3.7.1 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.

3.7.2 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.

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

The leakage current of the motor can be found in section *14.2 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.

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

One of the following installation examples must be used:

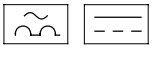
- A single protective earth conductor having a cross-sectional area of 10 mm².
- Separate duplicate conductors each having a minimum cross-sectional area of 4 mm².
- Duplicate (protective earth) conductors in a multicore cable. One of the conductors may be the metallic armour or sheath of the cable.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

3.7.3 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:


ELCB

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 motor can be found in section *14.2 Leakage current*.

3.7.4 Motor protection

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

3.7.5 Protection against mains voltage transients

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

3.7.6 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 pump 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.

For maximum back-up fuse, see section *14.1 Supply voltage*.

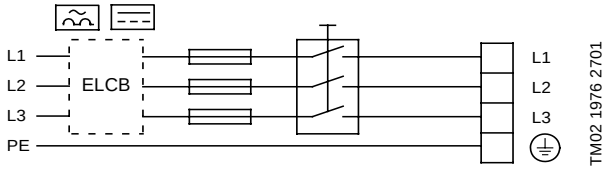


Fig. 9 Example of a mains-connected pump with mains switch, back-up fuses and additional protection

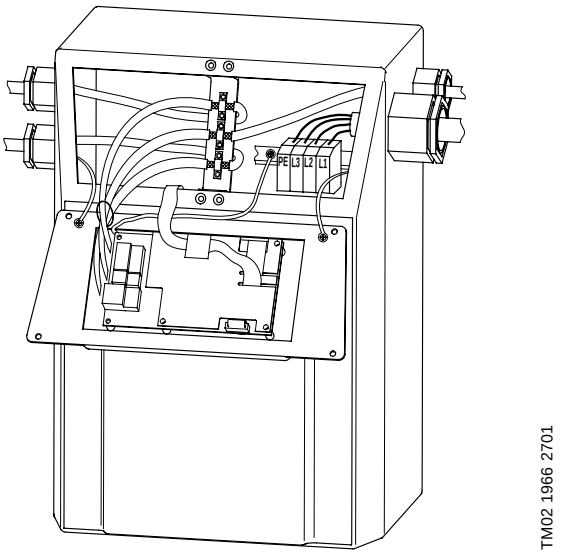


Fig. 10 Mains connection

3.7.7 Start/stop of pump

The number of starts and stops via the mains voltage must not exceed 4 times per hour.
When the pump is switched on via the mains, it will start after approx. 5 seconds.

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 started/stopped via an external on/off switch, it will start immediately.

3.8 Other connections

The connection terminals of external potential-free contacts for start/stop and digital function, external setpoint signal, sensor signal, GENIbus and relay signal are shown in fig. 11.

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

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, terminals 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** (relay signal, terminals NC, NO, C).

   The output (group 2) is galvanically separated from other circuits. A maximum supply voltage of 250 V 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 60 335.

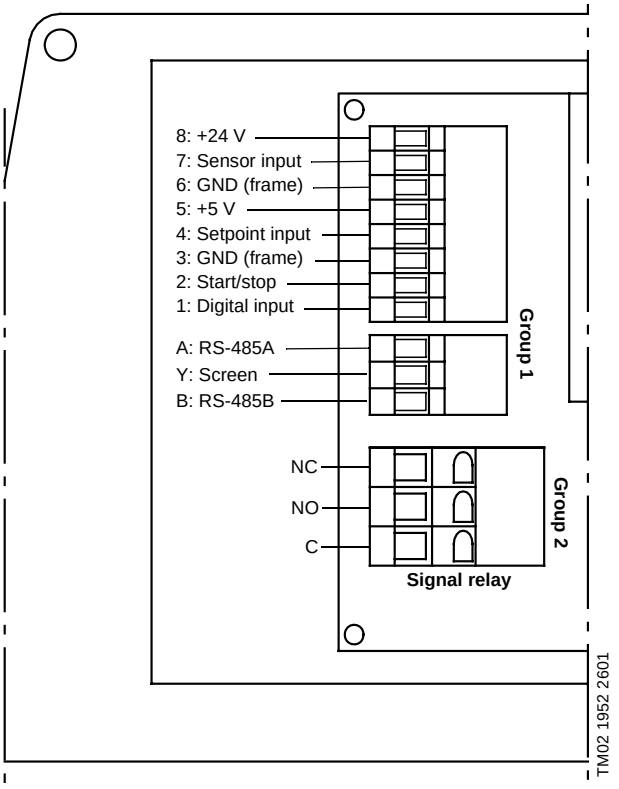


Fig. 11 Connection terminals

3.9 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. 12.

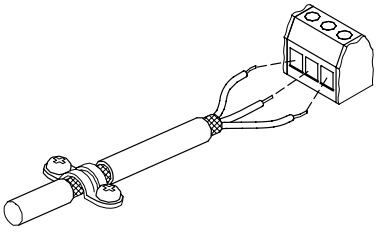


Fig. 12 Stripped cable with screen and wire connection

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

3.10 Bus connection cable

3.10.1 New installations

For the bus connection a screened 3-core cable having a cross-sectional area of min. 0.5 mm² and max. 1.5 mm² must be used.

- If the pump is connected to a unit with a cable clamp which is identical to the one on the pump, the screen must be connected to this cable clamp.
- If the unit has no cable clamp as shown in fig. 13, the screen is left unconnected at this end.

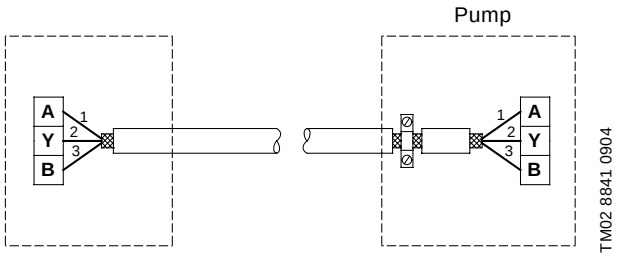


Fig. 13 Connection with screened 3-core cable

3.10.2 Replacing an existing pump

- If a screened 2-core cable is used in the existing installation, it must be connected as shown in fig. 14.

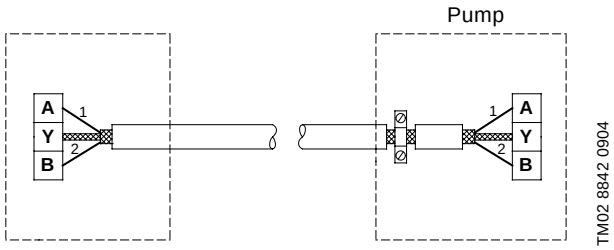


Fig. 14 Connection with screened 2-core cable

- If a screened 3-core cable is used in the existing installation, follow the instructions in section *3.10.1 New installations.*

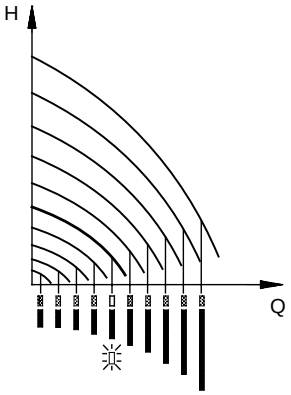
US

4. Setting the pump

4.1 Pumps without factory-fitted sensor

The pumps have been factory-set to uncontrolled operation.

In **uncontrolled-operation mode**, the pump will operate according to the constant curve set, fig. 15.



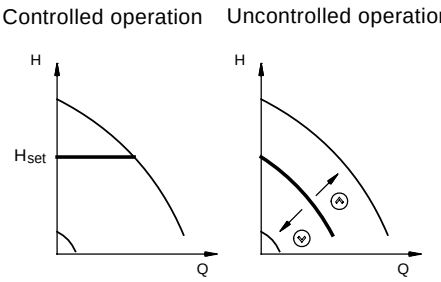
TM00 7746 1304

Fig. 15 Pump in uncontrolled-operation mode

4.2 Pumps with pressure sensor

The pump can be set to two control modes, i.e. controlled and uncontrolled operation, fig. 16.

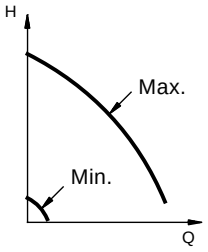
In **controlled-operation mode**, the pump will adjust its performance to the desired setpoint for the control parameter (pump discharge pressure).



TM00 7668 0404

Fig. 16 Pump in controlled-operation mode (pressure control) and in uncontrolled-operation mode

In addition to normal operation (controlled or uncontrolled operation), the following operating modes can be selected, **Stop**, **Min**. or **Max**., fig. 17.



TM00 5547 0995

Fig. 17 Min. and max. curves

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 *6. Setting by means of R100.*

4.3 Factory setting

Pumps without factory-fitted sensor: The pumps have been factory-set to uncontrolled operation. The setpoint value corresponds to 100 % of the maximum pump performance (see data sheet for the pump).

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

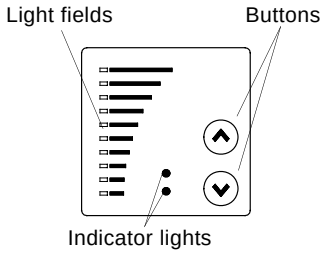
Other pump settings are marked with ***bold***-faced type under each individual display in sections *6.1 Menu OPERATION* and *6.3 Menu INSTALLATION.*

5. 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.

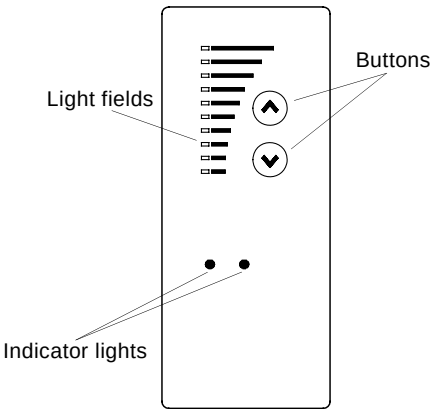
The pump control panel, fig. 18 or 19, incorporates the following:

- Buttons, ⌃ and ⌄, for setpoint setting.
- Light fields, yellow, for indication of setpoint.
- Indicator lights, green (operation) and red (fault).



TM00 7600 0304

Fig. 18 Control panel for single-phase pumps and for three-phase pumps, 11-22 kW



TM02 8513 0304

Fig. 19 Control panel for three-phase pumps, 0.75-7.5 kW

5.1 Setpoint setting

The desired setpoint is set by pressing the button ⊙ or ⊙.

The light fields on the control panel will indicate the setpoint set. See examples in sections *5.1.1* and *5.1.2*.

5.1.1 Pump in controlled-operation mode (pressure control)

Example:

Figure 20 shows that the light fields 5 and 6 are activated, indicating a desired setpoint of 3 bar. The setting range is equal to the sensor measuring range (see sensor nameplate).

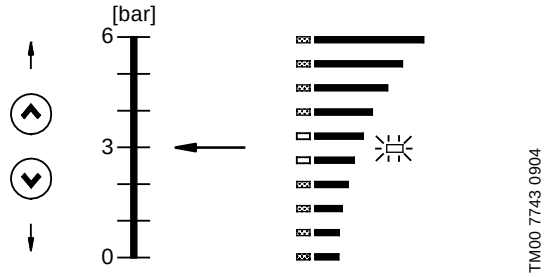


Fig. 20 Setpoint set to 3 bar, pressure-control mode

5.1.2 Pump in uncontrolled-operation mode

Example:

In uncontrolled-operation mode, the pump performance is set within the range from min. to max. curve, fig. 21.

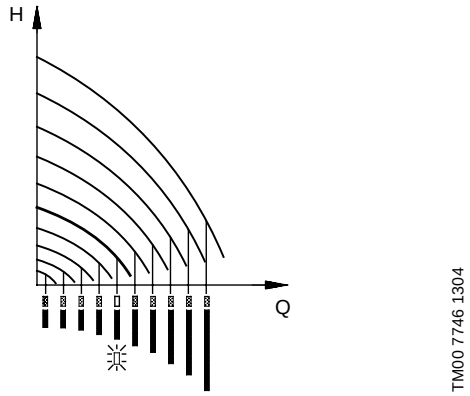


Fig. 21 Pump performance setting, uncontrolled-operation mode

5.2 Setting to max. curve duty

Press ⊙ continuously to change 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 return to uncontrolled or controlled operation, press ⊙ continuously until the desired setpoint is indicated.

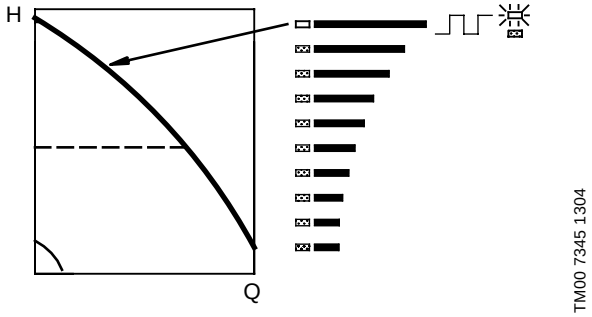


Fig. 22 Max. curve duty

5.3 Setting to min. curve duty

Press ⊙ continuously to change 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 return to uncontrolled or controlled operation, press ⊙ continuously until the desired setpoint is indicated.

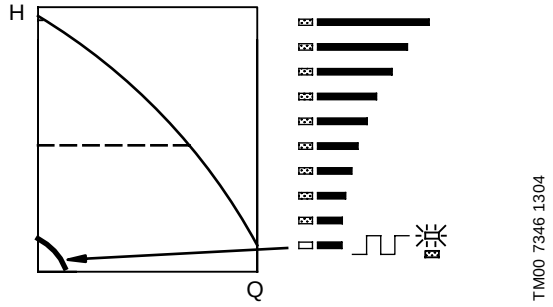


Fig. 23 Min. curve duty

5.4 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.

6. Setting by means of R100

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

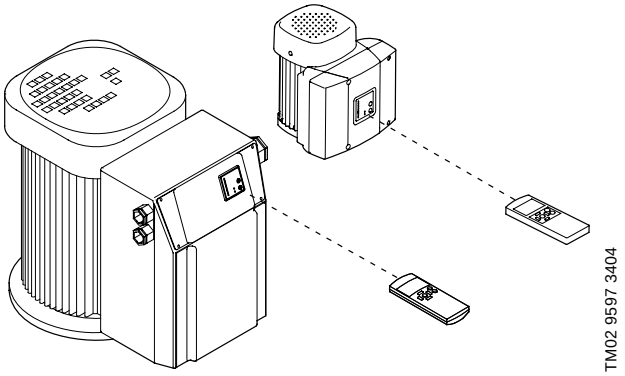


Fig. 24 R100 communicating with the pump via infra-red light

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. 25:

0. GENERAL (see operating instructions for the R100)

1. OPERATION

2. STATUS

3. INSTALLATION

The number stated at each individual display in fig. 25 refers to the section in which the display is described.

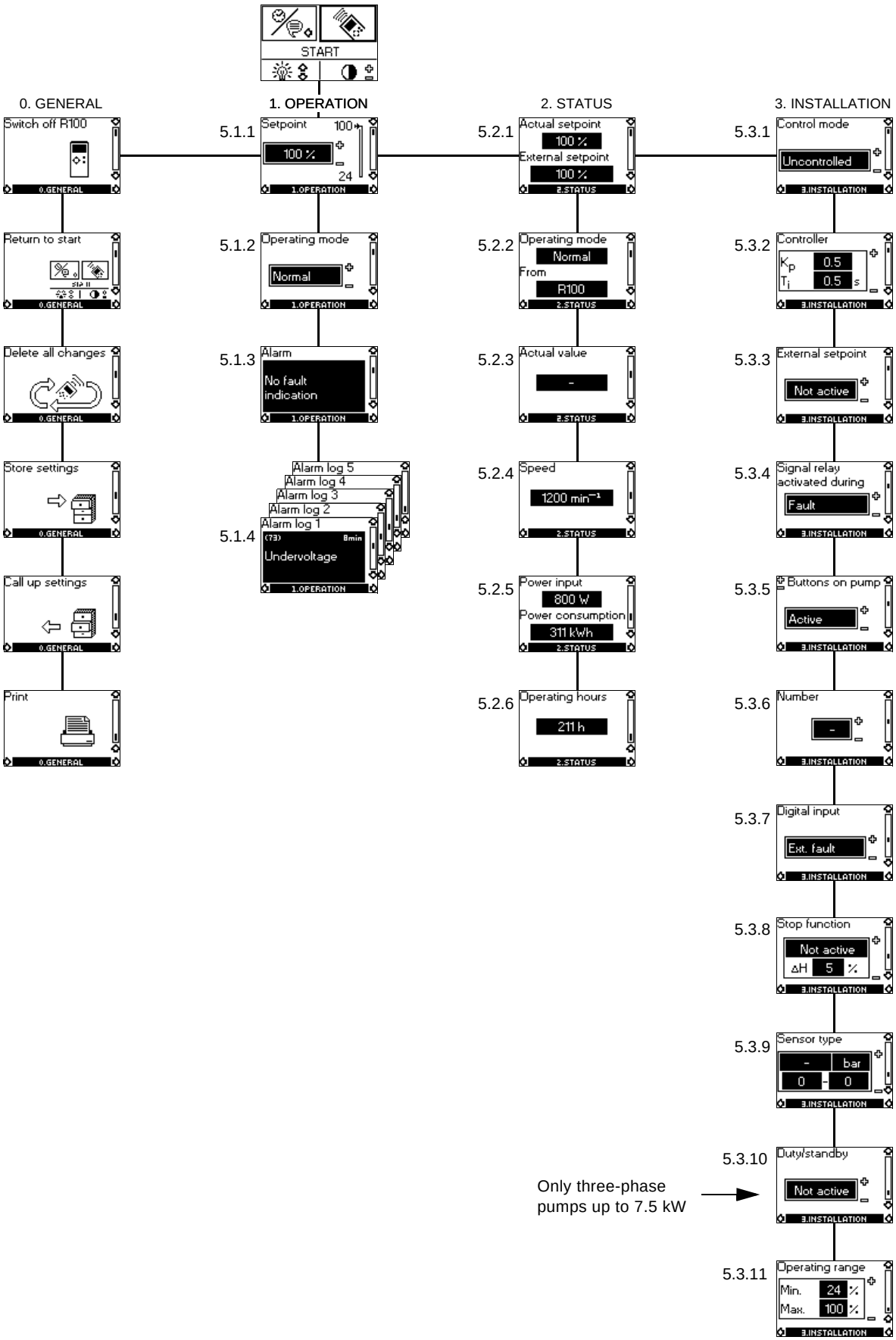


Fig. 25 Menu overview

Displays in general

In the explanation of the functions, one or two displays are shown.

One display:

Pumps without or with factory-fitted sensor have the same function.

Two displays:

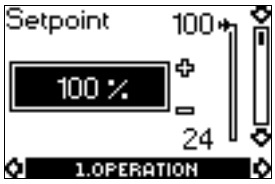
Pumps without or with factory-fitted sensor have different functions and factory settings.

6.1 Menu OPERATION

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

6.1.1 Setpoint setting

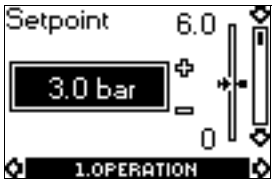
Without sensor



- Setpoint set
- Actual setpoint
- Actual value

Set the setpoint.

With pressure sensor



- Setpoint set
- Actual setpoint
- Actual value

Set the desired pressure in [bar].

In **uncontrolled-operation mode**, the setpoint is set in % of the maximum performance. The setting range will lie between the min. and max. curves.

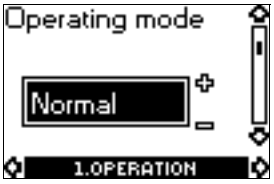
In **controlled-operation mode**, the setting range is equal to the sensor measuring range.

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 *8. 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 *10. Priority of settings.*

6.1.2 Setting of operating mode

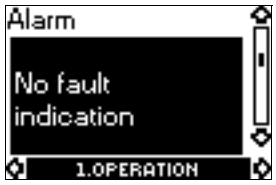


Select one of the following operating modes:

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

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

6.1.3 Fault indications



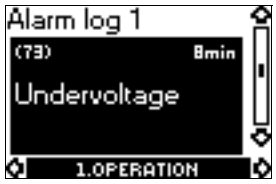
If the pump is faulty, the cause will appear in this display.

Possible causes:

- *Too high motor temperature*,
- *Undervoltage*,
- *Overvoltage*,
- *Too many restarts* (after faults),
- *Overload*,
- Sensor signal outside signal range,
- Setpoint signal outside signal range,
- *External fault*,
- *Duty/standby, Communication fault*,
- *Other fault.*

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

6.1.4 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", the fault code and the number of minutes the pump has been connected to the electricity supply after the fault occurred.

The time cannot be displayed for three-phase pumps, 11-22 kW, as the software does not support this function.

6.2 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.

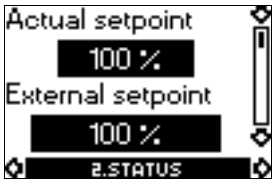
The tolerance of the displayed value is stated under each display. The tolerances are stated as a guide in % of the maximum values of the parameters.

US

US

6.2.1 Display of actual setpoint

Without sensor



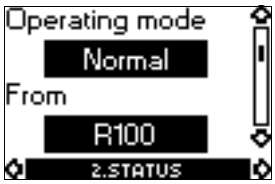
Tolerance: ±2 %

With pressure sensor

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 *8. External setpoint signal.*

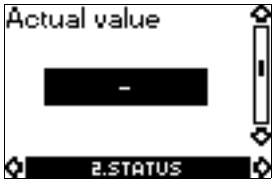
6.2.2 Display of operating mode



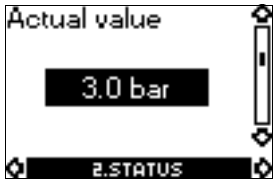
This display shows the actual operating mode (*Stop, Min., Normal* (duty) or *Max.*). Furthermore, it shows where this operating mode was selected (*R100*, *Pump*, *BUS*, *External or Stop func.*). For further details about the stop function (*Stop func.), see section 6.3.8 Setting of stop function.*

6.2.3 Display of actual value

Without sensor



With pressure sensor



The actually measured value of a connected sensor will appear in this display.

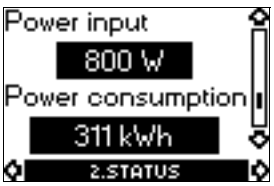
If no sensor is connected to the pump, "–" will appear in the display.

6.2.4 Display of actual speed

Tolerance: ±5 %

The actual pump speed will appear in this display.

6.2.5 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 or kW.

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.

6.2.6 Display of operating hours

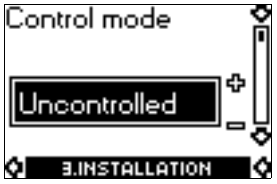
Tolerance: ±2 %

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

6.3 Menu INSTALLATION

6.3.1 Selection of control mode

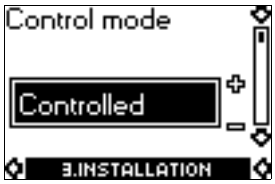
Without sensor



Select one of the following control modes (see fig. 16):

- *Controlled*,
- ***Uncontrolled***.

With pressure sensor



Select one of the following control modes (see fig. 16):

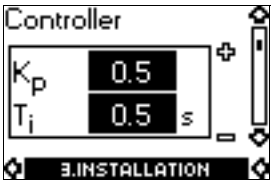
- ***Controlled***,
- ***Uncontrolled***.

Note

If the pump is connected to a bus (see section 9. Bus signal), it is not possible to select the control mode via the R100.

The desired performance is set in section *6.1.1 Setpoint setting.*

6.3.2 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.

Furthermore, it is possible to set the controller to inverse control (if the setpoint is increased, the speed will be reduced). In the case of inverse control, the gain (K_p) must be set within the range from *–0.1* to *–20*.

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 the following cases, a change of the setting can be useful or necessary.

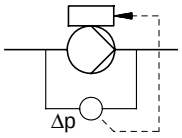
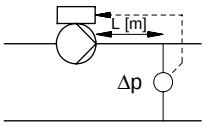
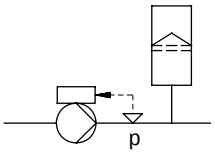
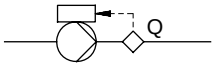
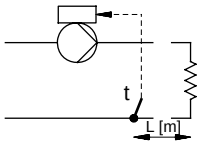
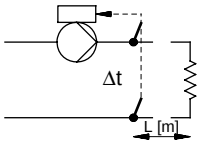
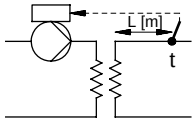
A change of the T_i setting can be useful:

- in a differential-pressure control system if the sensor is placed far away from the pump.

A change of the T_i setting, and in some cases the K_p setting, may be necessary:

- if the pump is controlled on the basis of temperature or differential temperature.

The table below shows the recommended controller settings:

System/ application	K_p		T_i
	Heating system[1]	Cooling system[2]	
	**0.5**		**0.5**
	**0.5**		L < 5 m: **0.5** L > 5 m: 3 L > 10 m: 5
	**0.5**		**0.5**
	**0.5**		**0.5**
	**0.5**	–0.5	10 + 5L
	**0.5**		10 + 5L
	**0.5**	–0.5	30 + 5L

1. Heating systems are systems in which an increase in pump performance will result in a **rise** in temperature at the sensor.
2. Cooling systems are systems in which an increase in pump performance will result in a **drop** in temperature at the sensor.

6.3.3 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 (*three-phase pumps, 11-22 kW, *only),*
- *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 *8. External setpoint signal.* The actual value of the external setpoint can be read from section *6.2.1 Display of actual setpoint.*

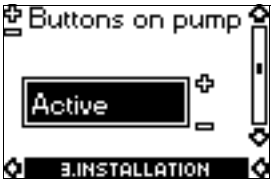
6.3.4 Selection of fault, operating or ready signal relay

It can be selected in which situation the relay should be activated:

- **Fault** *(fault indication),*
- *Operation (operating indication)*,
- *Ready (ready indication)*.

See section *11. Indicator lights and signal relay.*

6.3.5 Blocking of the buttons on the pump



The buttons ⊙ and ⊙ on the pump can be set to:

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

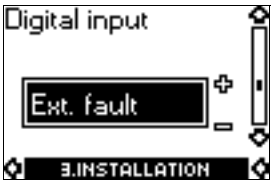
6.3.6 Allocation of pump number

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.

US

US

6.3.7 Selection of function for digital input



The digital input of the pump (terminal 1, fig. 5, 8 or 11) 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 the following terminals:

- 1 and 9 of single-phase pumps (fig. 5).
- 1 and 9 of three-phase pumps, 0.75-7.5 kW (fig. 8).
- 1 and 3 of three-phase pumps, 11-22 kW (fig. 11).

See also section *7.2 Digital input*.

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

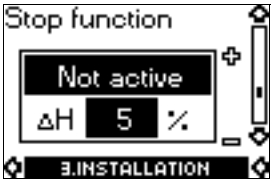
Max.:
When the input is activated, the pump is operating according to the max. curve.

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.
It is only possible to use this function if the pump is connected to a pressure sensor.

When the input is activated for more than 5 seconds, the stop function incorporated in the pump will take over, see section *6.3.8 Setting of stop function*.

6.3.8 Setting of stop function



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

It is only possible to use this function if the pump is connected to a pressure sensor, a non-return valve and a diaphragm tank.

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 chosen/connected to the digital input.
1. 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.

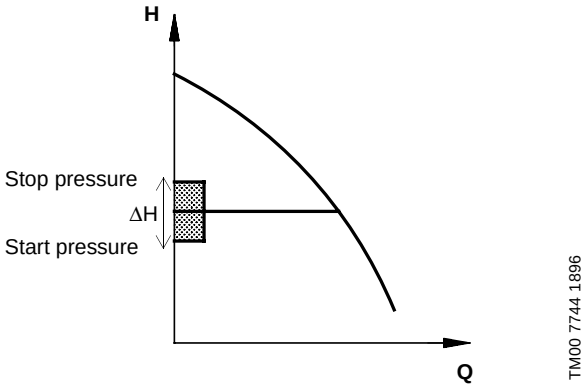


Fig. 26 Difference between start and stop pressures (ΔH)

ΔH is factory-set to **5 % 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. 27.***

Pumps without factory-fitted sensor: If the non-return valve is fitted between pump and diaphragm tank, the pressure sensor must be fitted after the non-return valve.

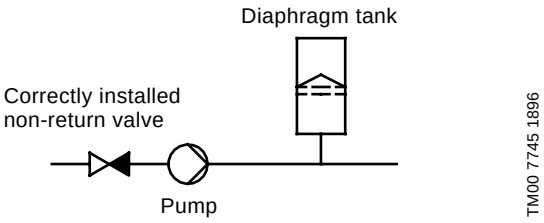


Fig. 27 Position of non-return valve in the system

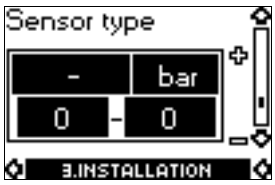
The stop function requires a diaphragm tank of a certain minimum size. The tank must be installed immediately after the pump and the precharge pressure must be 0.7 x actual setpoint.
Recommended diaphragm tank size:

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

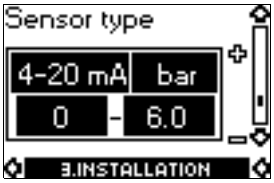
If a diaphragm tank of the above size is installed in the system, the factory setting of ΔH is the correct setting.
If the tank installed is too small, the pump will start and stop too often. This can be remedied by increasing ΔH.

6.3.9 Setting of sensor

Without sensor



With pressure sensor



The setting of the sensor is only carried out in the case of controlled operation.

Select the following:

- Sensor output signal (*0-5 V (*three-phase pumps, 11-22 kW, *only), 0-10 V, 0-20 mA* or *4-20 mA),*
- sensor measuring unit (*bar, mbar, m, kPa, psi, ft, m³/h, m³/s, l/s, gpm, °C, °F or %) and*
- sensor measuring range.

6.3.10 Duty/standby

Note ***This function applies only to three-phase pumps up to 7.5 kW.***

The duty/standby function applies to two pumps connected in parallel and controlled via GENIbus.

The duty/standby function can be set to:

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

When the function is active, the following applies:

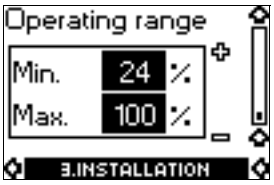
- Only one pump is running at a time.
- The stopped pump (standby) will automatically be cut in if the running pump (duty) becomes faulty. A fault will be indicated.
- Changeover between the duty pump and the standby pump will take place every 24 hours.

Activate the duty/standby function as follows:

1. Connect one of the pumps to the mains supply.
   Set the duty/standby function to "Not active".
   Using the R100, make the necessary settings in menu OPERATION and INSTALLATION.
2. Set the operating mode to “Stop” in menu OPERATION.
3. Connect the other pump to the mains supply.
   Using the R100, make the necessary settings in menu OPERATION and INSTALLATION.
   Set the duty/standby function to "*Active"*.

The running pump will search for the other pump and automatically set the duty/standby function of this pump to "Active". If it cannot find the other pump, a fault will be indicated.

6.3.11 Setting of min. and max. curves



The operating range can be changed as follows:

- The max. curve can be adjusted within the range from maximum performance (100 %) to min. curve.
- The min. curve can be adjusted within the range from max. curve to 12 % of maximum performance. The pump has been factory-set to 24 % of maximum performance.
- The operating range lies between the min. and max. curves.

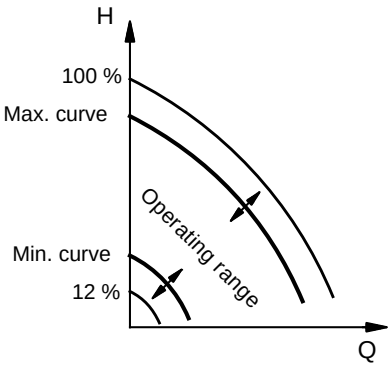


Fig. 28 Setting of the min. and max. curves in % of maximum performance

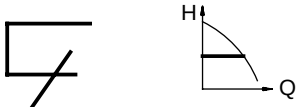
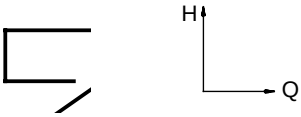
7. External forced-control signals

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

- Start/stop of pump.
- Digital function.

7.1 Start/stop input

Functional diagram: Start/stop input:

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

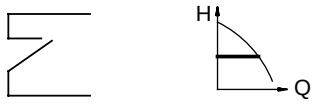
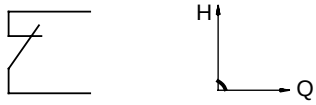
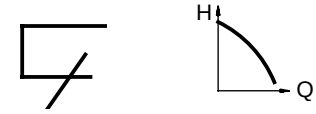
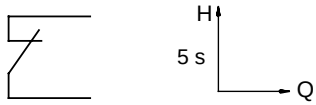
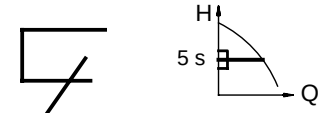
US

7.2 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 9 – single-phase pumps) (terminals 1 and 9 – three-phase pumps, 0.75-7.5 kW) (terminals 1 and 3 – three-phase pumps, 11-22 kW)	
	**Normal duty**
	**Min. curve**
	**Max. curve**
	**External fault**
	**Flow switch**

8. 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 (t*hree-phase pumps, 11-22 kW, *only), 0-10 V, 0-20 mA, 4-20 mA)* must be selected via the R100, see section *6.3.3 Selection of external setpoint signal.*

If uncontrolled operation is selected by means of the R100, the pump can be controlled by any controller.

In **controlled-operation 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. 29.

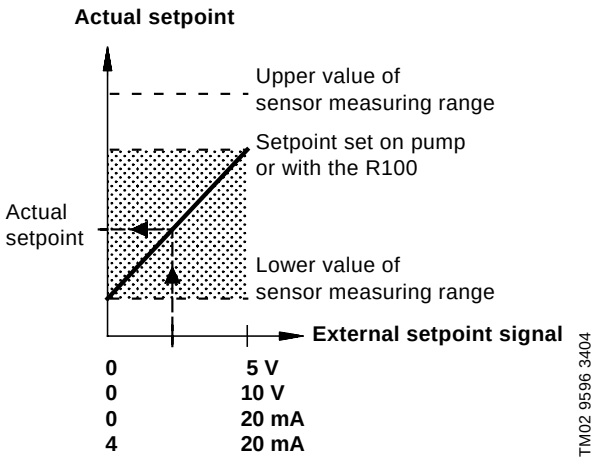


Fig. 29 Relation between the actual setpoint and the external setpoint signal in controlled-operation mode

Example: At a lower pressure-sensor value of 0 bar, a setpoint set of 3 bar and an external setpoint of 80 %, the actual setpoint will be as follows:

$H_{actual} = (H_{set} - H_{lower}) \times \%_{\text{external setpoint}} + H_{lower}$

$= (3 - 0) \times 80\ \% + 0$

$= 2.4$ bar

In **uncontrolled-operation 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. 30.

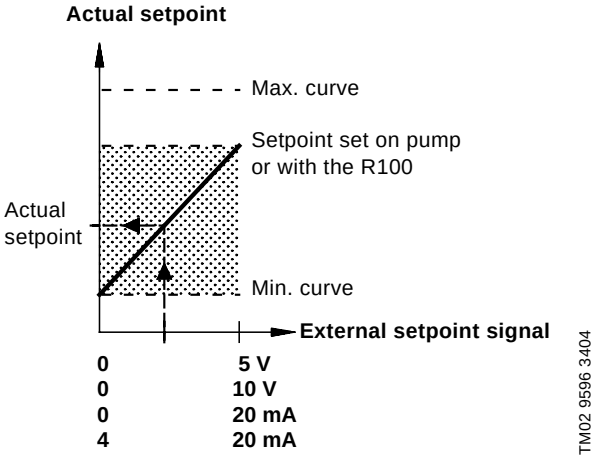


Fig. 30 Relation between the actual setpoint and the external setpoint signal in uncontrolled-operation mode

9. 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.***

10. 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.

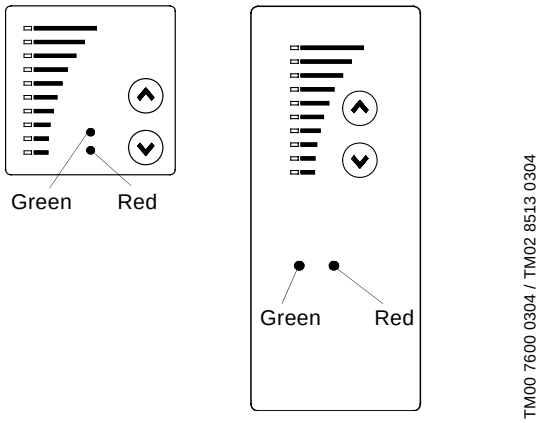
With bus signal			
Priority	**Possible settings**		
	Control panel on pump or R100	**External signals**	**Bus signal**
1	Stop		
2	Max. curve		
3		Stop	Stop
4			Max. curve
5			Min. curve
6			Setpoint setting

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.

US

11. Indicator lights and signal relay

The operating condition of the pump is indicated by the green and red indicator lights on the pump control panel, fig. 31.



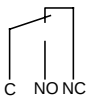
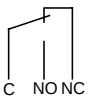
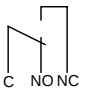
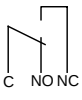
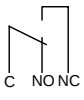
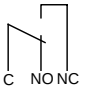
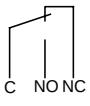
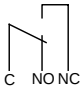
TM00 7600 0304 / TM02 8513 0304

Fig. 31 Indicator lights on control panels of single- and three-phase pumps

The pump incorporates an output for a potential-free signal via an internal relay.

The signal output can be set to fault, operating or ready indication by means of the R100, see section *6.3.4 Selection of fault, operating or ready signal relay.*

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

Indicator lights		**Signal relay activated during:**			
Fault (red)	**Operation (green)**	**Fault**	**Operation**	**Ready**	**Description**
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). If the cause is "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 **supply** until the indicator lights are off.
- By switching the external start/stop input off/on.
- By means of the R100, see section *6.1.3 Fault indications.*

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

12. Megging

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

13. Technical data – single-phase pumps

13.1 Supply voltage

1 x 200-240 V ±10 %, 50/60 Hz, PE.

Cable: 0.5 - 1.5 mm² / 14-12 AWG.

See nameplate.

Recommended fuse size

Motor sizes from 0.37 to 1.1 kW: Max. 10 A.

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

13.2 Leakage current

Earth leakage current < 3.5 mA.

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

13.3 Inputs/output

Start/stop

External potential-free switch.
Voltage: 5 VDC.
Current: < 5 mA.
Screened cable: 0.5 - 1.5 mm² / 28-16 AWG.

Digital

External potential-free switch.
Voltage: 5 VDC.
Current: < 5 mA.
Screened cable: 0.5 - 1.5 mm² / 28-16 AWG.

Setpoint signals

- Potentiometer
  0-10 VDC, 10 kΩ (via internal voltage supply).
  Screened cable: 0.5 - 1.5 mm² / 28-16 AWG.
  Maximum cable length: 100 m.
- Voltage signal
  0-10 VDC, R_i > 50 kΩ
  Tolerance: +0 %/–3 % at maximum voltage signal.
  Screened cable: 0.5 - 1.5 mm² / 28-16 AWG.
  Maximum cable length: 500 m.
- Current signal
  DC 0-20 mA/4-20 mA, R_i = 175 Ω
  Tolerance: +0 %/–3 % at maximum current signal.
  Screened cable: 0.5 - 1.5 mm² / 28-16 AWG.
  Maximum cable length: 500 m.

Sensor signals

- Voltage signal
  0-10 VDC, R_i > 50 kΩ (via internal voltage supply).
  Tolerance: +0 %/–3 % at maximum voltage signal.
  Screened cable: 0.5 - 1.5 mm² / 28-16 AWG.
  Maximum cable length: 500 m.
- Current signal
  DC 0-20 mA/4-20 mA, R_i = 175 Ω
  Tolerance: +0 %/–3 % at maximum current signal.
  Screened cable: 0.5 - 1.5 mm² / 28-16 AWG.
  Maximum cable length: 500 m.
- Electricity supply to sensor:
  +24 VDC, max. 40 mA.
  +10 VDC, max. 2.5 mA.

Signal output

Potential-free changeover contact.
Maximum contact load: 250 VAC, 2 A.
Minimum contact load: 5 VDC, 10 mA.
Screened cable: 0.5 - 2.5 mm² / 28-12 AWG.
Maximum cable length: 500 m.

Bus input

Grundfos bus protocol, GENIbus protocol, RS-485.
Screened 3-core cable: 0.5 - 1.5 mm² / 28-16 AWG.
Maximum cable length: 500 m.

14. Technical data – three-phase pumps, 0.75-7.5 kW

14.1 Supply voltage

3 x 380-480 V +-10 %, 50/60 Hz, PE.

3 x 208-230 V +-10 %, 50/60 Hz, PE.

Cable: 2.5 - 4 mm² / 10 - 8 AWG

See nameplate

Recommended fuse sizes

USA and Canada see page 24

Motor sizes from 0.75 to 5.5 kW: Max. 16 A.

Motor size 7.5 kW: Max. 32A.

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

14.2 Leakage current

Motor size [kW]	Leakage current [mA]
0.75 to 3.0 (supply voltage < 460 V)	< 3.5
0.75 to 3.0 (supply voltage > 460 V)	< 5
4.0 to 5.5	< 5
7.5	< 10

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

US

US

14.3 Inputs/output

Start/stop

External potential-free switch.
Voltage: 5 VDC.
Current: < 5 mA.
Screened cable: 0.5 - 1.5 mm² / 28-16 AWG.

Digital

External potential-free switch.
Voltage: 5 VDC.
Current: < 5 mA.
Screened cable: 0.5 - 1.5 mm² / 28-16 AWG.

Setpoint signals

- Potentiometer
  0-10 VDC, 10 kΩ (via internal voltage supply).
  Screened cable: 0.5 - 1.5 mm² / 28-16 AWG.
  Maximum cable length: 100 m.
- Voltage signal
  0-10 VDC, R_i > 50 kΩ
  Tolerance: +0 %/–3 % at maximum voltage signal.
  Screened cable: 0.5 - 1.5 mm² / 28-16 AWG.
  Maximum cable length: 500 m.
- Current signal
  DC 0-20 mA/4-20 mA, R_i = 175 Ω
  Tolerance: +0 %/–3 % at maximum current signal.
  Screened cable: 0.5 - 1.5 mm² / 28-16 AWG.
  Maximum cable length: 500 m.

Sensor signals

- Voltage signal
  0-10 VDC, R_i > 50 kΩ (via internal voltage supply).
  Tolerance: +0 %/–3 % at maximum voltage signal.
  Screened cable: 0.5 - 1.5 mm² / 28-16 AWG.
  Maximum cable length: 500 m.
- Current signal
  DC 0-20 mA/4-20 mA, R_i = 175 Ω
  Tolerance: +0 %/–3 % at maximum current signal.
  Screened cable: 0.5 - 1.5 mm² / 28-16 AWG.
  Maximum cable length: 500 m.
- Electricity supply to sensor:
  +24 VDC, max. 40 mA.
  +10 VDC, max. 2,5 mA.

Signal output

Potential-free changeover contact.
Maximum contact load: 250 VAC, 2 A.
Minimum contact load: 5 VDC, 10 mA.
Screened cable: 0.5 - 2.5 mm² / 28-12 AWG.
Maximum cable length: 500 m.

Bus input

Grundfos bus protocol, GENIbus protocol, RS-485.
Screened 3-core cable: 0.5 - 1.5 mm² / 28-16 AWG.
Maximum cable length: 500 m.

15. Technical data – three-phase pumps, 11-22 kW

15.1 Supply voltage

3 x 380-415 V ±10 %, 50/60 Hz, PE.

Cable: Max. 10 mm².

See nameplate.

Recommended fuse sizes

Motor size [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.

15.2 Leakage current

Earth leakage current > 30 mA.

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

15.3 Inputs/output

Start/stop

External potential-free switch.
Voltage: 5 VDC.
Current: < 5 mA.
Screened cable: 0.5 - 1.5 mm².

Digital

External potential-free switch.
Voltage: 5 VDC.
Current: < 5 mA.
Screened cable: 0.5 - 1.5 mm².

Setpoint signals

- Potentiometer
  0-5 VDC, 10 kΩ (via internal voltage supply).
  Screened cable: 0.5 - 1.5 mm².
  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: 0.5 - 1.5 mm².
  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: 0.5 - 1.5 mm².
  Maximum cable length: 500 m.

Sensor signals

- Voltage signal
  0-5 VDC/0-10 VDC, R_i > 50 kΩ (via internal voltage supply).
  Tolerance: +0 %/–3 % at maximum voltage signal.
  Screened cable: 0.5 - 1.5 mm².
  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: 0.5 - 1.5 mm².
  Maximum cable length: 500 m.
- Electricity supply to sensor:
  +24 VDC, max. 40 mA.
  +5 VDC, max. 5 mA.

Signal relay output

Potential-free changeover contact.
Maximum contact load: 250 VAC, 2 A.
Minimum contact load: 5 VDC, 10 mA.
Screened cable: 0.5 - 2.5 mm².
Maximum cable length: 500 m.

Bus input

Grundfos bus protocol, GENIbus protocol, RS-485.
Screened 3-core cable: 0.5 - 1.5 mm².
Maximum cable length: 500 m.

15.4 Other technical data

EMC (electromagnetic compatibility)

EN 61 800-3.

Motors of 0.37 kW up to and including 7.5 kW:

Residential areas **- unlimited distribution, corresponding to CISPR 11, class B, group 1.**

Industrial areas - unlimited distribution, corresponding to CISPR 11, class A, group 1.

Motors of 11 kW up to and including 22 kW:

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

Contact Grundfos for further information.

Enclosure class

- Single-phase pumps: IP 55 / NEMA3R (IEC 34-5)
- Three-phase pumps, 0.75 - 7.5 kW: IP55 / NEMA3R (IEC 34-5)
- Three-phase pumps, 11-22 kW: 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

Single-phase pumps:

<70 dB(A).

Three-phase pumps:

Motor [kW]	Speed stated on nameplate [min^{-1}]	Sound pressure level [dB(A)]
0.75	2800-3000	63
	3400-3600	68
1.1	2800-3000	63
	3400-3600	68
1.5	2800-3000	63
	3400-3600	68
2.2	2800-3000	64
	3400-3600	68
3.0	2800-3000	64
	3400-3600	68
4.0	2800-3000	68
	3400-3600	73
	4200-4500	75
5.5	2800-3000	68
	3400-3600	73
	4200-4500	75
7.5	2800-3000	74
	3400-3600	79
	4200-4500	80
11	2800-3000	69
15	2800-3000	70
18.5	2800-3000	70
22	2800-3000	73

16. Re-lubrication of motor motor bearings (MMGE motors)

The motor bearings are pre-lubricated on delivery. After approx. 3000 operating hours, the bearings must be re-lubricated.

Note ***Before re-lubrication, the bottom plug in the motor flange and the plug in 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.

17. 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.

Subject to alterations.

US

1. Installation in the USA and Canada

Note: Applies only to single-phase pumps and three-phase pumps up to and including 7.5 kW.

In order to maintain the UL/cUL approval, these additional installation procedures must be followed. The UL approval is according to UL508C.

1.1 Electrical installation

1.1.1 Conductors

Use 140/167° F (60/75° C) copper conductors only.

1.1.2 Torques

Power terminal, M4: 21 in-lb. (2.35Nm.)

Relay, M2.5: 4.4 in-lb. (0.5 Nm.)

Input control, M2: 1.8 in-lb. (0.2 Nm.)

1.1.3 Line reactors

Line reactors are normally not required for use with 3-phase Grundfos MLE and MGE motors.

If a line reactor is required, select the reactor per the inductance limits listed below.

- Inductance < 1.5 mH (10hp and 7.5hp)
- Inductance < 2.0 mH (5hp - 1hp)

1.1.4 Fuse size/circuit breaker

The pump is "suitable for use on a circuit capable of delivering not

more than 5000 A RMS symmetrical amperes, 480V maximum"

- when protected by fuses rated in the table below and/or
- "when protected by a circuit breaker having less let-through energy (i2t) and

less let-through curent (Ip) than the fuse in the table below"

USA - hp

Circuit breaker type						
		Max. pre-fuse size		Inverse time		
2-pole	4-pole	3/60/460	3/60/208-230	3/60/460	3/60/208-230	Fuse Models
0.33	0.33	25 A		25 A		Bussmann NOS*
0.5	0.5	25 A		25 A		Bussmann NOS*
0.75	0.75	25 A		25 A		Bussmann NOS*
1	1	25 A		25 A		Bussmann NOS*
1.5	1.5	25 A	35 A	25 A	35 A	Bussmann NOS*
2	2	25 A	35 A	25 A	35 A	Bussmann NOS*
3	3	25 A	35 A	25 A	35 A	Bussmann NOS*
5	5	40 A	60 A	40 A	60 A	Bussmann NOS*
7.5	–	40 A	60 A	40 A	60 A	Bussmann NOS*
10	7.5	50 A		50 A		Bussmann NOS*

Europa - kW

2-pole	4-pole	Max. pre-fuse size	Circuit breaker type	Fuse Models
–	0.55	25 A	25 A / Inverse time	Bussmann NOS*
0.75	0.75	25 A	25 A / Inverse time	Bussmann NOS*
1.1	1.1	25 A	25 A / Inverse time	Bussmann NOS*
1.5	1.5	25 A	25 A / Inverse time	Bussmann NOS*
2.2	2.2	25 A	25 A / Inverse time	Bussmann NOS*
3	3	25 A	25 A / Inverse time	Bussmann NOS*
4	4	40 A	40 A / Inverse time	Bussmann NOS*
5.5	–	40 A	40 A / Inverse time	Bussmann NOS*
7.5	5.5	50 A	50 A / Inverse time	Bussmann NOS*

* To comply with UL approval, use fuses with UL Fuse classification UL 248. It is recommended to use fast-acting pre-fuses by Bussmann type NOS fuses. Ferraz-Shawmut type OTS and Littelfuse type NLS fuses can also be used.

A UL 489 listed inverse-time circuit breaker having less let-through energy (i2t) and less let-through curent (Ip) than the max pre-fuses listed above can also be used.

The voltage rating of the fuse and the inverse-time circuit breaker must be at least the same voltage rating as the drive.

1.1.5 Overload protection

Degree of overload protection provided internally by the drive, in percent of full-load current: 102%.

1.2 Before starting the pump

- The pump must always be connected to the power supply at least one hour prior to start.
- From then on the pump must always be connected to the power supply.

This procedure will help to avoid condensation in the terminal box.

U.S.A.

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

Canada

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

México

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

Addresses revised 22.09.2005

L-MLE-TL-02 4/07	**US**
Repl. L-MLE-TL-02 8/04	