CRE, CRIE, CRNE, CRTE, SPKE, MTRE, CME, BMS hp

Installation and operating instructions

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Table of contents

CRE, CRIE, CRNE, CRTE, SPKE, MTRE, CME, BMS hp

Original installation and operating instructions

CONTENTS

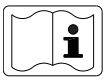
Warning

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!



Warning

The surface of the product may be so hot that it may cause burns or personal injury.

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

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

2. General information

These installation and operating instructions are a supplement to installation and operating instructions for the corresponding standard pumps CR, CRI, CRN, CRT, SPK, MTR, CM and BMS hp.

For instructions not mentioned specifically here, please see installation and operating instructions for the standard pump.

3. General description

Grundfos E-pumps have standard motors with integrated frequency converter. The pumps are for three-phase mains connection.

3.1 Pumps without factory-fitted sensor

The pumps have a built-in PI controller and can be set up for an external sensor enabling control of the following parameters:

- pressure
- differential pressure
- temperature
- differential temperature
- flow rate.

From factory, the pumps have been set to control mode uncontrolled. The PI controller can be activated by means of R100 or Grundfos GO Remote.

3.2 Pumps with pressure sensor

The pumps have a built-in PI controller and are set up with a pressure sensor enabling control of the pump discharge pressure.

The pumps are set to control mode controlled. The pumps are typically used to hold a constant pressure in variable-demand systems.

3.3 Settings

The description of settings apply both to pumps without factory-fitted sensor and to pumps with a factory-fitted pressure sensor.

Setpoint

The desired setpoint can be set in three different ways:

- directly on the pump control panel
- via an input for external setpoint signal
- by means of the Grundfos wireless remote control R100 or Grundfos GO Remote.

Other settings

All other settings can only be made by means of R100 or Grundfos GO Remote.

Important parameters such as actual value of control parameter and power consumption can be read via R100 or Grundfos GO Remote.

If special or customized settings are required, use the Grundfos PC Tool E-products. Contact your local Grundfos company for more information.

4. Mechanical installation

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

Note In order to retain the UL/cUL approval, follow the additional installation procedures on page 765.

4.1 Motor cooling

To ensure sufficient cooling of motor and electronics, observe the following requirements:

- Make sure that sufficient cooling air is available.
- Keep the temperature of the cooling air below 40 °C.
- Keep cooling fins and fan blades clean.

4.2 Outdoor installation

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

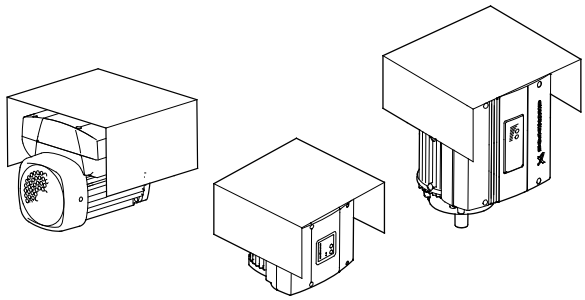


Fig. 1 Examples of covers

Remove the drain plug pointing downwards in order to avoid moisture and water buildup inside the motor.

Vertically mounted pumps are enclosure class IP55 after removal of the drain plug. Horizontally mounted pumps change enclosure class to IP54.

5. Electrical connection

For description of how to connect E-pumps electrically, see the following pages:

5.1 Three-phase pumps, 1.1 - 7.5 kW, page 4

5.2 Three-phase pumps, 11-22 kW, page 7.

5.1 Three-phase pumps, 1.1 - 7.5 kW

Warning

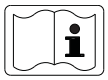
The user or the installer is responsible for the installation of correct earthing and protection according to current national and local standards. All operations must be carried out by qualified personnel.

Warning

Never make any connections in the pump terminal box unless all electric supply circuits have been switched off for at least 5 minutes.

Note for instance that the signal relay may be connected to an external supply which is still connected when the mains supply is disconnected.

The above warning is indicated on the motor terminal box by this yellow label:



5.1.1 Preparation

Before connecting the E-pump to the mains, take the issues illustrated in the figure below into consideration.

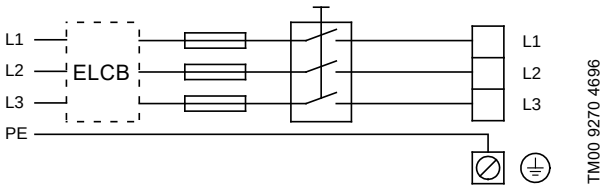


Fig. 2 Mains-connected pump with mains switch, backup fuses, additional protection and protective earthing

5.1.2 Protection against electric shock - indirect contact

Warning

The pump must be earthed in accordance with national regulations.

As the leakage current of 4 - 7.5 kW motors is greater than 3.5 mA, take extra precautions when earthing these motors.

EN 50178 and BS 7671 specify the following precautions when leakage current greater than 3.5 mA:

- The pump must be stationary and installed permanently.
- The pump must be permanently connected to the power supply.
- The earth connection must be carried out as duplicate conductors.

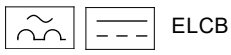
Protective earth conductors must always have a yellow/green (PE) or yellow/green/blue (PEN) colour marking.

5.1.3 Backup fuses

For recommended fuse sizes, see section *20.1 Supply voltage*.

5.1.4 Additional protection

If the pump is connected to an electrical installation where an earth leakage circuit breaker (ELCB) is used as additional protection, the circuit breaker must be of a type marked with the following symbols:



This circuit breaker is type B.

The total leakage current of all the electrical equipment in the installation must be taken into account.

The leakage current of the motor in normal operation can be seen in section *20.3 Leakage current*.

During start and at asymmetrical supply systems, the leakage current can be higher than normal and may cause the ELCB to trip.

5.1.5 Motor protection

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

5.1.6 Protection against mains voltage transients

The pump is protected against voltage transients by built-in varistors between the phases and between phases and earth.

5.1.7 Supply voltage and mains

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

The supply voltage and frequency are marked on the pump nameplate. Make sure that the pump is suitable for the power supply of the installation site.

The wires in the 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.

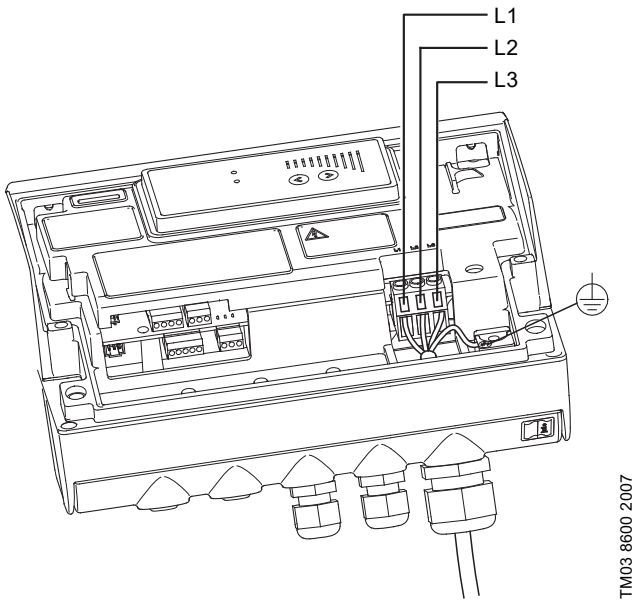


Fig. 3 Mains connection

Cable glands

Cable glands comply with EN 50626.

- 2 x M16 cable gland, cable diameter ∅4-∅10
- 1 x M20 cable gland, cable diameter ∅9-∅17
- 2 x M16 knock-out cable entries.

Warning

If the supply cable is damaged, it must be replaced by qualified personnel.

Grid types

Three-phase E-pumps can be connected to all grid types.

Warning

Do not connect three-phase E-pumps to a mains supply with a voltage between phase and earth of more than 440 V.

5.1.8 Start/stop of pump

Caution 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 approximately 5 seconds.

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

When the pump is switched on via an external on/off switch, it will start immediately.

Automatic restart

Note If a pump set up for automatic restart is stopped due to a fault, it will restart automatically when the fault has disappeared.

However, automatic restart only applies to fault types set up to automatic restart. These faults could typically be one of these faults:

- temporary overload
- fault in the power supply.

5.1.9 Connections Advanced IO module

As standard the CRE, CRIE, CRNE, CRTE, SPKE, MTRE, BMS hp pump types come with the Advanced IO module. Optional the pump types can be acquired with the basic Pump IO module. See section *5.1.10 Connections basic Pump IO module*.

Advanced IO module

The module has a number of inputs and outputs enabling the motor to be used in advanced applications where many inputs and outputs are required.

The Advanced IO module has these connections:

- start/stop terminals
- three digital inputs
- one setpoint input
- one sensor input
- one analog output
- GENIbus connection.

Note If no external on/off switch is connected, connect 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:

Group 1: Inputs

- start/stop (terminals 2 and 3)
- digital inputs (terminals 1 and 9, 10 and 9, 11 and 9)
- setpoint input (terminals 4, 5 and 6)
- sensor input (terminals 7 and 8)
- GENIbus (terminals B, Y and A).

All inputs are internally separated from the mains-conducting parts by reinforced insulation and galvanically separated from other circuits.

All control terminals are supplied with protective extra-low voltage (PELV), thus ensuring protection against electric shock.

Group 2: Output (relay signal, terminals NC, C, NO)

The output is galvanically separated from other circuits.

Therefore, the supply voltage or protective extra-low voltage can be connected to the output as desired.

- analog output (terminal 12 and 13).

Group 3: Mains supply (terminals L1, L2, L3)

A galvanic separation must fulfil the requirements for reinforced insulation including creepage distances and clearances specified in EN 60335.

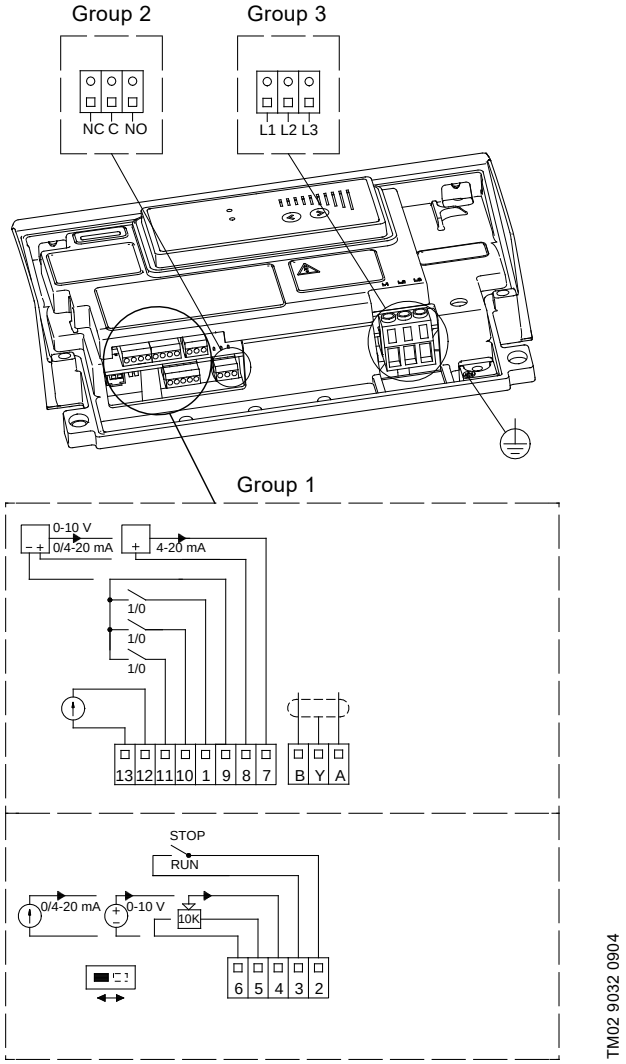


Fig. 4 Connection terminals Advanced IO module

13	GND (frame)
12	Analog output
11	Digital input 4
10	Digital input 3
1	Digital input 2
9	GND (frame)
8	+24 V
7	Sensor input
B	RS-485B
Y	Screen
A	RS-485A
6	GND (frame)
5	+10 V
4	Setpoint input
3	GND (frame)
2	Start/stop

5.1.10 Connections basic Pump IO module

As standard the CME pump types come with the basic Pump IO module. Optional the pump types can be acquired with the Advanced IO module. See section *5.1.9 Connections Advanced IO module*.

Note If no external on/off switch is connected, connect 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:

Group 1: Inputs

- start/stop terminals 2 and 3
- digital input terminals 1 and 9
- setpoint input terminals 4, 5 and 6
- sensor input terminals 7 and 8
- GENIbus terminals B, Y and 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 with protective extra-low voltage (PELV), thus ensuring protection against electric shock.

Group 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.

Group 3: Mains supply (terminals N, PE, L)

A galvanic separation must fulfil the requirements for reinforced insulation including creepage distances and clearances specified in EN 60335.

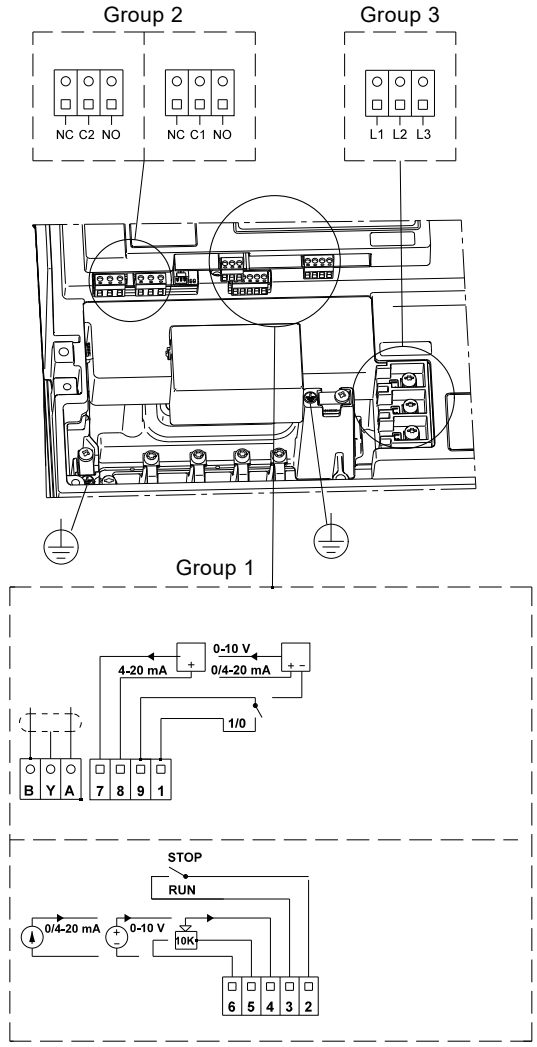


Fig. 5 Connection terminals of pump IO module

1	Digital input
9	GND (frame)
8	+24 V
7	Sensor input
B	RS-485B
Y	Screen
A	RS-485A
6	GND (frame)
5	+10 V
4	Setpoint input
3	GND (frame)
2	Start/stop

5.2 Three-phase pumps, 11-22 kW

Warning

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

Warning

Never make any connections in the pump terminal box unless all electric supply circuits have been switched off for at least 5 minutes.

Note for instance that the signal relay may be connected to an external supply which is still connected when the mains supply is disconnected.

Warning

The surface of the terminal box may be above 70 °C when the pump is operating.

5.2.1 Preparation

Before connecting the E-pump to the mains, take the issues illustrated in the figure below into consideration.

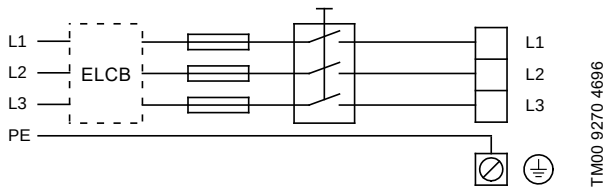


Fig. 6 Mains-connected pump with mains switch, backup fuses, additional protection and protective earthing

5.2.2 Protection against electric shock - indirect contact

Warning

The pump must be earthed in accordance with national regulations.

As the leakage current of 11-22 kW motors is greater than 10 mA, take extra precautions when earthing these motors.

EN 61800-5-1 specifies that the pump must be stationary and installed permanently when the leakage current is greater than 10 mA.

One of the following requirements must be fulfilled:

- A single protective earth conductor having a cross-sectional area of min. 10 mm^2 copper.

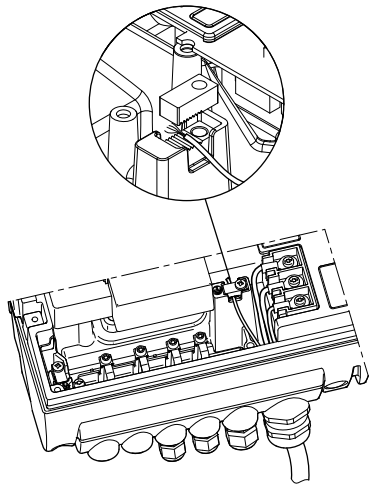


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Fig. 7 Connection of a single protective earth conductor using one of the conductors of a 4-core mains cable with cross-sectional area of min. 10 mm^2

- Two protective earth conductors of the same cross-sectional area as the mains conductors, with one conductor connected to an additional earth terminal in the terminal box.

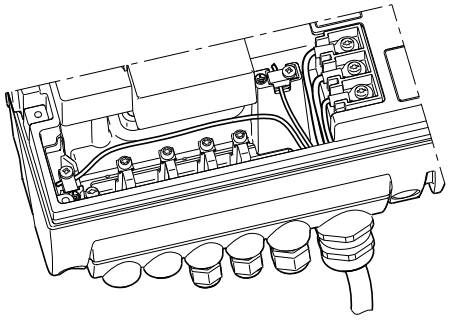

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Fig. 8 Connection of two protective earth conductors using two of the conductors of a 5-core mains cable

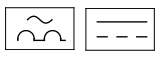
Protective earth conductors must always have a yellow/green (PE) or yellow/green/blue (PEN) colour marking.

5.2.3 Backup fuses

For recommended fuse sizes, see section *21.1 Supply voltage*.

5.2.4 Additional protection

If the pump is connected to an electrical installation where an earth leakage circuit breaker (ELCB) is used as additional protection, the circuit breaker must be of a type marked with the following symbols:



ELCB

This circuit breaker is type B.

The total leakage current of all the electrical equipment in the installation must be taken into account.

The leakage current of the motor in normal operation can be seen in section *21.3 Leakage current*.

During start and at asymmetrical supply systems, the leakage current can be higher than normal and may cause the ELCB to trip.

5.2.5 Motor protection

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

5.2.6 Protection against mains voltage transients

The pump is protected against mains voltage transients in accordance with EN 61800-3 and is capable of withstanding a VDE 0160 pulse.

The pump has a replaceable varistor which is part of the transient protection.

Over time this varistor will be worn and need to be replaced. When the time for replacement has come, R100 and PC Tool E-products will indicate this as a warning. See section *19. Maintenance and service*.

5.2.7 Supply voltage and mains

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

The supply voltage and frequency are marked on the pump nameplate. Make sure that the motor is suitable for the power supply of the installation site.

The wires in the 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.

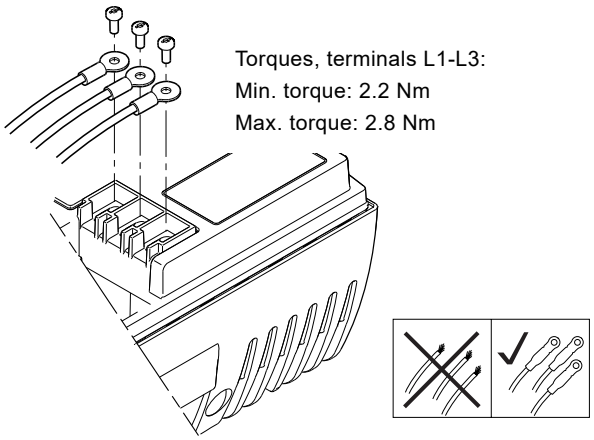


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Fig. 9 Mains connection

Cable glands

Cable glands comply with EN 50626.

- 1 x M40 cable gland, cable diameter ∅16-∅28
- 1 x M20 cable gland, cable diameter ∅9-∅17
- 2 x M16 cable gland, cable diameter ∅4-∅10
- 2 x M16 knock-out cable entries.

Warning

If the supply cable is damaged, it must be replaced by qualified personnel.

Grid types

Three-phase E-pumps can be connected to all grid types.

Warning

Do not connect three-phase E-pumps to a mains supply with a voltage between phase and earth of more than 440 V.

5.2.8 Start/stop of pump

Caution 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 approximately 5 seconds.

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

When the pump is switched on via an external on/off switch, it will start immediately.

5.2.9 Connections

As standard the pump types come with the Advanced IO module.

Advanced IO module

The Advanced IO module is the standard functional module in all MGE motors from 11 to 22 kW.

The module has a number of inputs and outputs enabling the motor to be used in advanced applications where many inputs and outputs are required.

The Advanced IO module has these connections:

- start/stop terminals
- three digital inputs
- one setpoint input
- one sensor input (feedback sensor)
- one sensor 2 input
- one analog output
- two Pt100 inputs
- two signal relay outputs
- GENIbus connection.

Note If no external on/off switch is connected, connect 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:

Group 1: Inputs

- Start/stop (terminals 2 and 3)
- digital inputs (terminals 1 and 9, 10 and 9, 11 and 9)
- sensor input 2 (terminals 14 and 15)
- Pt100 sensor inputs (terminals 17, 18, 19 and 20)
- setpoint input (terminals 4, 5 and 6)
- sensor input (terminals 7 and 8)
- GENIbus (terminals B, Y and A).

All inputs are internally separated from the mains-conducting parts by reinforced insulation and galvanically separated from other circuits.

All control terminals are supplied with protective extra-low voltage (PELV), thus ensuring protection against electric shock.

Group 2: Output (relay signal, terminals NC, C, NO)

The output is galvanically separated from other circuits.

Therefore, the supply voltage or protective extra-low voltage can be connected to the output as desired.

- Analog output (terminal 12 and 13).

Group 3: Mains supply (terminals L1, L2, L3)

A galvanic separation must fulfil the requirements for reinforced insulation including creepage distances and clearances specified in EN 61800-5-1.

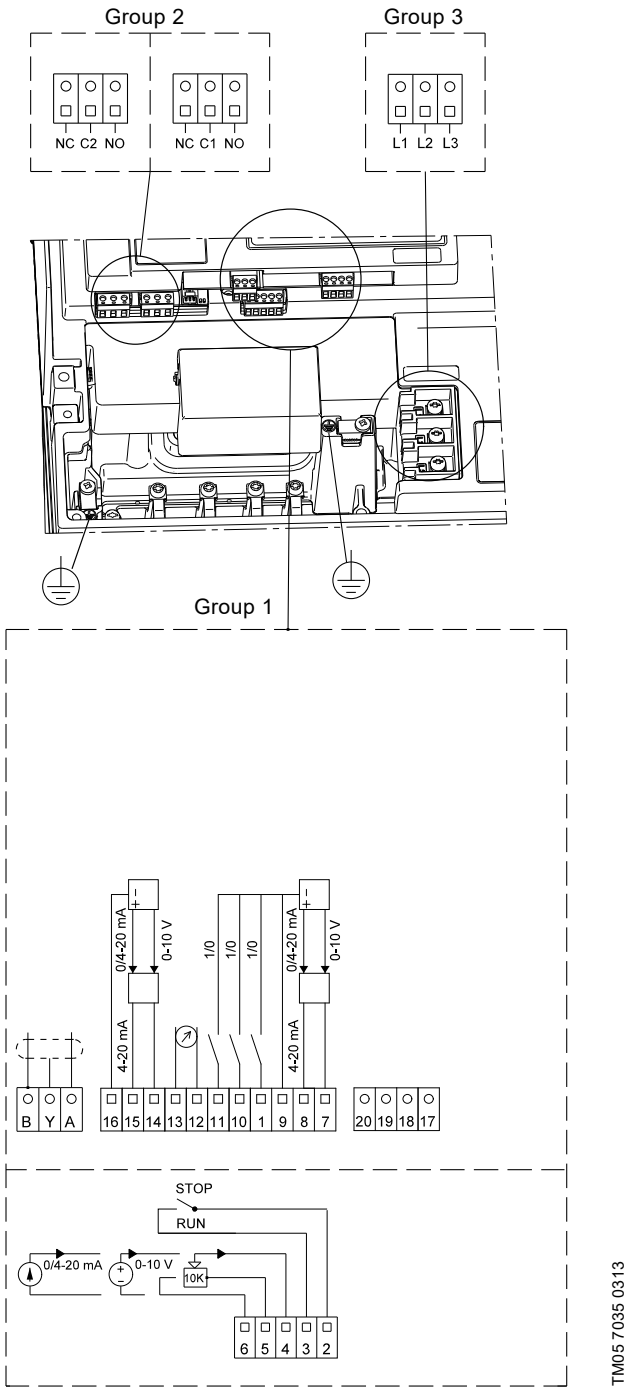

Fig. 10 Connection terminals Advanced IO module

20	Pt100 B	9	GND (frame)
19	Pt100 B	8	+24 V
18	Pt100 A	7	Sensor input
17	Pt100 A	B	RS-485B
16	GND (frame)	Y	Screen
15	24 V	A	RS-485A
14	Sensor input 2	6	GND (frame)
13	GND	5	+10 V
12	Analog output	4	Setpoint input
11	Digital input 4	3	GND (frame)
10	Digital input 3	2	Start/stop
1	Digital input		

5.3 Signal cables

- Use screened cables with a conductor cross-section of min. 0.5 mm^2 and max. 1.5 mm^2 for external on/off switch, digital input, setpoint and sensor signals.
- Connect the screens of the cables to frame at both ends with good frame connection. The screens must be as close as possible to the terminals. See fig. 11.

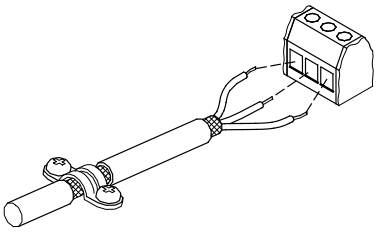

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Fig. 11 Stripped cable with screen and wire connection

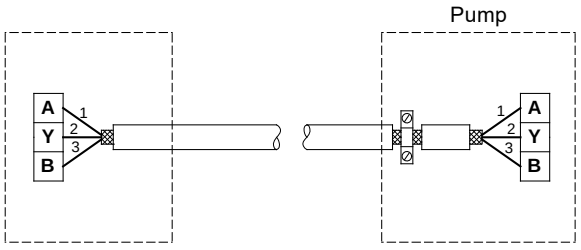
- Always tighten screws for frame connections whether a cable is fitted or not.
- Make the wires in the pump terminal box as short as possible.

5.4 Bus connection cable

5.4.1 New installations

For the bus connection, use a screened 3-core cable with a conductor cross-section of 0.2 mm^2 - 1.5 mm^2.

- If the pump is connected to a unit with a cable clamp which is identical to the one on the pump, connect the screen to this cable clamp.
- If the unit has no cable clamp as shown in fig. 12, leave the screen unconnected at this end.

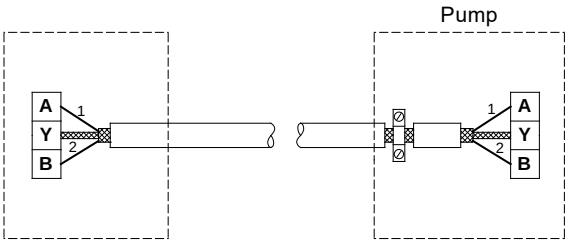


TM02 8841 0904

Fig. 12 Connection with screened 3-core cable

5.4.2 Replacing an existing pump

- If a screened 2-core cable is used in the existing installation, connect it as shown in fig. 13.



TM02 8842 0904

Fig. 13 Connection with screened 2-core cable

- If a screened 3-core cable is used in the existing installation, follow the instructions in section *5.4.1 New installations*.

6. Modes

Grundfos E-pumps are set and controlled according to operating and control modes.

6.1 Overview of modes

Operating modes	Normal	— Stop	— Min.	— Max.
Control modes	Uncontrolled	— Controlled		
	Constant curve	Constant pressure[1)]		

1) For this control mode the pump is equipped with a pressure sensor. The pump may also be equipped with a temperature sensor in which case the description would be constant temperature in control mode controlled.

6.2 Operating mode

When the operating mode is set to Normal, the control mode can be set to controlled or uncontrolled. See section *6.3 Control mode*.

The other operating modes that can be selected are Stop, Min. or Max.

- Stop: the pump has been stopped
- Min.: the pump is operating at its minimum speed
- Max.: the pump is operating at its maximum speed.

Figure 14 is a schematic illustration of min. and max. curves.

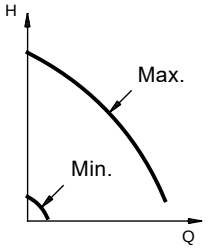


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Fig. 14 Min. and max. curves

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.

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

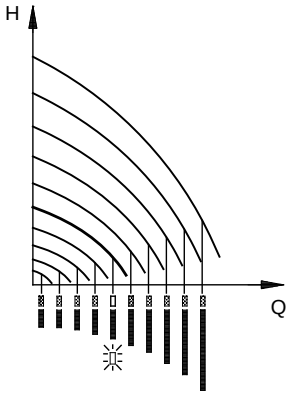
The remote control R100 offers additional possibilities of setting and status displays. See section *9. Setting by means of R100*.

6.3 Control mode

6.3.1 Pumps without factory-fitted sensor

The pumps are factory-set to control mode uncontrolled.

In control mode uncontrolled, the pump will operate according to the constant curve set, see fig. 15.



TM00 7746 1304

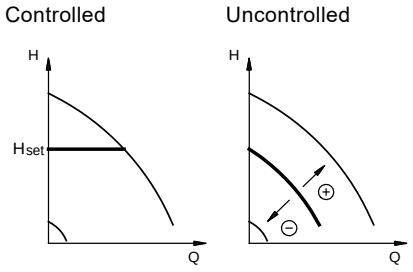
Fig. 15 Pump in control mode uncontrolled (constant curve)

6.3.2 Pumps with pressure sensor

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

In control mode controlled, the pump will adjust its performance, i.e. pump discharge pressure, to the desired setpoint for the control parameter.

In control mode uncontrolled, the pump will operate according to the constant curve set.



TM00 7668 0404

Fig. 16 Pump in control mode controlled (constant pressure) or uncontrolled (constant curve)

7. Setting up the pump

7.1 Factory setting

Pumps without factory-fitted sensor

The pumps have been factory-set to control mode uncontrolled. The setpoint value corresponds to 100 % of the maximum pump performance (see data sheet for the pump).

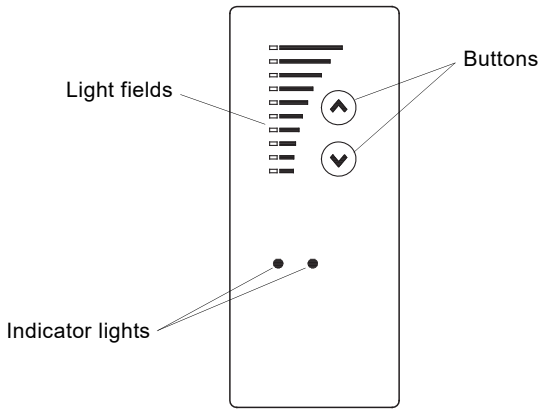
Pumps with pressure sensor

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

8. Setting by means of control panel

The pump control panel, see fig. 17, incorporates the following buttons and indicator lights:

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



TM02 8513 0304

Fig. 17 Control panel, three-phase pumps, 1.1 - 22 kW

8.1 Setting of operating mode

Settings available:

- Normal
- Stop
- Min.
- Max.

Start/stop of pump

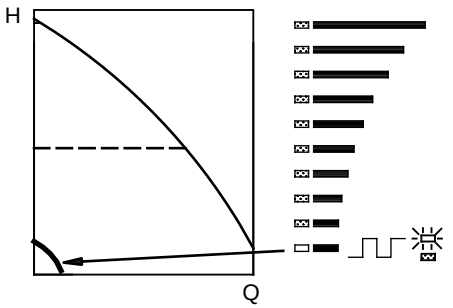
Start the pump by continuously pressing ⊛ until the desired setpoint is indicated. This is operating mode Normal.

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

Setting to Min.

Press ⊛ continuously to change to the min. curve of the pump (bottom light field flashes). When the bottom light field is on, press ⊛ for 3 seconds until the light field starts flashing.

To return to uncontrolled or controlled operation, press ⊛ continuously until the desired setpoint is indicated.



TM00 7346 1304

Fig. 18 Min. curve duty

Setting to Max.

Press ⌃ continuously to change to the max. curve of the pump (top light field flashes). When the top light field is on, press ⌃ for 3 seconds until the light field starts flashing.

To return to uncontrolled or controlled operation, press ⌄ continuously until the desired setpoint is indicated.

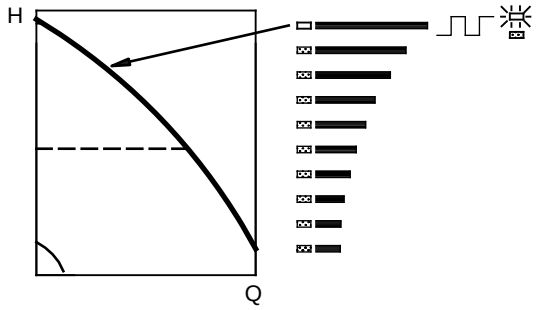


Fig. 19 Max. curve duty

8.2 Setpoint setting

Set the desired setpoint by pressing the button ⌃ or ⌄.

The light fields on the control panel will indicate the setpoint set. See examples in sections *8.2.1 Pump in control mode controlled (pressure control)* and *8.2.2 Pump in control mode uncontrolled*.

8.2.1 Pump in control mode controlled (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 the sensor nameplate.

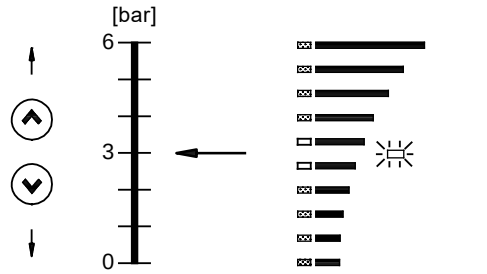


Fig. 20 Setpoint set to 3 bar, pressure control

8.2.2 Pump in control mode uncontrolled

Example

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

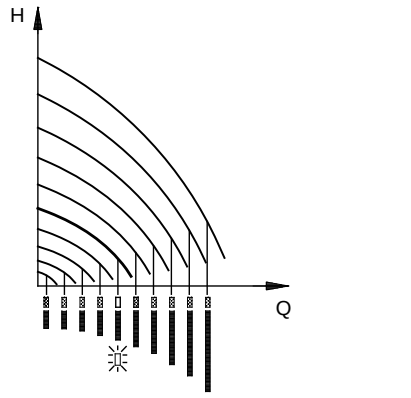


Fig. 21 Pump performance setting, control mode uncontrolled

9. Setting by means of R100

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

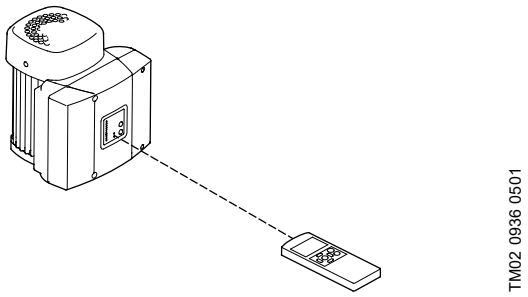


Fig. 22 R100 communicating with the pump via infra-red light

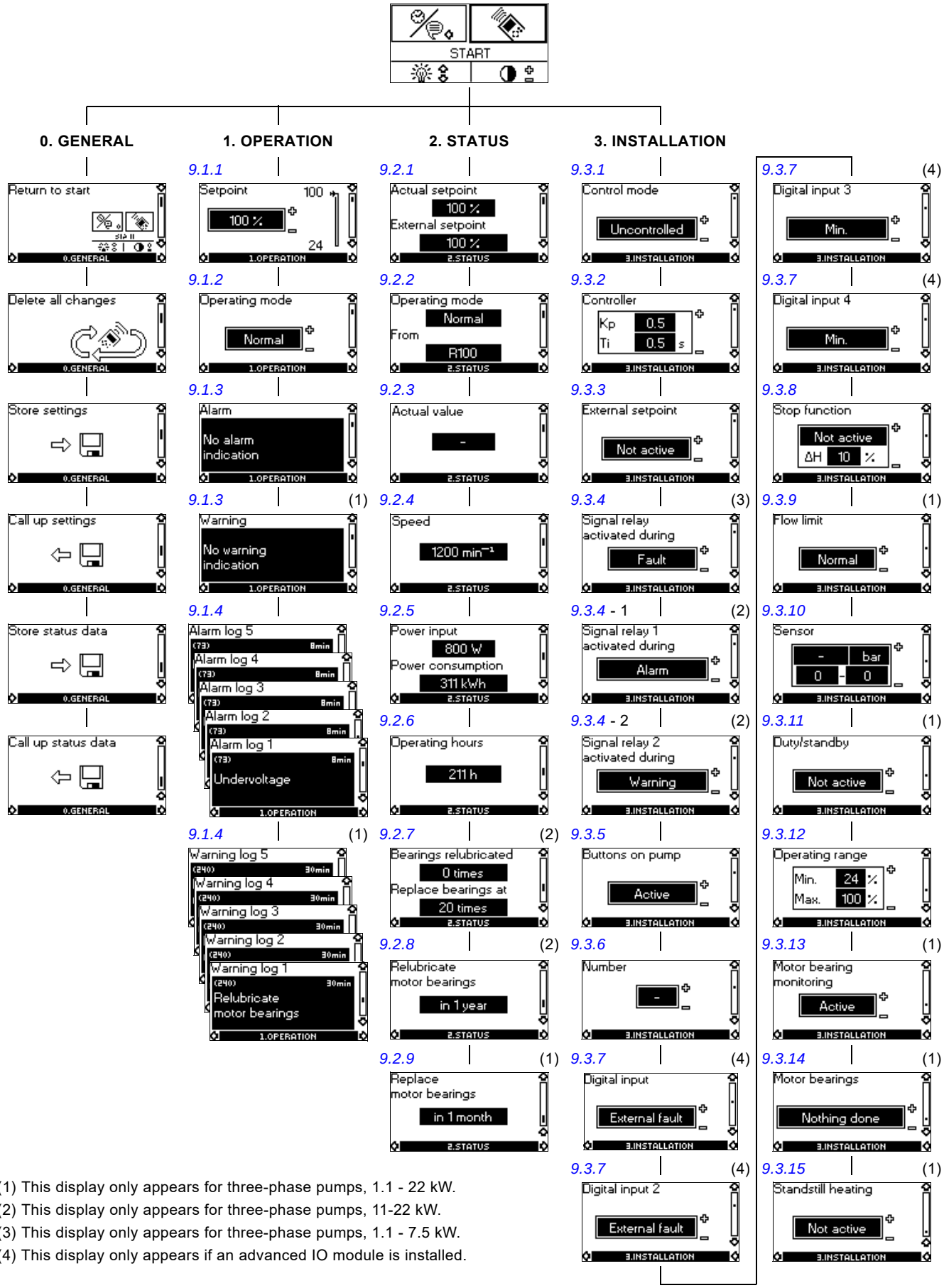
During communication, the R100 must be pointed at the control panel. When the R100 communicates with the pump, the red indicator light will flash rapidly. Keep pointing the R100 at the control panel until the red LED diode stops flashing.

The R100 offers setting and status displays for the pump.

The displays are divided into four parallel menus (see fig. 23):

0. GENERAL (see operating instructions for the R100)
1. OPERATION
2. STATUS
3. INSTALLATION

The figure above each individual display in fig. 23 refers to the section in which the display is described.



(1) This display only appears for three-phase pumps, 1.1 - 22 kW.
(2) This display only appears for three-phase pumps, 11-22 kW.
(3) This display only appears for three-phase pumps, 1.1 - 7.5 kW.
(4) This display only appears if an advanced IO module is installed.

Fig. 23 Menu overview

Displays in general

In the following 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

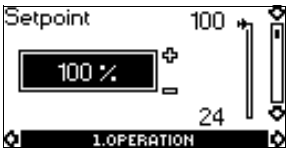
Pumps without or with factory-fitted pressure sensor have different functions and factory settings.

9.1 Menu OPERATION

The first display in this menu is this:

9.1.1 Setpoint

Without sensor (uncontrolled)



- Setpoint set
- Actual setpoint
- Actual value

Set the setpoint in %.

With pressure sensor (controlled)

- Setpoint set
- Actual setpoint
- Actual value

Set the desired pressure in bar.

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

In control mode controlled, the setting range is equal to the sensor measuring range.

If the pump is connected to an external setpoint signal, the value in this display will be the maximum value of the external setpoint signal. See section *13. External setpoint signal*.

Setpoint and external signal

The setpoint cannot be set if the pump is controlled via external signals (Stop, Min. curve or Max. curve). R100 will give this warning: External control!

Check if the pump is stopped via terminals 2-3 (open circuit) or set to min. or max. via terminals 1-3 (closed circuit).

See section *11. Priority of settings*.

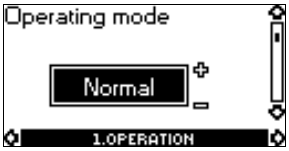
Setpoint and bus communication

The setpoint cannot be set either if the pump is controlled from an external control system via bus communication. R100 will give this warning: Bus control!

To override bus communication, disconnect the bus connection.

See section *11. Priority of settings*.

9.1.2 Operating mode



Set one of the following operating modes:

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

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

9.1.3 Fault indications

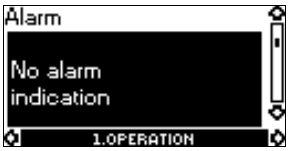
In E-pumps, faults may result in two types of indication: alarm or warning.

An "alarm" fault will activate an alarm indication in R100 and cause the pump to change operating mode, typically to stop. However, for some faults resulting in alarm, the pump is set to continue operating even if there is an alarm.

A "warning" fault will activate a warning indication in R100, but the pump will not change operating or control mode.

Note The indication, Warning, only applies to three-phase pumps.

Alarm



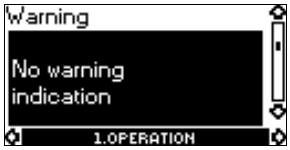
In case of alarm, the cause will appear in this display.

Possible causes:

- No alarm indication
- Too high motor temperature
- Undervoltage
- Mains voltage asymmetry (11-22 kW)
- Overvoltage
- Too many restarts (after faults)
- Overload
- Underload (only three-phase pumps)
- Sensor signal outside signal range
- Setpoint signal outside signal range
- External fault
- Duty/standby, Communication fault
- Dry running (only three-phase pumps)
- Other fault.

If the pump has been set up to manual restart, an alarm indication can be reset in this display if the cause of the fault has disappeared.

Warning (only three-phase pumps)



In case of warning, the cause will appear in this display.

Possible causes:

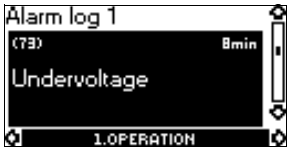
- No warning indication
- Sensor signal outside signal range
- Relubricate motor bearings, see section *19.2 Relubrication of motor bearings*
- Replace motor bearings, see section *19.3 Replacement of motor bearings*
- Replace varistor, see section *19.4 Replacement of varistor (only 11-22 kW)*.

A warning indication will disappear automatically once the fault has been remedied.

9.1.4 Fault log

For both fault types, alarm and warning, the R100 has a log function.

Alarm log

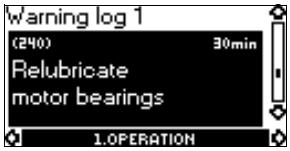


In case of "alarm" faults, the last five alarm indications will appear in the alarm log. "Alarm log 1" shows the latest fault, "Alarm log 2" shows the latest fault but one, etc.

The example above gives this information:

- the alarm indication "Undervoltage"
- the fault code (73)
- the number of minutes the pump has been connected to the power supply after the fault occurred, 8 min.

Warning log (only three-phase pumps)



In case of "warning" faults, the last five warning indications will appear in the warning log. "Warning log 1" shows the latest fault, "Warning log 2" shows the latest fault but one, etc.

The example above gives this information:

- the warning indication "Relubricate motor bearings"
- the fault code (240)
- the number of minutes the pump has been connected to the power supply since the fault occurred, 30 min.

9.2 Menu STATUS

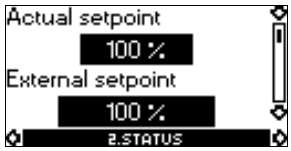
The displays appearing in this menu are status displays only. It is not possible to change or set values.

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.

9.2.1 Actual setpoint

Without sensor (uncontrolled)



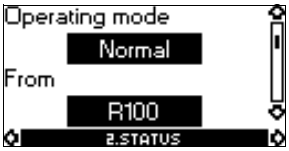
Tolerance: ± 2 %.

With pressure sensor (controlled)

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 *13. External setpoint signal*.

9.2.2 Operating mode



This display shows the actual operating mode:

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

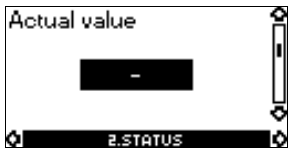
Furthermore, it shows where this operating mode was selected:

- R100
- Pump
- Bus
- External
- Stop function.

For further details about the stop function, see section *9.3.8 Stop function*.

9.2.3 Actual value

Without sensor (uncontrolled)



With pressure sensor (controlled)

This display shows the value actually measured by a connected sensor.

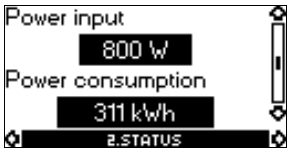
If no sensor is connected to the pump, "-" will appear in the display.

9.2.4 Speed

Tolerance: ± 5 %

The actual pump speed will appear in this display.

9.2.5 Power input 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.

9.2.6 Operating hours

Tolerance: ± 2 %

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

9.2.7 Lubrication status of motor bearings (only 11-22 kW)

This display shows how many times the motor bearings have been relubricated and when to replace the motor bearings.

When the motor bearings have been relubricated, confirm this action in the INSTALLATION menu.

See section *9.3.14 Confirming relubrication/replacement of motor bearings (only three-phase pumps)*. When relubrication is confirmed, the figure in the above display will be increased by one.

9.2.8 Time till relubrication of motor bearings (only 11-22 kW)

This display shows when to relubricate the motor bearings. The controller monitors the operating pattern of the pump and calculates the period between bearing relubrications. If the operating pattern changes, the calculated time till relubrication may change as well.

The displayable values are these:

- in 2 years
- in 1 year
- in 6 months
- in 3 months
- in 1 month
- in 1 week
- Now!

9.2.9 Time till replacement of motor bearings (only three-phase pumps)

When the motor bearings have been relubricated a prescribed number of times stored in the controller, the display in section *9.2.8 Time till relubrication of motor bearings (only 11-22 kW)* will be replaced by the display below.

This display shows when to replace the motor bearings. The controller monitors the operating pattern of the pump and calculates the period between bearing replacements.

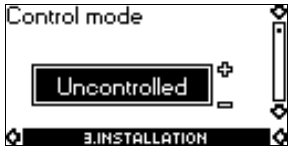
The displayable values are these:

- in 2 years
- in 1 year
- in 6 months
- in 3 months
- in 1 month
- in 1 week
- Now!

9.3 Menu INSTALLATION

9.3.1 Control mode

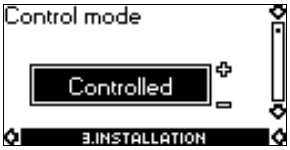
Without sensor (uncontrolled)



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

- Controlled
- Uncontrolled.

With pressure sensor (controlled)



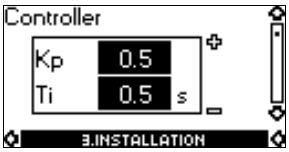
Select one of the following control modes (see fig. 16):

- Controlled
- Uncontrolled.

Note If the pump is connected to a bus, the control mode cannot be selected via the R100. See section *14. Bus signal*.

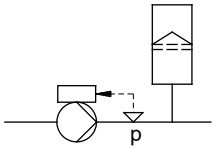
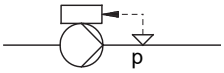
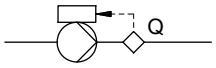
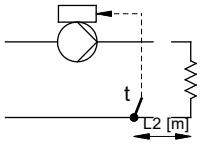
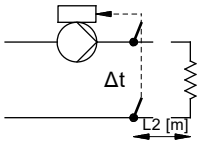
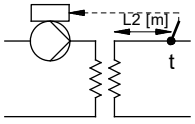
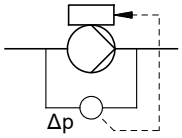
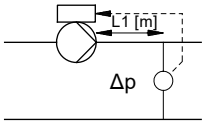
9.3.2 Controller

E-pumps have a factory default setting of gain (Kp) and integral time (Ti). However, if the factory setting is not the optimum setting, the gain and the integral time can be changed in the display below.



- The gain (Kp) can be set within the range from 0.1 to 20.
- The integral time (Ti) can be 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, meaning that if the setpoint is increased, the speed will be reduced. In the case of inverse control, the gain (Kp) must be set within the range from -0.1 to -20.

The table below shows the suggested controller settings:

System/application	Kp		Ti
	Heating system1)	Cooling system2)	
	**0.5**		**0.5**
	**0.1**		**0.5**
	**0.5**		**0.5**
	**0.5**	-0.5	10 + 5L2
	**0.5**		10 + 5L2
	**0.5**	-0.5	30 + 5L2
	**0.5**		**0.5**
	**0.5**		L1 less than 5 m: 0.5 L1 greater than 5 m: 3 L1 greater than 10 m: 5

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.

L1: distance in [m] between pump and sensor.

L2: distance in [m] between heat exchanger and sensor.

How to set the PI controller

For most applications, the factory setting of the controller constants Kp and Ti will ensure optimum pump operation. However, in some applications an adjustment of the controller may be needed.

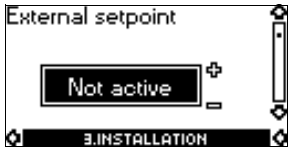
Proceed as follows:

1. Increase the gain (Kp) until the motor becomes unstable. Instability can be seen by observing if the measured value starts to fluctuate. Furthermore, instability is audible as the motor starts hunting up and down.
   Some systems, such as temperature controls, are slow-reacting, meaning that it may be several minutes before the motor becomes unstable.
2. Set the gain (Kp) to half of the value which made the motor unstable. This is the correct setting of the gain.
3. Reduce the integral time (Ti) until the motor becomes unstable.
4. Set the integral time (Ti) to twice the value which made the motor unstable. This is the correct setting of the integral time.

General rules of thumb:

- If the controller is too slow-reacting, increase Kp.
- If the controller is hunting or unstable, dampen the system by reducing Kp or increasing Ti.

9.3.3 External setpoint



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

Select one of the following types:

- 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.

If one of the signal types is selected, the actual setpoint is influenced by the signal connected to the external setpoint input. See section *13. External setpoint signal*.

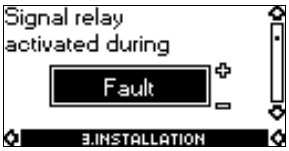
9.3.4 Signal relay

Pumps of 0.37 - 7.5 kW have one signal relay. The factory setting of the relay will be Fault.

Pumps of 11-22 kW have two signal relays. Signal relay 1 is factory set to Alarm and signal relay 2 to Warning.

In one of the displays below, select in which one of three or six operating situations the signal relay should be activated.

0.37 - 7.5 kW



- Ready
- Fault
- Operation
- Pump running (only three-phase pumps, 0.55 - 7.5 kW)
- Warning (only three-phase pumps, 0.55 - 7.5 kW).

11-22 kW

- Ready
- Alarm
- Operation
- Pump running
- Warning
- Relubricate.

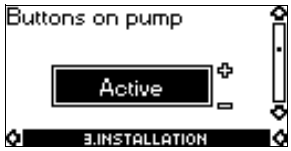
11-22 kW

- Ready
- Alarm
- Operation
- Pump running
- Warning
- Relubricate.

Note Fault and Alarm cover faults resulting in Alarm. Warning covers faults resulting in Warning. Relubricate covers only that one individual event. For distinction between alarm and warning, see section *9.1.3 Fault indications*.

For further information, see section *16. Indicator lights and signal relay*.

9.3.5 Buttons on pump

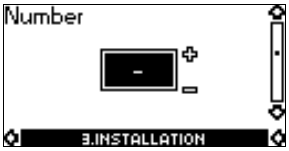


The operating buttons ⊛ and ⊛ on the control panel can be set to these values:

- Active
- Not active.

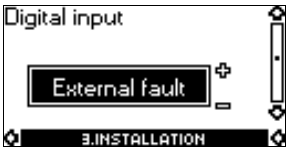
When set to Not active (locked), the buttons do not function. Set the buttons to Not active if the pump should be controlled via an external control system.

9.3.6 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.

9.3.7 Digital inputs



The digital inputs of the pump (terminal 1, fig. 5, 4 or 10) can be set to different functions.

Select one of the following functions:

- Min. (min. curve)
- Max. (max. curve)
- External fault
- Flow switch
- Dry running (from external sensor) (only three-phase pumps).

The selected function is activated by closing the contact between terminals 1 and 9, 1 and 10 or 1 and 11. See figures 5, 4 and 10.

See also section *12.2 Digital input*.

Min.

When the input is activated, the pump will operate according to the min. curve.

Max.

When the input is activated, the pump will operate according to the max. curve.

External fault

When the input is activated, a timer will be started. If the input is activated for more than 5 seconds, the pump will be stopped and a fault will be indicated. If the input is deactivated for more than 5 seconds, the fault condition will cease and the pump can only be restarted manually by resetting the fault indication.

Flow switch

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

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

If the input is activated for more than 5 seconds, the stop function incorporated in the pump will take over. See section *9.3.8 Stop function*.

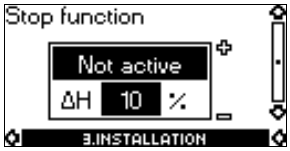
Dry running (only three-phase pumps)

When this function is selected, lack of inlet pressure or water shortage can be detected. This requires the use of an accessory, such as these:

- a Grundfos Liqtec® dry-running sensor
- a pressure switch installed on the suction side of a pump
- a float switch installed on the suction side of a pump.

When lack of inlet pressure or water shortage (Dry running) is detected, the pump will be stopped. The pump cannot restart as long as the input is activated.

9.3.8 Stop function



The stop function can be set to these values:

- Active
- Not active.

When the stop function is active, the pump will be stopped at very low flows. The causes are the following:

- avoid unnecessary heating of the pumped liquid
- reduce wear of the shaft seals
- reduce noise from operation.

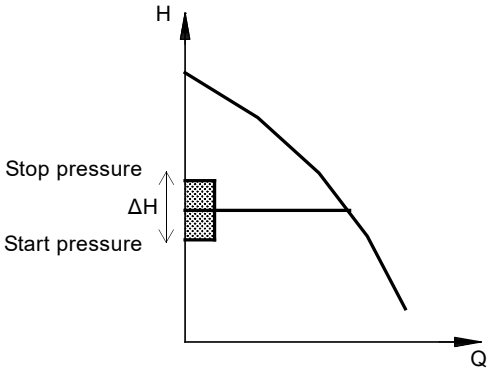


Fig. 24 Difference between start and stop pressures (ΔH)

ΔH is factory-set to 10 % of actual setpoint.

ΔH can be set within the range from 5 % to 30 % of actual setpoint.

Low flow can be detected in two different ways:

1. A built-in "low-flow detection function" which functions if the digital input is not set up for flow switch.
2. A flow switch connected to the digital input.

1. Low-flow detection function

The pump will check the flow regularly by reducing the speed for a short time. If there is no or only a small change in pressure, this means that there is low flow. The speed will be increased until the stop pressure (actual setpoint + 0.5 x ΔH) is reached and the pump will stop. When the pressure has fallen to the start pressure (actual setpoint - 0.5 x ΔH), the pump will restart.

When restarting, the pumps will react differently according to pump type:

Single-phase pumps

The pump will return to continuous operation at constant pressure and the pump will continue checking the flow regularly by reducing the speed for a short time.

Three-phase pumps

1. If the flow is higher than the low-flow limit, the pump will return to continuous operation at constant pressure.
2. If the flow is still lower than the low-flow limit, the pump will continue in start/stop operation. It will continue in start/stop operation until the flow is higher than the low-flow limit; when the flow is higher than the low-flow limit, the pump will return to continuous operation.

2. Flow switch

When the digital input is activated for more than 5 seconds because there is low flow, the speed will be increased until the stop pressure (actual setpoint + 0.5 x ΔH) is reached, and the pump will stop. When the pressure has fallen to start pressure, the pump will start again. If there is still no flow, the pump will quickly reach stop pressure and stop. If there is flow, the pump will continue operating according to the setpoint.

Operating conditions for the stop function

It is only possible to use the stop function if the system incorporates a pressure sensor, a non-return valve and a diaphragm tank.

Caution The non-return valve must always be installed before the pressure sensor. See figures 25 and 26.

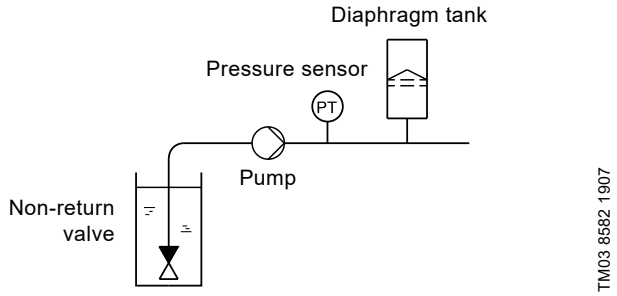


Fig. 25 Position of the non-return valve and pressure sensor in system with suction lift operation

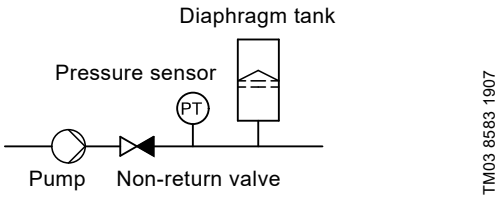


Fig. 26 Position of the non-return valve and pressure sensor in system with positive inlet pressure

Diaphragm tank

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:

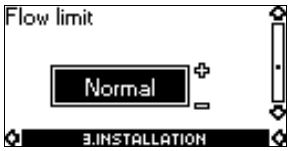
Rated flow rate of pump [m^3/h]	CRE pump	Typical diaphragm tank size [litres]
0-6	1s, 1, 3, 5	8
7-24	10, 15, 20	18
25-40	32	50
41-70	45, 64	120
71-100	90	180

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.

9.3.9 Flow limit for the stop function (only three-phase pumps)

Note: Flow limit for the stop function only works if the system is not set up for flow switch.



In order to set at which flow rate the system is to go from continuous operation at constant pressure to start/stop operation, select among these four values of which three are preconfigured flow limits:

- Low
- Normal
- High
- Custom.

The default setting of the pump is Normal, representing approx. 10 % of the rated flow rate of the pump.

If a lower flow limit than Normal is desired or the tank size is smaller than recommended, select Low.

If a higher flow than Normal is wanted or a large tank is used, set the limit to High.

The value Custom can be seen in R100 but it can only be set by means of the PC Tool E-products. Custom is for customised setup and optimising to the process.

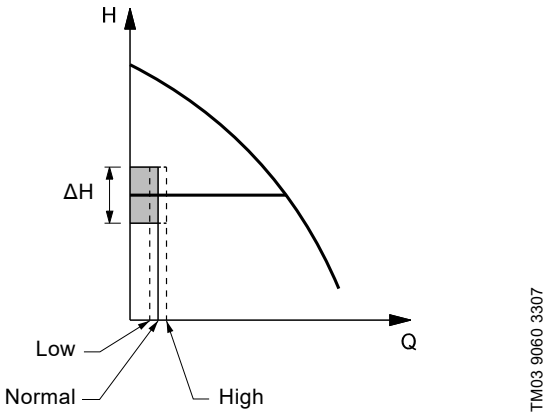
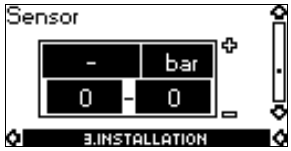


Fig. 27 Three preconfigured flow limits, Low, Normal and High

9.3.10 Sensor

Without sensor (uncontrolled)



With pressure sensor (controlled)

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

Select among the following values:

- Sensor output signal
  0-10 V
  0-20 mA
  4-20 mA,
- Unit of measurement of sensor:
  bar, mbar, m, kPa, psi, ft, m^3/h, m^3/s, l/s, gpm, °C, °F, %
- Sensor measuring range.

9.3.11 Duty/standby (only three-phase pumps)

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

The duty/standby function can be set to these values:

- Active
- Not active.

When the function is set to Active, the following applies:

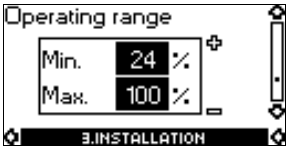
- Only one pump is running at a time.
- The stopped pump (standby) will automatically be cut in if the running pump (duty) has a fault. A fault will be indicated.
- Changeover between the duty pump and the standby pump will take place every 24 hours.

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.

9.3.12 Operating range



How to set the operating range:

- Set the min. curve within the range from max. curve to 12 % of maximum performance. The pump is factory-set to 24 % of maximum performance.
- Set the max. curve within the range from maximum performance (100 %) to min. curve.

The area between the min. and max. curves is the operating range.

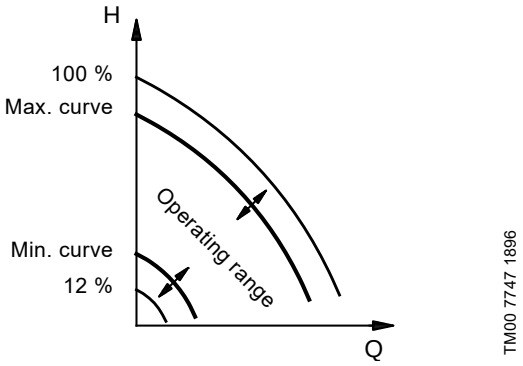


Fig. 28 Setting of the min. and max. curves in % of maximum performance

9.3.13 Motor bearing monitoring (only three-phase pumps)

The motor bearing monitoring function can be set to these values:

- Active
- Not active.

When the function is set to Active, a counter in the controller will start counting the mileage of the bearings. See section *9.2.7 Lubrication status of motor bearings (only 11-22 kW)*.

Note

The counter will continue counting even if the function is switched to Not active, but a warning will not be given when it is time for relubrication.

When the function is switched to Active again, the accumulated mileage will again be used to calculate the relubrication time.

9.3.14 Confirming relubrication/replacement of motor bearings (only three-phase pumps)

This function can be set to these values:

- Relubricated (only 11-22 kW)
- Replaced
- Nothing done.

When the bearing monitoring function is Active, the controller will give a warning indication when the motor bearings are due to be relubricated or replaced. See section *9.1.3 Fault indications*.

When the motor bearings have been relubricated or replaced, confirm this action in the above display by pressing "OK".

Note

Relubricated cannot be selected for a period of time after confirming relubrication.

9.3.15 Standstill heating (only three-phase pumps)

The standstill heating function can be set to these values:

- Active
- Not active.

When the function is set to Active, an AC voltage will be applied to the motor windings. The applied voltage will ensure that sufficient heat is generated to avoid condensation in the motor.

10. Setting by means of PC Tool E-products

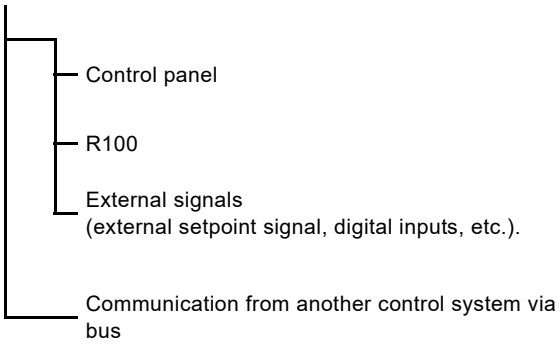
Special setup requirements differing from the settings available via the R100 require the use of Grundfos PC Tool E-products. This again requires the assistance of a Grundfos service technician or engineer. Contact your local Grundfos company for more information.

11. Priority of settings

The priority of settings depends on two factors:

1. control source
2. settings.

1. Control source



2. Settings

- Operating mode Stop
- Operating mode Max. (Max. curve)
- Operating mode Min. (Min. curve)
- Setpoint setting.

An E-pump can be controlled by different control sources at the same time, and each of these sources can be set differently. Consequently, it is necessary to set an order of priority of the control sources and the settings.

Note

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

Priority of settings without bus communication

Priority	Control panel or R100	External signals
1	Stop	
2	Max.	
3		Stop
4		Max.
5	Min.	Min.
6	Setpoint setting	Setpoint setting

Example

If the E-pump has been set to operating mode Max. (Max. frequency) via an external signal, such as digital input, the control panel or R100 can only set the E-pump to operating mode Stop.

Priority of settings with bus communication

Priority	Control panel or R100	External signals	Bus communication
1	Stop		
2	Max.		
3		Stop	Stop
4			Max.
5			Min.
6			Setpoint setting

Example

If the E-pump is operating according to a setpoint set via bus communication, the control panel or R100 can set the E-pump to operating mode Stop or Max., and the external signal can only set the E-pump to operating mode Stop.

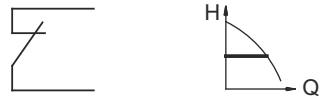
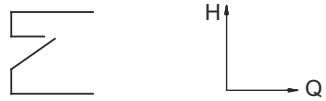
12. External forced-control signals

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

- Start/stop of pump
- Digital function.

12.1 Start/stop input

Functional diagram: Start/stop input:

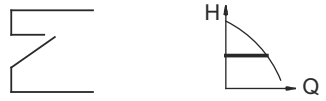
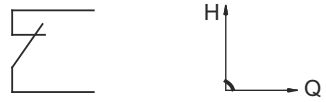
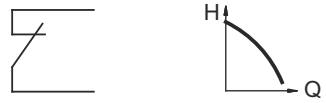
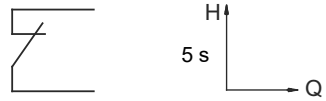
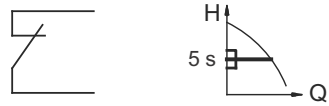
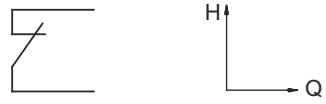
Start/stop (terminals 2 and 3)	
	**Normal duty**
	**Stop**

12.2 Digital input

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

- Normal duty
- Min. curve
- Max. curve
- External fault
- Flow switch
- Dry running.

Functional diagram: Input for digital function

Digital function (terminals 1 and 9)	
	**Normal duty**
	**Min. curve**
	**Max. curve**
	**External fault**
	**Flow switch**
	**Dry running**

13. External setpoint signal

The setpoint can be remote-set by connecting an analogue signal transmitter to the input for the setpoint signal (terminal 4).

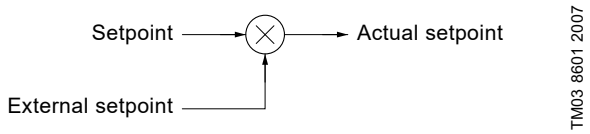


Fig. 29 Actual setpoint as a product (multiplied value) of setpoint and external setpoint

Select the actual external signal, 0-10 V, 0-20 mA, 4-20 mA, via the R100. See section *9.3.3 External setpoint*.

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

In control mode controlled, 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.

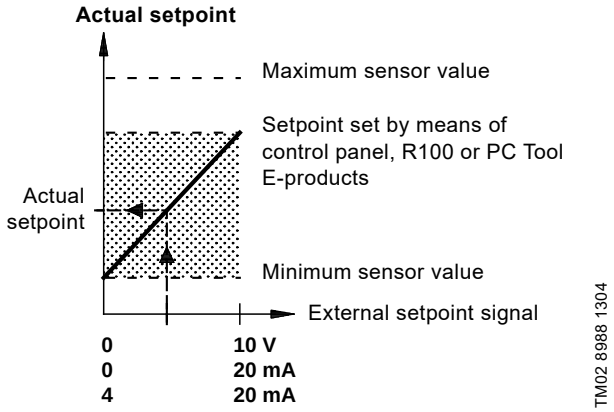


Fig. 30 Relation between the actual setpoint and the external setpoint signal in control mode controlled

Example

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

Actual setpoint = (setpoint - minimum sensor value) x % external setpoint + minimum sensor value
= (3 - 0) x 80 % + 0
= 2.4 bar

In control mode uncontrolled, 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.

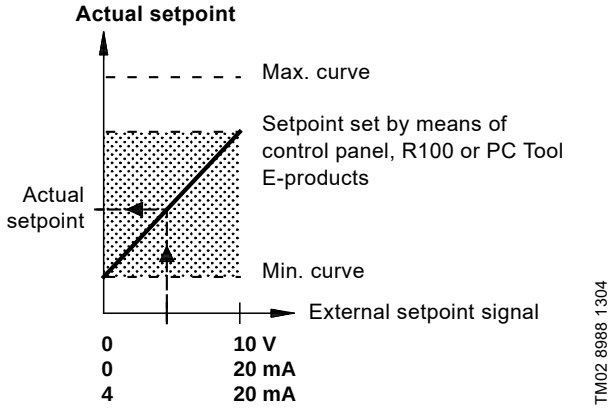


Fig. 31 Relation between the actual setpoint and the external setpoint signal in control mode uncontrolled

14. Bus signal

The pump supports 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.

Operating parameters, such as setpoint, operating mode, etc. can be remote-set via the bus signal. At the same time, the pump can provide status information about important parameters, such as 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.

15. Other bus standards

Grundfos offers various bus solutions with communication according to other standards.

Contact Grundfos for further details.

16. Indicator lights and signal relay

The operating condition of the pump is indicated by the green and red indicator lights fitted on the pump control panel and inside the terminal box. See figures 32 and 33.

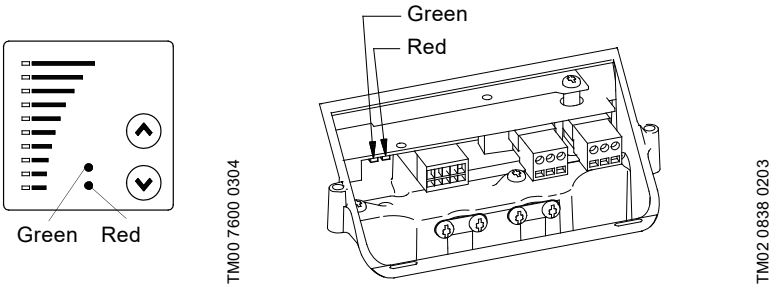


Fig. 32 Position of indicator lights on single-phase pumps

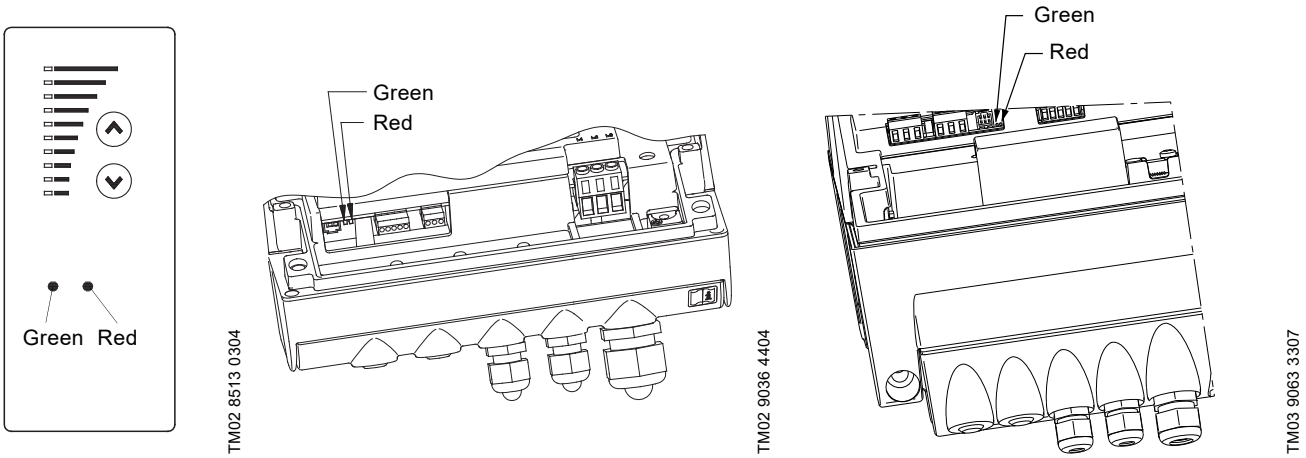
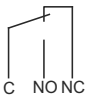


Fig. 33 Position of indicator lights on three-phase pumps

Besides, the pump incorporates an output for a potential-free signal via an internal relay.

For signal relay output values, see section *9.3.4 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:				Description
Fault (red)	Operation (green)	Fault/Alarm, Warning and Relubricate	Operating	Ready	Pump running	
Off	Off					The power supply has been switched off.
Off	Permanently on					The pump is operating.
Off	Permanently on					The pump is stopped by the stop function.
Off	Flashing					The pump has been set to stop.
Permanently on	Off					The pump has stopped because of a Fault/Alarm or is running with a Warning or Relubricate indication. If the pump was stopped, 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 or has had a Fault/Alarm allowing the pump to continue operation or it is operating with a Warning or Relubricate indication. 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.

Resetting of fault indication

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

- Briefly press 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.
- Switch off the power supply until the indicator lights are off.
- Switch the external start/stop input off and then on again.
- Use the R100. See section *9.1.3 Fault indications*.

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

17. Insulation resistance

0.37 - 7.5 kW

Caution

Do not measure the insulation resistance of motor windings or an installation incorporating E-pumps using high voltage megging equipment, as this may damage the built-in electronics.

11-22 kW

Caution

Do not measure the insulation resistance of an installation incorporating E-pumps using high voltage megging equipment, as this may damage the built-in electronics.

The motor conductors can be disconnected separately and the insulation resistance of the motor windings can be tested.

18. Emergency operation (only 11-22 kW)

Warning

Never make any connections in the pump terminal box unless all electric supply circuits have been switched off for at least 5 minutes.

Note for instance that the signal relay may be connected to an external supply which is still connected when the mains supply is disconnected.

If the pump is stopped and you cannot start the pump immediately after normal remedies, the reason could be a faulty frequency converter. If this is the case it is possible to maintain emergency operation of the pump.

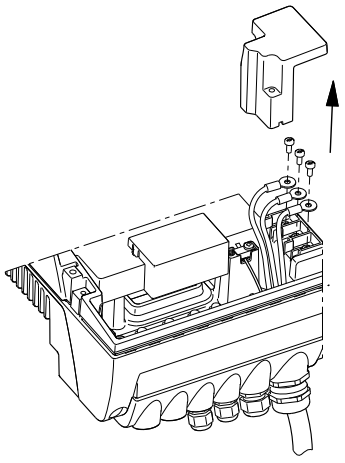
Before change over to emergency operation we recommend you to:

- Check that the mains supply is OK.
- Check that control signals are working (start/stop signals).
- Check that all alarms are reset.
- Make a resistance test on the motor windings (disconnect the motor conductors from the terminal box).

If the pump remains stopped it is possible that the frequency converter is faulty.

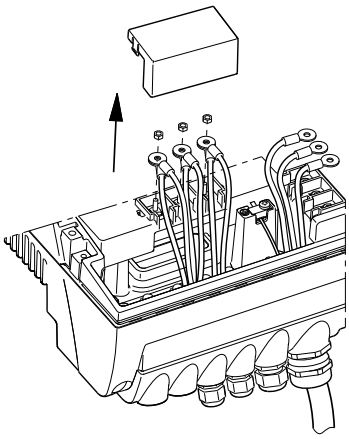
To establish emergency operation proceed as follows:

1. Disconnect the three mains conductors, L1, L2, L3, from the terminal box, but leave the protective earth conductor(s) in position on the PE terminal(s).



TM03 8607 2007

2. Disconnect the motor supply conductors, U/W1, V/U1, W/V1, from the terminal box.



TM03 9120 3407

3. Connect the conductors as shown in fig. 34.

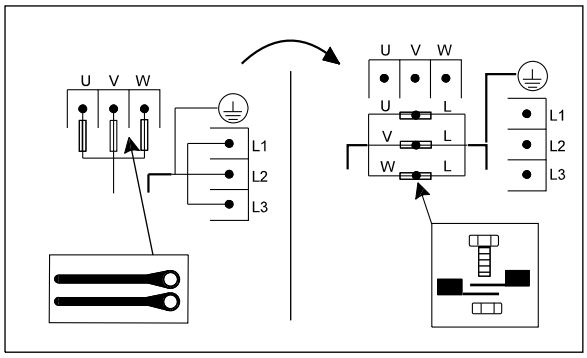


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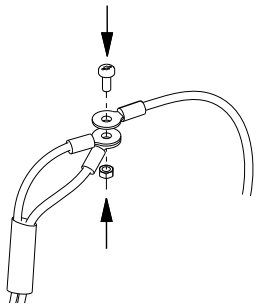
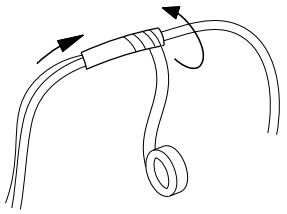
Fig. 34 How to switch an E-pump from normal operation to emergency operation

Use the screws from the mains terminals and the nuts from the motor terminals.



TM03 9121 3407

4. Insulate the three conductors from each other by means of insulating tape or the like.



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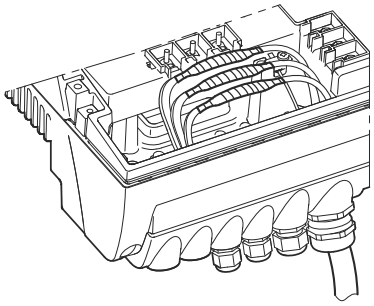


TM03 9123 3407

Warning

Do not bypass the frequency converter by connecting the mains conductors to the U, V and W terminals.

This may cause hazardous situations for personnel as the high voltage potential of the mains may be transferred to touchable components in the terminal box.

Caution Check the direction of rotation when starting up after switching to emergency operation.

19. Maintenance and service

19.1 Cleaning of the motor

Keep the motor cooling fins and fan blades clean to ensure sufficient cooling of the motor and electronics.

19.2 Relubrication of motor bearings

1.1 - 7.5 kW pumps

The motor bearings are of the closed type and greased for life. The bearings cannot be relubricated.

11-22 kW pumps

The motor bearings are of the open type and must be relubricated regularly.

The motor bearings are prelubricated on delivery. The built-in bearing monitoring function will give a warning indication on the R100 when the motor bearings are due to be relubricated.

Note Before relubrication, remove the bottom plug in the motor flange and the plug in the bearing cover to ensure that old and excess grease can escape.

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

Frame size	Quantity of grease [ml]	
	Drive end	Non-drive end
MGE 160	13	13
MGE 180	15	15

The recommended grease type is a polycarbamide-based lubricating grease.

19.3 Replacement of motor bearings

11-22 kW motors have built-in bearing monitoring function which will give a warning indication on the R100 when the motor bearings are due to be replaced.

19.4 Replacement of varistor (only 11-22 kW)

The varistor protects the pump against mains voltage transients. If voltage transients occur, the varistor will be worn over time and need to be replaced. The more transients, the more quickly the varistor will be worn. When it is time to replace the varistor, R100 and PC Tool E-products will indicate this as a warning.

A Grundfos technician is required for replacement of the varistor. Contact your local Grundfos company for assistance.

19.5 Service parts and service kits

For further information on service parts and service kits, visit www.grundfos.com, select country, select WebCAPS.

20. Technical data - three-phase pumps, 1.1 - 7.5 kW

20.1 Supply voltage

3 x 380-480 V - 10 %/+ 10 %, 50/60 Hz - 2 %/+ 2 %, PE.

Cable: Max 10 mm^2 / 8 AWG.

Use min. 70 °C copper conductors only.

Recommended fuse sizes

Motor sizes from 1.1 to 5.5 kW: Max. 16 A.

Motor size 7.5 kW: Max. 32 A.

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

20.2 Overload protection

The overload protection of the E-motor has the same characteristic as an ordinary motor protector. As an example, the E-motor can stand an overload of 110 % of Inom for 1 min.

20.3 Leakage current

Motor size [kW]	Leakage current [mA]
1.1 to 3.0 (supply voltage less than 460 V)	less than 3.5
1.1 to 3.0 (supply voltage greater than 460 V)	less than 5
4.0 - 5.5	less than 5
7.5	less than 10

The leakage currents are measured in accordance with EN 61800-5-1.

20.4 Inputs/output

Start/stop

External potential-free contact.

Voltage: 5 VDC.

Current: less than 5 mA.

Screened cable: 0.5 - 1.5 mm^2 / 28-16 AWG.

Digital

External potential-free contact.

Voltage: 5 VDC.

Current: less than 5 mA.

Screened cable: 0.5 - 1.5 mm^2 / 28-16 AWG.

Setpoint signals

- Potentiometer
  0-10 VDC, 10 kΩ (via internal voltage supply).
  Screened cable: 0.5 - 1.5 mm^2 / 28-16 AWG.
  Maximum cable length: 100 m.
- Voltage signal
  0-10 VDC, Ri greater than 50 kΩ.
  Tolerance: + 0 %/- 3 % at maximum voltage signal.
  Screened cable: 0.5 - 1.5 mm^2 / 28-16 AWG.
  Maximum cable length: 500 m.
- Current signal
  DC 0-20 mA / 4-20 mA, Ri equal to 175 Ω.
  Tolerance: + 0 %/- 3 % at maximum current signal.
  Screened cable: 0.5 - 1.5 mm^2 / 28-16 AWG.
  Maximum cable length: 500 m.

Sensor signals

- Voltage signal
  0-10 VDC, Ri greater than 50 kΩ (via internal voltage supply).
  Tolerance: + 0 %/- 3 % at maximum voltage signal.
  Screened cable: 0.5 - 1.5 mm^2 / 28-16 AWG.
  Maximum cable length: 500 m.
- Current signal
  DC 0-20 mA / 4-20 mA, Ri equal to 175 Ω.
  Tolerance: + 0 %/- 3 % at maximum current signal.
  Screened cable: 0.5 - 1.5 mm^2 / 28-16 AWG.
  Maximum cable length: 500 m.

Internal power supplies

- 10 V power supply for external potentiometer:
  Max. load: 2.5 mA.
  Short-circuit-protected.
- 24 V power supply for sensors:
  Max. load: 40 mA.
  Short-circuit-protected.

Signal relay output

Potential-free changeover contact.

Maximum contact load: 250 VAC, 2 A, cos φ 0.3 - 1.

Minimum contact load: 5 VDC, 10 mA.

Screened cable: 0.5 - 2.5 mm^2 / 28-12 AWG.

Maximum cable length: 500 m.

Bus input

Grundfos bus protocol, GENIbus protocol, RS-485.

Screened 3-core cable: 0.2 - 1.5 mm^2 / 28-16 AWG.

Maximum cable length: 500 m.

21. Technical data - three-phase pumps, 11-22 kW

21.1 Supply voltage

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

Cable: Max. 10 mm^2 / 8 AWG.

Use min. 70 °C copper conductors only.

Recommended fuse sizes

Motor size [kW]	Max. [A]
11	32
15	36
18.5	43
22	51

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

21.2 Overload protection

The overload protection of the E-motor has the same characteristic as an ordinary motor protector. As an example, the E-motor can stand an overload of 110 % of Inom for 1 min.

21.3 Leakage current

Earth leakage current greater than 10 mA.

The leakage currents are measured in accordance with EN 61800-5-1.

21.4 Inputs/output

Start/stop

External potential-free contact.

Voltage: 5 VDC.

Current: less than 5 mA.

Screened cable: 0.5 - 1.5 mm^2 / 28-16 AWG.

Digital

External potential-free contact.

Voltage: 5 VDC.

Current: less than 5 mA.

Screened cable: 0.5 - 1.5 mm^2 / 28-16 AWG.

Setpoint signals

- Potentiometer
  0-10 VDC, 10 kΩ (via internal voltage supply).
  Screened cable: 0.5 - 1.5 mm^2 / 28-16 AWG.
  Maximum cable length: 100 m.
- Voltage signal
  0-10 VDC, Ri greater than 50 kΩ.
  Tolerance: + 0 %/- 3 % at maximum voltage signal.
  Screened cable: 0.5 - 1.5 mm^2 / 28-16 AWG.
  Maximum cable length: 500 m.
- Current signal
  DC 0-20 mA / 4-20 mA, Ri equal to 250 Ω.
  Tolerance: + 0 %/- 3 % at maximum current signal.
  Screened cable: 0.5 - 1.5 mm^2 / 28-16 AWG.
  Maximum cable length: 500 m.

Sensor signals

- Voltage signal
  0-10 VDC, Ri greater than 50 kΩ (via internal voltage supply).
  Tolerance: + 0 %/- 3 % at maximum voltage signal.
  Screened cable: 0.5 - 1.5 mm^2 / 28-16 AWG.
  Maximum cable length: 500 m.
- Current signal
  DC 0-20 mA / 4-20 mA, Ri equal to 250 Ω.
  Tolerance: + 0 %/- 3 % at maximum current signal.
  Screened cable: 0.5 - 1.5 mm^2 / 28-16 AWG.
  Maximum cable length: 500 m.

Internal power supplies

- 10 V power supply for external potentiometer:
  Max. load: 2.5 mA.
  Short-circuit-protected.
- 24 V power supply for sensors:
  Max. load: 40 mA.
  Short-circuit-protected.

Signal relay output

Potential-free changeover contact.

Maximum contact load: 250 VAC, 2 A, cos φ 0.3 - 1.

Minimum contact load: 5 VDC, 10 mA.

Screened cable: 0.5 - 2.5 mm^2 / 28-12 AWG.

Maximum cable length: 500 m.

Bus input

Grundfos bus protocol, GENIbus protocol, RS-485.

Screened 3-core cable: 0.2 - 1.5 mm^2 / 28-16 AWG.

Maximum cable length: 500 m.

21.5 Other technical data

EMC (electromagnetic compatibility to EN 61800-3)

<table>
<tr><th>Motor [kW]</th><th>Emission/immunity</th></tr>
<tr><td>1.1
1.5
2.2
3.0
4.0
5.5
7.5</td><td>Emission:
The motors may be installed in residential areas (first environment), unrestricted distribution, corresponding to CISPR11, group 1, class B.

Immunity:
The motors fulfil the requirements for both the first and second environment.</td></tr>
<tr><td>11
15
18.5
22</td><td>Emission:
The motors are category C3, corresponding to CISPR11, group 2, class A, and may be installed in industrial areas (second environment).
If equipped with an external Grundfos EMC filter, the motors are category C2, corresponding to CISPR11, group 1, class A, and may be installed in residential areas (first environment).

 
Warning
When the motors are installed in residential areas, supplementary measures may be required as the motors may cause radio interference.

Motor sizes 11, 18.5 and 22 kW comply with EN 61000-3-12 provided that the short-circuit power at the interface point between the user's electrical installation and the public power supply network is greater than or equal to the values stated below. It is the responsibility of the installer or user to ensure, by consultation with the power supply network operator, if necessary, that the motor is connected to a power supply with a short-circuit power greater than or equal to these values:

<table><tr><th>Motor size [kW]</th><th>Short-circuit power [kVA]</th></tr><tr><td>11</td><td>1500</td></tr><tr><td>15</td><td>-</td></tr><tr><td>18.5</td><td>2700</td></tr><tr><td>22</td><td>3000</td></tr></table>
Note 15 kW motors do not comply with EN 61000-3-12.

By installing an appropriate harmonic filter between the motor and the power supply, the harmonic current content will be reduced. In this way, the 15 kW motor will comply with EN 61000-3-12.
Immunity:
The motors fulfil the requirements for both the first and second environment.</td></tr>
</table>

Contact Grundfos for further information.

Enclosure class

- Three-phase pumps, 1.1 - 7.5 kW: IP55 (IEC 34-5).
- Three-phase pumps, 11-22 kW: IP55 (IEC 34-5).

Insulation class

F (IEC 85).

Ambient temperature

During operation:

- Min. -20 °C
- Max. +40 °C without derating.

During storage/transport:

- -30 to +60 °C (0.37 - 7.5 kW)
- -25 to +70 °C (11-22 kW).

Relative air humidity

Maximum 95 %.

Sound pressure level

Three-phase pumps

Motor [kW]	Speed stated on nameplate [min^{-1}]	Sound pressure level [dB(A)]
1.1	2800-3000	60
	3400-3600	65
1.5	2800-3000	65
	3400-3600	70
2.2	2800-3000	65
	3400-3600	70
3.0	2800-3000	65
	3400-3600	70
4.0	2800-3000	70
	3400-3600	75
5.5	2800-3000	75
	3400-3600	80
7.5	2800-3000	65
	3400-3600	69
11	2800-3000	63
	3400-3600	68
15	2800-3000	64
	3400-3600	68
18.5	2800-3000	66
	3400-3600	70
22	2800-3000	66
	3400-3600	70

22. 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.

翻译原来的英文版

目录

警告

装机前，先仔细阅读本安装操作手册。安装和运行必须遵守当地规章制度并符合公认的良好操作习惯。

1. 本文献中所用符号

警告

如果不遵守这些安全指导会导致人身伤害!

警告

该产品的表面十分灼热可以引起烫伤或其它人身伤害。

小心 不遵守这些指导可能会造成设备故障或设备损坏。

注意 遵守注意事项或使用说明可以简化作业并可保证操作安全。

2. 概述

本安装与操作指导手册是对CR、CRI、CRN、CRT、SPK、MTR、CM和BMS hp型水泵安装与操作指导的对应补充。

对于补充手册中未作说明的指导，请参阅标准泵型的安装与操作指导手册。

3. 概述

格兰富E-泵配置带整合变频器的标准电机。这些泵型适用于三相工频连接。

3.1 出厂时未装传感器的泵

此型泵配置一个内置型PI控制器，可使用外部传感器设置实现对下列参数的控制:

- 压力
- 压差
- 温度
- 温差
- 流量。

该泵型在出厂时已经设置成非受控模式。PI传感器可以通过R100或格兰富GO Remote激活。

3.2 配备压力传感器的泵

此型泵配置一个内置型PI控制器，可通过压力传感器设置实现对水泵排出压力的控制。

该泵型已设置成受控模式。典型说来，该泵能够为那些需求量可变的系统提供恒定压力。

3.3 设置

对于设置的说明同时适用于出厂时未装传感器的泵型和出厂时已装传感器的泵型两者。

设定值

所需设定值可通过三种不同方法设置:

- 直接在泵的控制面板上设置
- 通过一个外部设置点信号输入
- 通过格兰富无线远程控制器R100或格兰富GO Remote进行设置。

其他设置

所有其他设置均可通过R100或格兰富GO Remote完成。

诸如控制参数的实际值、功率消耗之类的重要参数可以通过R100或格兰富Go Remote读出。

如果要求特殊设置或客户个体化设置，请使用Grundfos PC Tool E-products （格兰富PC工具E-产品）。详细信息请与用户当地的格兰富公司联系。

4. 机械安装

该泵必须通过在法兰或基板上钻孔并用螺栓将泵固定在一个坚固基础上的方法来固定。

注意 为遵守 UL/cUL ，请按照第56页上的附加安装程序操作。

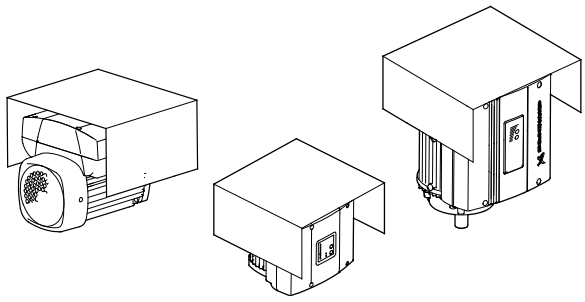
4.1 电机冷却

为确保电机和电子设备的充分冷却，请遵守以下要求:

- 确保充足的冷空气循环。
- 保持冷空气的温度在40 °C以下。
- 保持散热片和风扇叶片清洁。

4.2 室外安装

需要室外安装时，必须为泵提供合适的防护罩，以免电子元件上冷凝形成。见图1。



TM00 8622 0101 - TM02 8514 0304

图 1 防护罩举例

拆去朝向下方的放水螺塞以免电机内部潮湿或水气聚集。

竖立安装的水泵在放水螺塞打开后为IP55。水平安装泵的防护等级改到IP54。

5. 电气连接

对于如何进行E-泵的电气连接，请参见以下页数

5.1 三相泵，1.1 - 7.5 kW，第31页

5.2 三相泵, 11-22 kW，第34页。

5.1 三相泵，1.1 - 7.5 kW

警告

用户或安装人员负责根据所在国和当地标准正确安装接地和防护。所有操作必须由符合资质的电工进行。

警告

电源电路关闭至少5分钟后，才能连接泵接线盒。

请注意，信号继电器可能连接到一个外部开关，因此在工频电源切断后继电器仍可能有电。

以上警告以此黄色标签显示在电机接线盒盖上:

5.1.1 准备工作

在将E-泵连接到工频电源上之前，请先考虑下图所示事项。

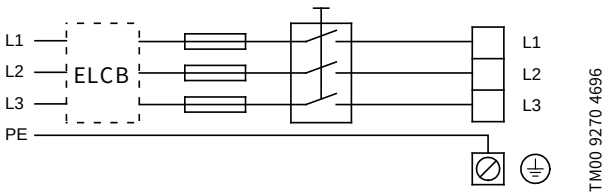


图 2 连接工频电源的泵，配置主开关、备用保险丝、附加保护和保护性接地

5.1.2 防止触电 - 间接接触

警告

泵必须按照国家法规接地。

4 - 7.5 kW电机的泄漏电流为> 3.5 mA，因此在接地操作时需要特别小心。

EN 50178和BS 7671标准对> 3.5 mA 泄漏电流作出以下特别规定:

- 水泵必须为固定的永久安装。
- 水泵必须与电源永久连接。
- 地线连接必须使用双重导线。

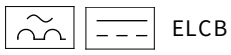
保护性接地导体必须一直有黄/绿 （PE）或黄/绿/蓝 （PEN）颜色标记。

5.1.3 备用保险丝

对于保险丝型号，请见章节*20.1 电源电压*。

5.1.4 附加保护

如果在水泵所连接的系统中使用了漏地断路器 （ELCB）作为附加保护措施，则该断路器必须是一个标有以下标签的型号:



该断路器为B型。

安装中所有电气设备的全部泄漏电流均应被考虑在内。

正常运行时电机的泄漏电流请见章节*20.3 漏电电流*。

启动时间内以及在非对称供电系统内的泄漏电流可以高出正常情况下的泄漏电流而致使ELCB跳闸。

5.1.5 电机保护

该泵不需要外部电机保护。电机配备热防护装置，避免慢速超载与阻塞 （IEC 34-11，TP211）。

5.1.6 工频电压瞬变保护

该泵有一个内置的压敏电阻，可以针对相与相之间以及相与地之间的瞬变电压为泵提供保护。

5.1.7 电源电压与工频电源

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

供电电压和供电频率在水泵铭牌上标明。请务必保证水泵与安装现场电源之间的适用性。

接线盒中的线路必须尽可能短。其中保护性地线例外。接地导线应该足够长，使得在电缆被意外地从电缆引入装置拉出时，接地导线最后断开。

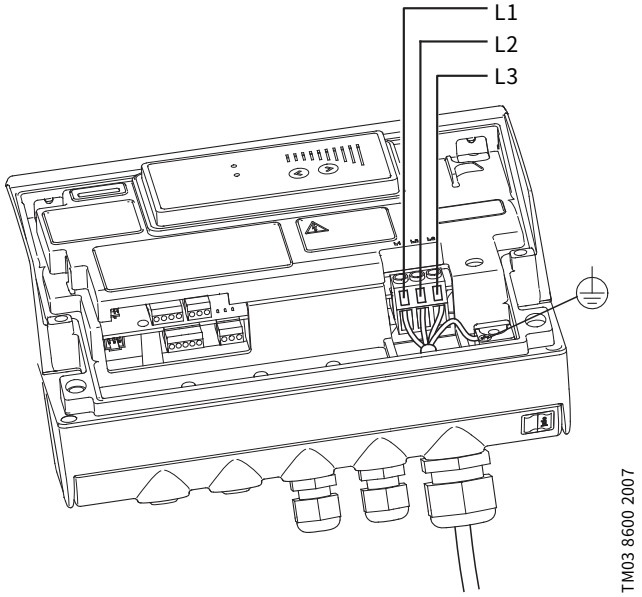


图 3 工频连接

电缆接头

电缆接头符合EN 50626标准。

- 2 x M16电缆接头, 电缆直径∅4-∅10
- 1 x M20电缆接头, 电缆直径∅9-∅17
- 2 x M16脱落式电缆引入。

警告

如果电源电缆发生损坏，必须由有资质的工作人员进行更换。

电网类型

三相E-泵可以连接到所有类型的电网。

警告

不可将三相E-泵连接到相与地之间电压超过440 V的工频电源上。

5.1.8 泵的启动/停止次数

小心 通过工频电压启动和停止水泵的次数不得超过每小时4次。

通过工频电源启动水泵时，泵会在大约5秒钟时间后启动。

如果需要增加每小时启动和停止次数，请使用外部启动/停止功能来启动和停止水泵。

使用外部启动/停止功能启动水泵时，水泵会立即启动。

自动重新启动

注意 如果设置到自动重新启动的泵因故障而停机，该泵会在故障排除后自动重新启动。

但是，自动重新启动功能只能用于设置到自动启动功能的故障类型。这些故障通常可以是以下类型之一:

- 暂时过载
- 电源故障。

5.1.9 连接高级I/O模块

作为标准，CRE、CRIE、CRNE、CRTE、SPKE、MTRE、BMS hp型泵配备了高级I/O模块。可选的泵类型可与基础泵I/O模块一起购买见 *5.1.10 连接泵基础I/O模块*。

高级I/O模块

该模块拥有大量输入和输出接口，可让电机用于需要较多输入和输出的高级应用中。

高级I/O模块具有以下连接：

- 启动/停止端子
- 三个数字输入
- 一个设定值输出
- 一个传感器输入
- 一个模拟输出
- GENIbus连接。

注意 如果未连接外部开/关转换，则用一根短线连接端子2和3。

作为预防措施，连接到以下连接组的接线必须全程以加强绝缘相互分隔:

1组: 输入信号

- 启动/停止 （端子2和3）
- 数字输入 （端子1和9、10和9、11和9）
- 设定值输入 （端子4、5和6）
- 传感器输入 （端子7和8）
- GENIbus （端子B、Y和A）。

所有输入均与连接到工频电源的部件以加强绝缘相互分隔，而且与其他电路电流分离。

所有控制端子均配有保护性超低电压 （PELV），以确保防止触电。

2组: 输出 （继电器信号, 端子NC, C, NO）

输出与其他电路电流分离。

因此，电源电压或保护性超低电压可以任意连接到输出上。

- 模拟输出 （端子12和13）。

3组: 电源 （端子L1、L2、L3）

电流分离必须符合EN 60335标准中对加强绝缘所作的规定，包括爬电距离以及间隔距离。

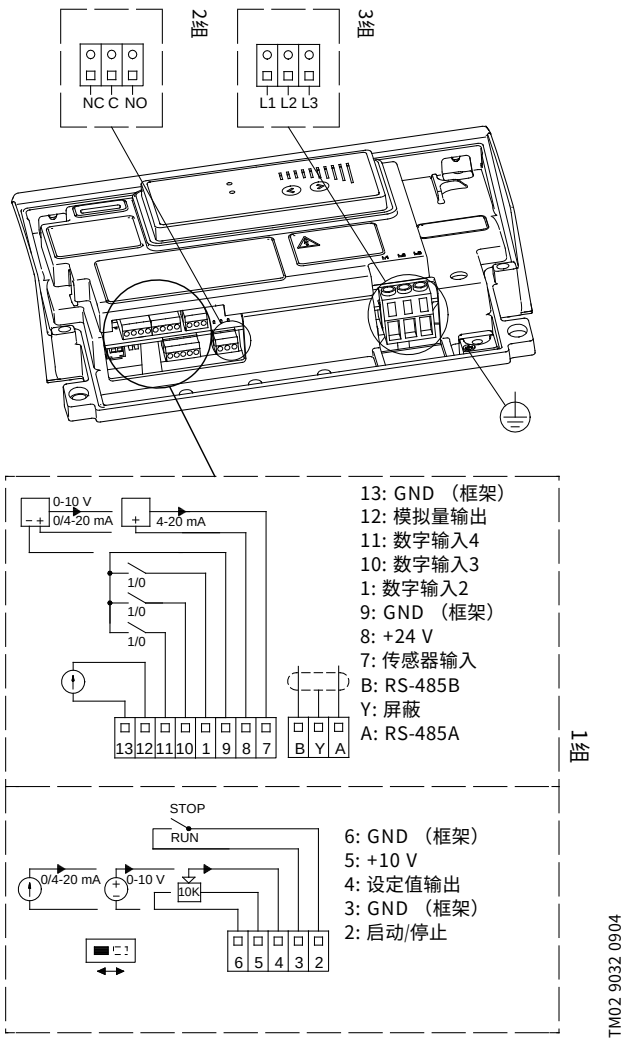


图 4 连接端子高级I/O模块

5.1.10 连接泵基础I/O模块

作为标准，CME泵配备了基础泵I/O模块。可选的泵类型可与高级I/O模块一起购买 见 *5.1.9 连接高级I/O模块*。

注意 如果未连接外部开/关转换，则用一根短线连接端子2和3。

作为预防措施，连接到以下连接组的接线必须全程以加强绝缘相互分隔:

1组: 输入信号

- 启动/停止　　端子2和3
- 数字输入　　端子1和9
- 设定值输入　　端子4, 5和6
- 传感器输入　　端子7和8
- GENIbus　　端子B, Y和A

所有输入 （1组）均与连接到工频电源的部件以加强绝缘相互分隔，而且与其他电路电流分离。

所有控制端子均配有保护性超低电压 （PELV），以确保防止触电。

2组: 输出 （继电器信号, 端子NC, C, NO）

输出 （2组）与其他电路电流分离。因此，电源电压或保护性超低电压可以任意连接到输出上。

3组: 工频电源 （端子N, PE, L）

电流分离必须符合EN 60335标准中对加强绝缘所作的规定，包括爬电距离以及间隔距离。

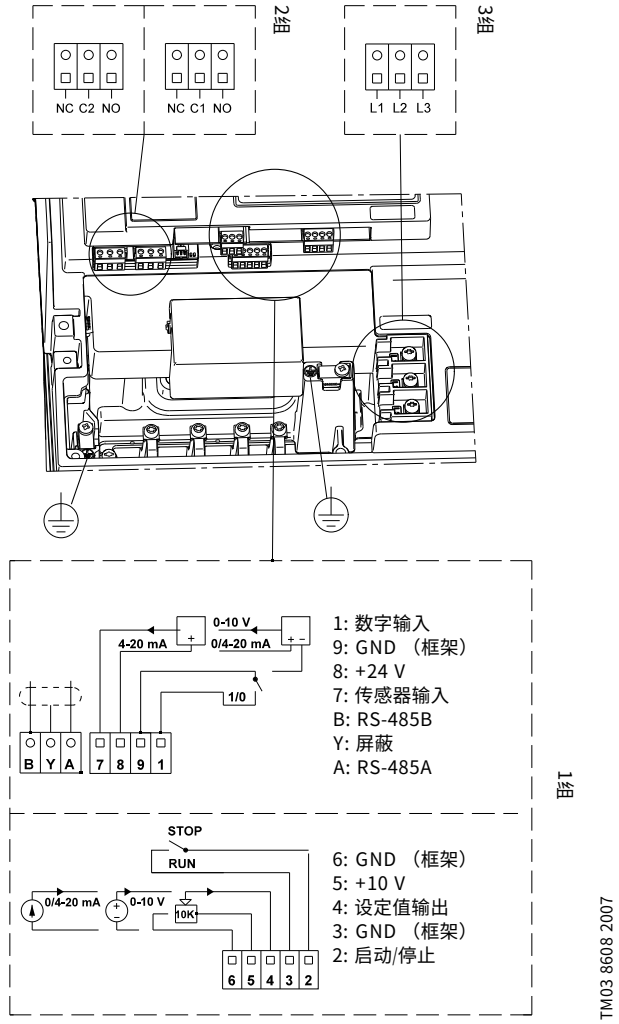


图 5　连接端子泵I/O模块

5.2 三相泵, 11-22 kW

警告
用户或安装人员负责根据所在国和当地标准正确安装接地和防护。所有操作必须由符合资质的电工进行。

警告
电源电路关闭至少5分钟后，才能连接泵接线盒。
请注意，信号继电器可能连接到一个外部开关，因此在工频电源切断后继电器仍可能有电。

警告
端子接线盒在水泵运行时温度可达70 °C以上。

5.2.1 准备工作

在将E-泵连接到工频电源上之前，请先考虑下图所示事项。

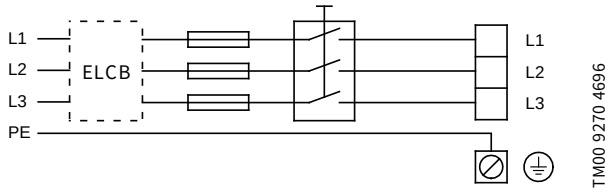


图 6　连接工频电源的泵, 配置主开关、备用保险丝、附加保护和保护性接地

5.2.2 防止触电 - 间接接触

警告
泵必须按照国家法规接地。
11-22 kW电机的漏电电流为> 10 mA，因此在这些电机接地操作中需要格外小心。

EN 61800-5-1标准明确规定，在漏电电流为> 10 mA，水泵必须为固定的永久安装。

必须满足以下要求之一:

- 单根地线，截面积最小10 mm^2铜线。

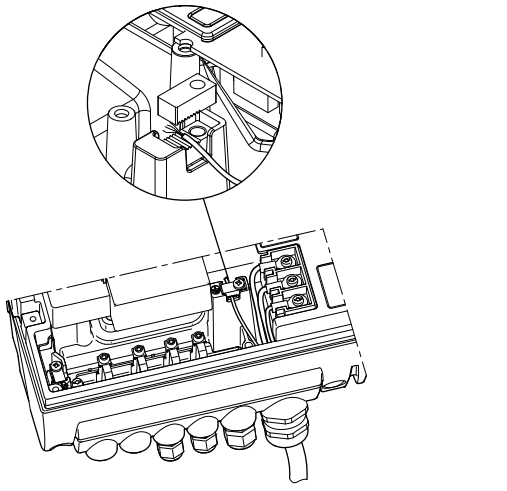
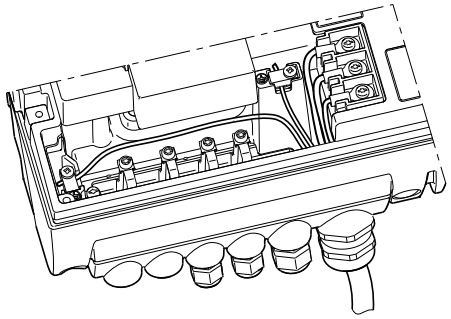


图 7　用四芯工频线中的一根导线连接的单根地线（截面积最小10 mm^2）

- 两根地线与工频导线的截面积相同，其中一根连接到接线盒内的一个附加地线端子上。



TM03 8606 2007

图 8 使用五芯工频线中的两根导线连接的两重保护性地线

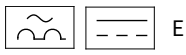
保护性接地导体必须一直有黄/绿 （PE）或黄/绿/蓝 （PEN）颜色标记。

5.2.3 备用保险丝

对于保险丝型号，请见章节*21.1 电源电压*。

5.2.4 附加保护

如果在水泵所连接的系统中使用了漏地断路器 （ELCB）作为附加保护措施，则该断路器必须是一个标有以下标签的型号:



该断路器为B型。

安装中所有电气设备的全部泄漏电流均应被考虑在内。

正常运行时电机的泄漏电流请见章节*21.3 漏电电流*。

启动时间内以及在非对称供电系统内的泄漏电流可以高出正常情况下的泄漏电流而致使ELCB跳闸。

5.2.5 电机保护

该泵不需要外部电机保护。电机配备热防护装置，避免慢速超载与阻塞 （IEC 34-11，TP211）。

5.2.6 工频电压瞬变保护

该泵针对工频瞬间电压的保护符合EN 61800-3标准，能够承受VDE 0160脉冲。

该泵有一个可拆换的压敏电阻，该电阻是瞬间电压保护元件的一部分。

压敏电阻随着使用时间的延续可以老损，老损的压敏电阻需要更换。在更换时间到来时，R100和PC Tool E-products （PC工具E-产品）会发出警告。见章节*19. 保养和服务*。

5.2.7 电源电压与工频电源

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

供电电压和供电频率在水泵铭牌上标明。请确保电机与安装现场中电源之间的匹配性。

接线盒中的线路必须尽可能短。其中保护性地线例外。接地导线应该足够长，使得在电缆被意外地从电缆引入装置拉出时，接地导线最后断开。

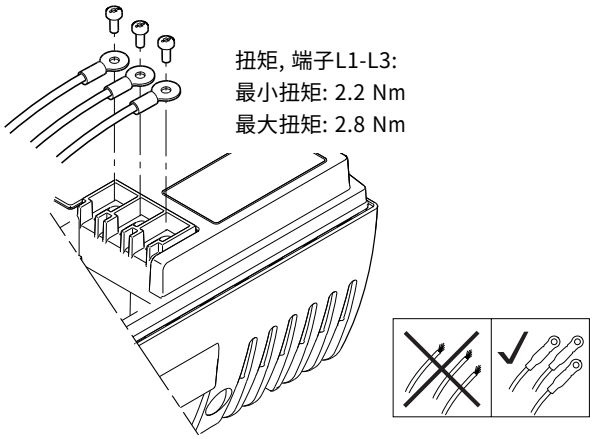


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图 9 工频连接

电缆接头

电缆接头符合EN 50626标准。

- 1 x M40电缆接头, 电缆直径∅16-∅28
- 1 x M20电缆接头, 电缆直径∅9-∅17
- 2 x M16电缆接头, 电缆直径∅4-∅10
- 2 x M16脱落式电缆引入。

警告

如果电源电缆发生损坏，必须由有资质的工作人员进行更换。

电网类型

三相E-泵可以连接到所有类型的电网。

警告

不可将三相E-泵连接到相与地之间电压超过440 V的工频电源上。

5.2.8 泵的启动/停止次数

小心 通过工频电压启动和停止水泵的次数不得超过每小时4次。

通过工频电源启动水泵时，泵会在大约5秒钟时间后启动。

如果需要增加每小时启动和停止次数，请使用外部启动/停止功能来启动和停止水泵。

使用外部启动/停止功能启动水泵时，水泵会立即启动。

5.2.9 接口

作为标准，泵配备了高级I/O模块。

高级I/O模块

高级I/O模块是11到22 kW的所有MGE电机的标准功能模块。

该模块拥有大量输入和输出接口，可让电机用于需要较多输入和输出的高级应用中。

高级I/O模块具有以下连接：

- 启动/停止端子
- 三个数字输入
- 一个设定值输出
- 一个传感器输入 （反馈传感器）
- 一个传感器2输入
- 一个模拟输出
- 两个Pt100输入
- 两个信号继电器输出
- GENIbus连接。

注意 如果未连接外部开/关转换，则用一根短线连接端子2和3。

作为预防措施，连接到以下连接组的接线必须全程以加强绝缘相互分隔:

1组: 输入信号

- 启动/停止 （端子2和3）
- 数字输入 （端子1和9、10和9、11和9）
- 传感器输入2 （端子14和15）
- Pt100传感器输入 （端子17、18、19和20）
- 设定值输入 （端子4、5和6）
- 传感器输入 （端子7和8）
- GENIbus （端子B、Y和A）。

所有输入均与连接到工频电源的部件以加强绝缘相互分隔，而且与其他电路电流分离。

所有控制端子均配有保护性超低电压 （PELV），以确保防止触电。

2组: 输出 （继电器信号, 端子NC, C, NO）

输出与其他电路电流分离。

因此，电源电压或保护性超低电压可以任意连接到输出上。

- 模拟输出 （端子12和13）。

3组: 电源 （端子L1、L2、L3）

电流分离必须满足EN 61800-5-1标准中对加强绝缘的要求，包括爬电距离和间隔距离。

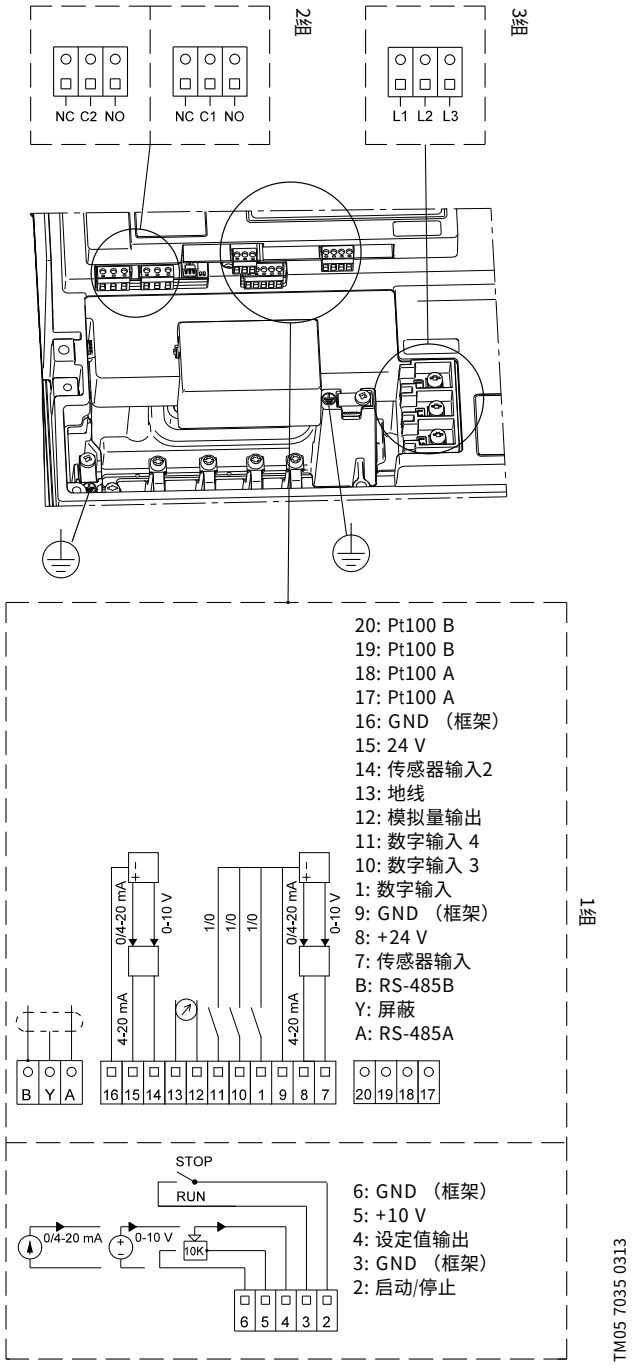
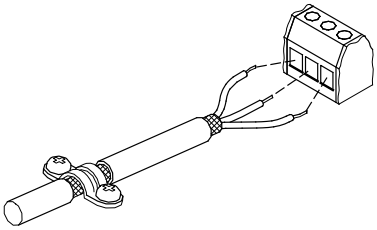


图 10 连接端子高级I/O模块

5.3 信号电缆

- 外部开/关转换、数字输入、设定值和传感器信号需要使用截面积最小0.5 mm^2最大1.5 mm^2的屏蔽电缆。
- 用高质量的屏蔽接头将电缆的屏蔽接到框架的两端。确保屏蔽尽量靠近端子。见图11。



TM02 1325 0901

图 11 剥离电缆带屏蔽和电线接头

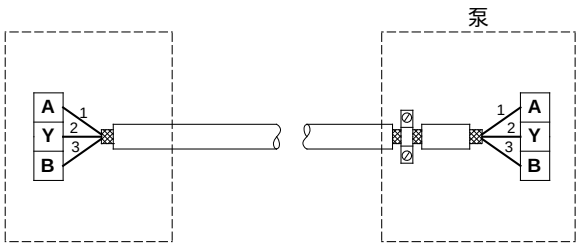
- 时刻将框架接头的螺丝拧紧，无论是否接有电缆。
- 位于水泵接线盒内的电线保持越短越好。

5.4 总线连接电缆

5.4.1 新安装

总线连接电缆需要使用截面积0.2 mm^2 - 1.5 mm^2的三芯屏蔽电缆。

- 如果将要与水泵连接的设备使用的电缆夹是与泵上的某个电缆夹完全相同，可将屏蔽连接到这个电缆夹上。
- 如果该设备没有如图12所示的电缆夹，则使这一端的屏蔽保持未连接状态。

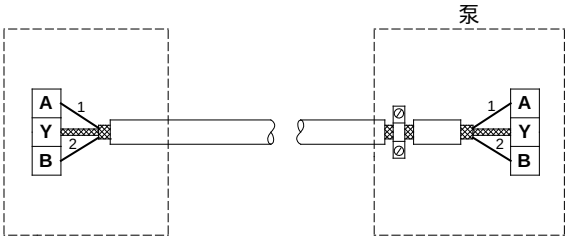


TM02 8841 0904

图 12 用三芯屏蔽电缆连接

5.4.2 更换现有的泵

- 如果现有安装中使用的是两芯屏蔽电缆，按图13所示接线连接。



TM02 8842 0904

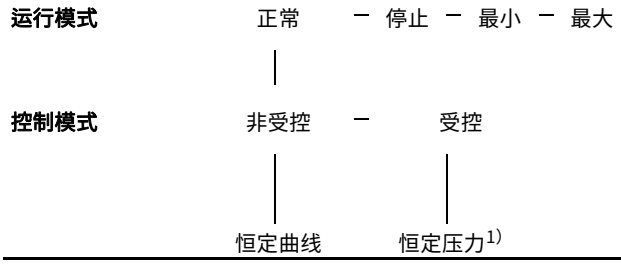
图 13 用两芯屏蔽电缆连接

- 如果现有安装中使用的是三芯屏蔽电缆，按章节*5.4.1 新安装*中的说明进行操作。

6. 模式

格兰富E-泵是根据运行与控制模式来设置和控制的。

6.1 模式概览



1) 该控制模式的泵配置一个压力传感器。水泵亦可配置一个温度传感器。这种情况下，上面说明中受控控制模式即改为恒定温度。

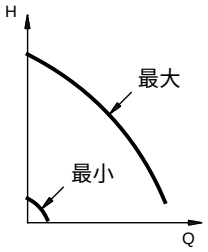
6.2 运行模式

当运行模式设置到正常，控制模式的设置可以是受控和非受控两种。见章节*6.3 控制模式*。

可供选择的其他运行模式有 停止、最小或最大。

- 停止: 水泵停止运行
- 最小: 水泵以最低速度运行
- 最大: 水泵以最高速度运行。

图14为最小曲线和最大曲线的示意图。



TM00 5547 0995

图 14 最小曲线和最大曲线

最大曲线可在安装期间用于排气操作。

最小曲线可用在最低流量运行期间。

如果泵的电源断开，则模式设置将被储存。

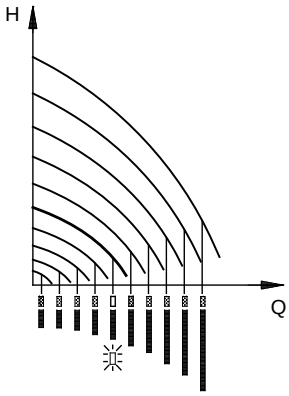
远程控制器R100可提供更多其他设置以及状态显示。见章节*9. 通过R100设置*。

6.3 控制模式

6.3.1 出厂时未装传感器的泵

水泵出厂时期控制模式设置为"非受控"。

在非受控模式中，泵会根据恒定曲线的设置来运行，见图15。



TM00 7746 1304

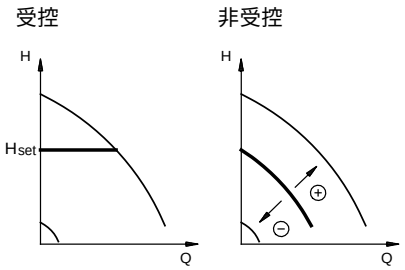
图 15 水泵的控制模式为"非受控" （恒定曲线）

6.3.2 配备压力传感器的泵

可以将水泵设置到以下两种控制模式之一，即：受控与非受控，见图16。

在受控模式中，水泵会按照控制参数的设定值调整泵的性能，例如：泵的排出压力。

在非受控模式中，水泵会根据恒定曲线的设置来运行。



TM00 7668 0404

图 16 水泵的控制模式为受控 （恒定压力）或非受控 （恒定曲线）

7. 水泵设置

7.1 工厂默认设置

出厂时未装传感器的泵

水泵在出厂时其控制模式已被设置到"非受控"。设定值与水泵的最大性能相一致 （见泵的数据单）。

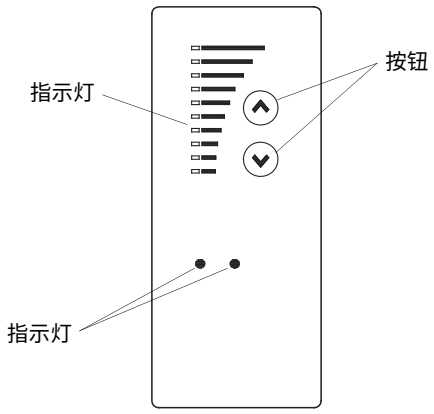
配备压力传感器的泵

水泵在出厂时其控制模式已被设置到"受控"。设定值相当于水泵传感器测量范围的50 % （见传感器的铭牌）。

8. 通过控制面板进行设置

泵的控制面板 （见图17）含有以下按钮和指示灯:

- 按钮⊙和⊙，用于设定值的设置。
- 指示灯, 黄色, 用于设定值的指示。
- 指示灯, 绿色 （运行）和红色 （故障）。



TM02 8513 0304

图 17 控制面板，三相泵，1.1 - 22 kW

8.1 运行模式的设置

可选设置:

- 正常
- 停止
- 最小
- 最大

泵的启动/停止次数

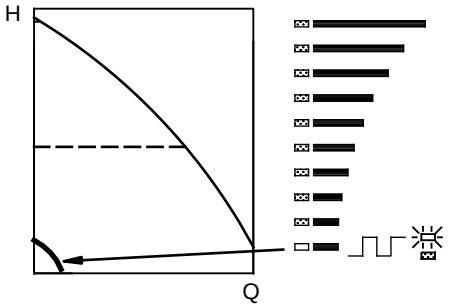
启动泵时连续按⊙直至需要的设定值得到显示。此时的运行模式为正常。

停止泵时连续按⊙直至所有指示灯均熄灭并且绿色指示灯闪烁。

设置到最小

连续按⊙改变到泵的最小曲线 （下方指示灯闪烁）。在下方指示灯亮起后，按⊙3秒钟直至该指示灯开始闪烁。

需要回到非受控或受控运行时，连续按⊙直至需要的设定值被显示。



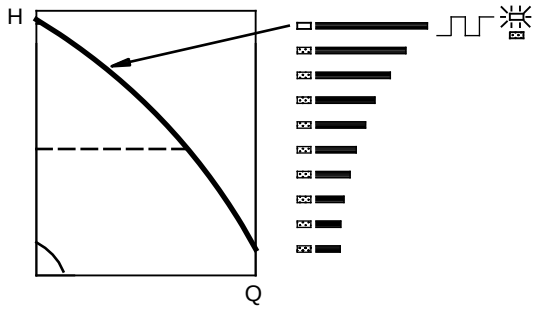
TM00 7346 1304

图 18 最小曲线工作

设置到最大

连续按⊙改变到泵的最大曲线 （上方指示灯闪烁）。在上方指示灯亮起后，按⊙3秒钟直至该指示灯开始闪烁。

需要回到非受控或受控运行时，连续按⊙直至需要的设定值被显示。



TM00 7345 1304

图 19 最大曲线工作

8.2 设置设定值

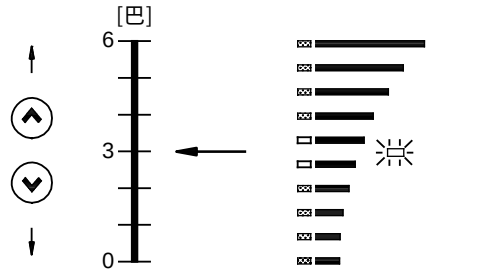
需要设置设定值时，按下按钮⊙或⊙。

控制面板上的指示灯会指示设定值的设置。见章节*8.2.1 受控控制模式下的泵 （压力控制）*和*8.2.2 非受控控制模式下的泵*中的示例。

8.2.1 受控控制模式下的泵 （压力控制）

示例

图20显示指示灯5和6被激活，说明需要的设定值为3巴。设定范围与传感器的测量范围相同 （见传感器铭牌）。



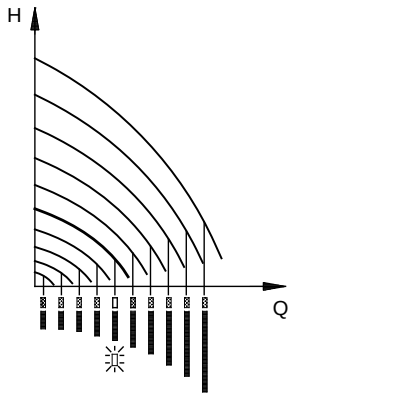
TM00 7743 0904

图 20 设定值设置到3巴, 压力控制

8.2.2 非受控控制模式下的泵

示例

在非受控控制模式下，可在最小曲线和最大曲线范围之间设置泵的性能。见图21。

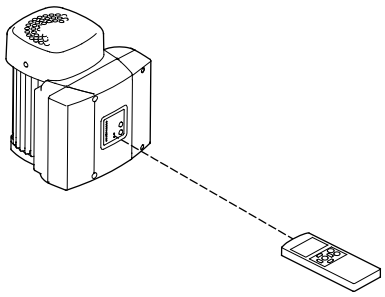


TM00 7746 1304

图 21 泵的性能设置, 非受控控制模式

9. 通过R100设置

该泵的设计允许泵与格兰富遥控R100之间的无线通信。



TM02 0936 0501

图 22 R100与泵之间的红外线通信

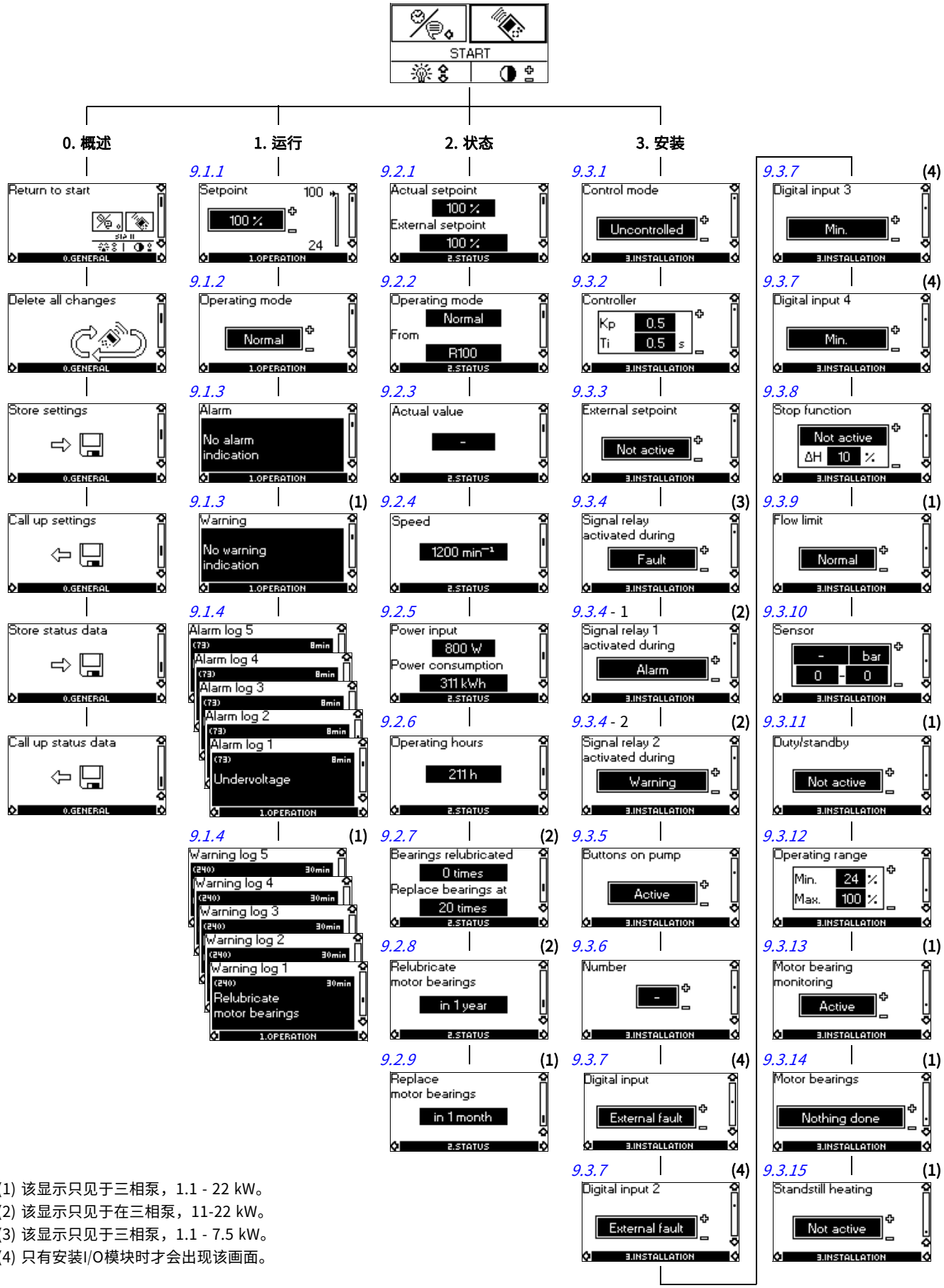
通信时间内，R100必须指向控制面板。在R100与泵通信时，红色指示灯会快速闪烁。将R100持续对准控制面板直至红色 LED 二极管停止闪烁。

可通过R100设置水泵或显示泵的状态。

显示屏划分为以下四个平行菜单 （见图23）：

0. 概述 （见R100的操作指导）
1. 运行
2. 状态
3. 安装

图23中，对于每一单独显示图请参照手册内对该屏显示的说明部分。



(1) 该显示只见于三相泵，1.1 - 22 kW。
(2) 该显示只见于在三相泵，11-22 kW。
(3) 该显示只见于三相泵，1.1 - 7.5 kW。
(4) 只有安装I/O模块时才会出现该画面。

图 23 菜单总览

显示概述

在下述功能说明中，可见一个或两个显示。

一个显示

出厂时配置或未配置传感器的泵型其功能相同。

两个显示

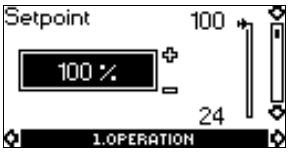
出厂时配置或未配置压力传感器的泵型其功能和工厂设置不同。

9.1 运行菜单

该菜单的第一屏显示是这样的:

9.1.1 设定值

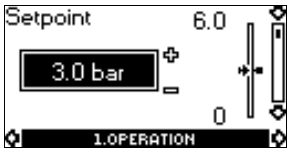
未配传感器（非受控）



- 设定值设置
- 实际设定值
- 实际值

以%设置设定值。

配压力传感器（受控）



- 设定值设置
- 实际设定值
- 实际值

以巴为单位设置所需的压力。

在"非受控"控制模式中，设定值以最大性能的%设置。设置范围是在最小和最大曲线之间。

在"受控"控制模式中，设置范围与传感器的测量范围相同。

如果水泵连接到一个外部设定值信号，则在本显示中出现的值为该外部设定值信号的最大值。见章节*13. 外部设定值信号*。

设定值与外部信号

无法对由外部信号 （停止、最小曲线或最大曲线）控制的水泵设定值进行设置。R100会给出这个警告: 外部控制!

检查水泵是否经端子2-3 （开放回路）停机，或者是经端子1-3设置到最小或最大 （闭合回路）。

见章节*11. 设置的优先级*。

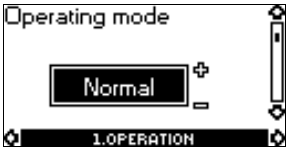
设定值与总线通信

亦无法对由总线通信外部控制系统控制的水泵设定值进行设置。R100会给出这个警告: 总线控制!

如需超驰总线通信，断开总线连接。

见章节*11. 设置的优先级*。

9.1.2 运行模式



设置以下运行模式之一:

- 正常 （工作）
- 停止
- 最小
- 最大

可以在不改变设定值的设定时设置运行模式。

9.1.3 故障指示

在E-泵中，故障可以引发这两种指示: 报警或警告。

一次"报警" 故障会激活R100中的报警指示并引发水泵切换运行模式，通常情况下切换到停止。然而，对于某些引发报警的故障来说，水泵设置为即使是在报警存在时也继续运行。

一次"警告"故障会激活R100中的警告指示，但泵不会切换运行或控制模式。

注意 警告指示只适用于三相水泵。

报警

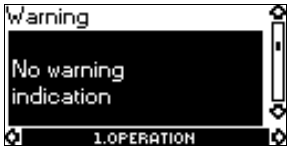
发生报警时，报警的原因会出现在这个显示中。

可能原因:

- 无报警指示
- 电机温度过高
- 低压
- 工频电压不对称 （11-22 kW）
- 过压
- 重新启动次数过多 （故障后）
- 过载
- 载荷不足 （仅对于三相水泵）
- 传感器信号超出信号范围
- 设定值信号超出信号范围
- 外部故障
- 工作/待机, 通信故障
- 干运行 （仅对于三相水泵）
- 其它故障。

如果水泵已经设置到手动重新启动，那么在故障原因清除后可以在这个显示中复位报警指示。

警告 （仅对于三相水泵）



发生警告时，警告原因会出现在这个显示中。

可能原因:

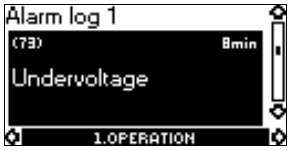
- 无警告指示
- 传感器信号超出信号范围
- 润滑电机轴承，见章节*19.2 电机轴承的再润滑*
- 更换电机轴承，见章节*19.3 更换电机轴承*
- 更换压敏电阻, 见章节*19.4 更换压敏电阻 （仅对于11-22 kW）*。

警告指示在故障排除后会自动消失。

9.1.4 故障记录

R100对于报警和警告这两个故障类型都有一个记录功能。

报警记录



在"报警"故障时，报警记录显示最近五条报警指示。"报警记录1" 显示最近那次故障，"报警记录2" 显示倒数最近第二次故障，以此类推。

上面这个例子给出以下信息:

- 报警指示电压过低
- 故障代码 （73）
- 该次故障发生后水泵连接到电源的分钟数, 8分钟。

故障记录 （仅对于三相水泵）

在"警告"故障时，警告记录显示最近五条警告指示。"警告记录1" 显示最近一次故障，"警告记录2" 显示倒数最近第二次故障，如此等等。

上面这个例子给出以下信息:

- 警告记录显示润滑电机轴承
- 故障代码 （240）
- 该次故障发生后水泵连接到电源的分钟数, 30分钟。

9.2 状态菜单

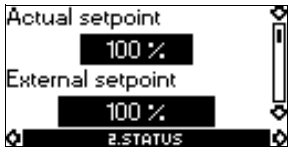
与该菜单相关的显示页仅为状态显示。不可以对数值进行改动或设置。

所显示的值为水泵与R100之间进行最后一次通信时所用的值。如果需要对某一状态值进行更新，将R100对准控制面板然后按 "OK"。如果需要连续显示某一参数，例如速度，在需要对该参数进行监控的时间内持续按"OK"。

显示值的允许偏差在每一显示的下方说明。允许偏差作为指导是以所指参数最大值的%来表示。

9.2.1 实际设定值

未配传感器 （非受控）



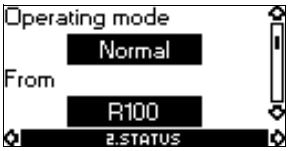
允许误差: ± 2 %.

配压力传感器 （受控）

允许误差: ± 2 %.

该画面显示实际设定值以及以从最小值到设定值的范围内百分比表示的外部设定值。见章节*13. 外部设定值信号*。

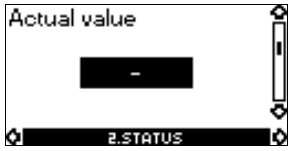
9.2.2 运行模式



这屏显示说明实际运行模式 （正常/ （工作）、停止、最小或最大）。该画面还进一步展示该运行模式是从何处选择的 （R100、水泵、总线、外部/或停止功能）。对于停止功能 （停止功能）的进一步信息，见章节*9.3.8 停机功能*。

9.2.3 实际值

未配传感器 （非受控）



配压力传感器 （受控）

该画面显示从所接传感器测得的实际值。

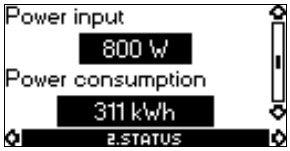
如果水泵未连接传感器，那么该画面中会出现"-" 。

9.2.4 转速

允许误差: ± 5 %

泵的实际速度会出现在该显示中。

9.2.5 功率输入和功耗



允许误差: ± 10 %

该画面显示从工频电源而来的实际输入功率。功率显示以W或kW为单位。

还可以从该显示中读出水泵的功耗。耗电量是从泵生产日期起计算的累计值，不能复位。

9.2.6 运行小时数

允许误差: ± 2 %

运行小时数是一个累计值，不可以重置。

9.2.7 电机轴承的润滑状态 （仅对于11-22 kW）

该画面显示电机轴承已经润滑的次数以及更换电机轴承的时间。

在电机轴承再次润滑完成之后，在安装菜单中确认此项。

见章节*9.3.14 电机轴承重新润滑/更换的确认 （仅对于三相泵）*。在再次润滑确认以后，以上画面中的数字会增加一次。

9.2.8 润滑电机轴承的时间 （仅对于11-22 kW）

该画面显示何时再次润滑电机轴承。控制器监控水泵的运行规律并计算两次轴承润滑之间的时间。如果运行规律发生改变，至再次润滑的计算时间可能也会改变。

可以显示的值如下:

- 2年内
- 1年内
- 6个月内
- 3个月内
- 1个月内
- 1星期内
- 现在!

9.2.9 下次更换电机轴承的时间 （仅对于三相泵）

在电机轴承的润滑次数达到储存在控制器内的预定次数时，下面这个画面会取代章节*9.2.8 润滑电机轴承的时间 （仅对于11-22 kW）*中所述的画面。

该画面显示何时应该更换电机轴承。控制器监控水泵的运行规律并计算两次更换轴承之间的时间。

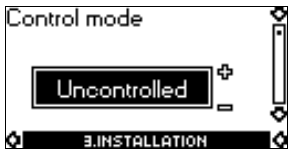
可以显示的值如下:

- 2年内
- 1年内
- 6个月内
- 3个月内
- 1个月内
- 1星期内
- 现在!

9.3 安装菜单

9.3.1 控制模式

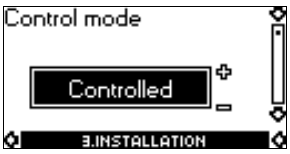
未配传感器（非受控）



选择以下控制模式之一（见图16）：

- 受控
- 非受控。

配压力传感器（受控）



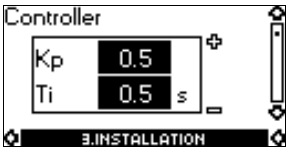
选择以下控制模式之一（见图16）：

- 受控
- 非受控。

注意 如果水泵连接到总线，则无法经R100选择控制模式。见章节*14. 总线信号*。

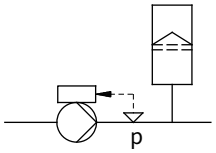
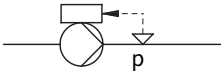
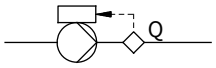
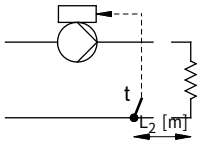
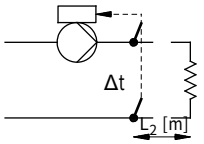
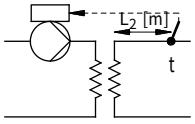
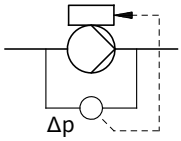
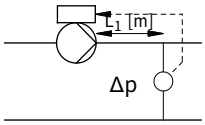
9.3.2 控制器

E-泵有一个出厂默认设置的增益 （K_p）和积分时间 （T_i）。但是，如果出厂默认设置并非最优设置，则可以在以下显示中修改增益和积分时间。



- 增益 （K_p）的可设置范围是从0.1至20。
- 积分时间 （T_i）可在0.1至3600 s之间设置。如果选择3600 s，控制器将用作P控制器。
- 可以进一步将控制器设置成逆向控制，也就是说如果设定值增加，速度会降低。在逆向控制情况下，增益 （K_p）的设置范围必须是从-0.1至-20。

下表说明建议的控制器设置:

系统/应用	K_p		T_i
	加热系统[1]	冷却系统[2]	
	0.5		0.5
	0.1		0.5
	0.5		0.5
	0.5	-0.5	10 + 5L_2
	0.5		10 + 5L_2
	0.5	-0.5	30 + 5L_2
	0.5		0.5
	0.5		L_1 < 5 m: 0.5 L_1 > 5 m: 3 L_1 > 10 m: 5

[1] 加热系统是指在系统中水泵性能的增加会导致传感器上温度的上升。

[2] 冷却系统是指系统中水泵性能的增加会导致传感器上温度的下降。

L_1 = 泵和传感器之间的距离 [m]。

L_2 = 热交换器和传感器之间的距离 [m]。

如何设置PI控制器

对于大多数应用，控制器恒量K_p和T_i的工厂设置可以确保优化的水泵运行。然而，在某些应用中可能需要对控制器作调整。

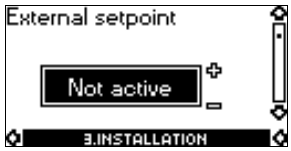
请按以下步骤操作：

1. 加大增益 （K_p）直至电机出现不稳定。可以通过观察实测值是否开始出现波动而决定是否为不稳定。进一步来说，不稳定性可以在电机开始上下振荡时听见。
   某些系统，比如说温度控制，其反应比较缓慢，也就是说 可能需要等待数分钟时间电机才会出现不稳定。
2. 将增益 （K_p）设置到引起电机不稳定的那个数值的一半。此值是增益的正确设置。
3. 减小积分时间 （T_i）直至电机出现不稳定。
4. 将积分时间 （T_i）设置到引起电机不稳定的那个值的两倍。此值是积分时间的正确设置。

经验总结:

- 如果控制器反应太慢，增加K_p。
- 如果控制器出现振荡或不稳定，通过减小K_p或增加T_i而抑制系统。

9.3.3 外部设定值



可将外部设定值信号输入设置为不同的信号类型。

选择以下类型之一:

- 0-10 V
- 0-20毫安
- 4-20毫安
- 未激活。

如果选择未激活，则通过R100设置的设定值或控制面板上的设定值将会被采用。

如果选择了信号类型中的一种，则实际设定值会受到连接到外部设定值输入的信号所影响。见章节*13. 外部设定值信号*。

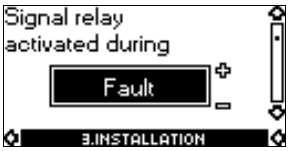
9.3.4 信号继电器

0.37 - 7.5 kW的泵配置一个信号继电器。该继电器的工厂设置会是故障。

11-22 kW的泵配置两个信号继电器。继电器1的工厂设置是报警，继电器2的工厂设置是警告。

在下面这个显示中，选择下面这三种或六种运行情况中哪种情况下应该启用信号继电器。

0.37 - 7.5 kW



- 就绪
- 故障
- 运行
- 泵运行 （仅对于三相水泵，0.55 - 7.5 kW）
- 警告 （仅对于三相水泵，0.55 - 7.5 kW）。

11-22 kW

- 就绪
- 报警
- 运行
- 水泵运行
- 警告
- 再次润滑。

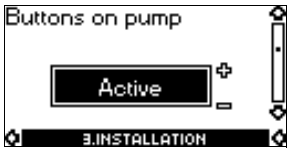
11-22 kW

- 就绪
- 报警
- 运行
- 水泵运行
- 警告
- 再次润滑。

注意 故障和报警涵盖引发报警的故障。警告涵盖引发警告的故障。再润滑仅涵盖一个单独事件。如需了解报警和警告之间的区别，见章节*9.1.3 故障指示*。

若需了解更多信息，见章节*16. 指示灯与信号继电器*。

9.3.5 泵上的按钮

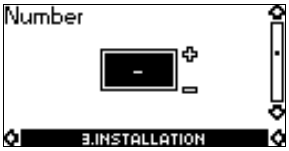


位于控制面板上的运行按钮⊙和⊙可被设置成这些值：

- 激活
- 未激活。

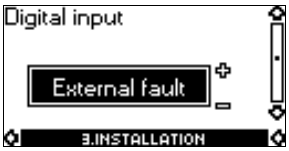
如果设置到未激活 （锁定），则这些按钮不行使功能。如果水泵是由一个外部控制系统来控制，则将按钮设置到未激活。

9.3.6 水泵编号



可将水泵的编号指定为1到64之间的某个数字。在总线通信情况下，必须为每个泵指定一个编号。

9.3.7 数字输入



可将水泵的数字输入 （端子1、图5、图4或图10）设置到不同功能。

选择以下功能之一:

- 最小 （最小曲线）
- 最大 （最大曲线）
- 外部故障
- 流量开关
- 干运行 （从外部传感器）（仅对于三相水泵）。

选定的功能通过端子1和9、1和10或1和11之间的触点闭合来激活。见图5、4和10。

另见章节*12.2 数字输入*。

***最小*：**

一旦该输入被激活，水泵会按照最小曲线运行。

***最大*：**

一旦该输入被激活，水泵会按照最大曲线运行。

***外部故障*：**

一旦该输入被激活，计时器将起动。如果此输入的激活时间超过5秒钟，水泵会停止并且会出现一次故障指示。如果此输入停止激活的时间超过5秒钟，则故障状态停止，可通过复位故障指示对水泵进行手动重新启动。

***流量开关*：**

当选择该功能时，在流量开关探测到低流量时水泵会被停止。

只有在水泵连接一个压力传感器时才能使用该功能。

如果此输入激活时间5秒钟，水泵内置的停机功能会接管。
见章节*9.3.8 停机功能*。

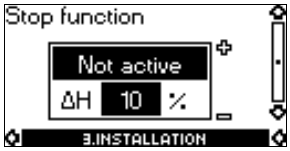
干运行 （仅对于三相水泵）：

当此功能启用时，可以探测到是否缺乏入口压力或是否缺水。该功能需要使用附件，如以下附件：

- 一台格兰富Liqtec®干运行传感器
- 一个安装在水泵吸入侧的压力开关
- 一个安装在水泵吸入侧的浮子开关。

如果探测到入口压力缺乏或缺水 （干转），水泵会停止。只要该输入处于激活状态水泵就不能够重新启动。

9.3.8 停机功能



停机功能可以被设置成以下值:

- 激活
- 未激活。

一旦停机功能被激活，水泵在流量过低时停机。原因有以下:

- 避免泵送液体不必要的加热
- 减少轴封磨损
- 降低运行噪音。

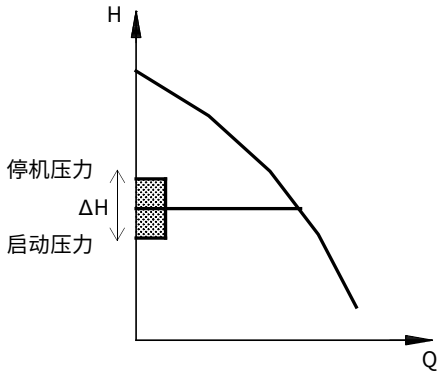


图 24 启动压力和停机压力之间的差 （ΔH）

ΔH在工厂设置为实际设定值的10 %。

ΔH的设置范围可以是实际设定值的5 %至30 %。

低流量可以通过两种不同的方式探测:

1. 一个内置的 "低流量探测功能"，在未对流量开关设置数字输入情况下发挥功能。
2. 一个连接到数字输入的流量开关。

1. 低流量探测功能

水泵会短时间降低速度以便定时检查流量。如果压力无改变或改变很小，这意味着低流量存在。速度会增加，直至达到停机压力 （实际设定值 + 0.5 x ΔH）时水泵停止。在压力降低到启动压力 （实际设定值 - 0.5 x ΔH）时，水泵会重新启动。

重新启动时，水泵的反应根据泵型的不同而不同:

单相供电

水泵会回到恒定压力下的持续运行，并且水泵会继续在短时间内降低速度以便定期检查流量。

三相泵

1. 如果流量高于低流量极限，水泵会回到恒定压力下的连续运行。
2. 如果流量仍然低于低流量极限，水泵继续以启动/停止模式运行。水泵会继续以启动/停止模式运行直至流量高于低流量极限；在流量高于低流量极限后，水泵会回到持续运行模式。

2. 流量开关

当该数字输入激活时间超过5秒时，因为是低流量，所以速度会加快直至达到停机压力 （实际压力 + 0.5 x ΔH），然后水泵会停止。当压力降落到启动压力时，水泵再次启动。如果仍然没有流量，则水泵会很快达到停机压力然后停止。如果有流量，水泵会持续运行直至达到设定值。

停机功能的运行条件

只有在系统包含了一个压力传感器、一个单向阀和一个隔膜水箱时才可以使用停机功能。

小心 止回阀必须安装在压力传感器之前。见图25和26。

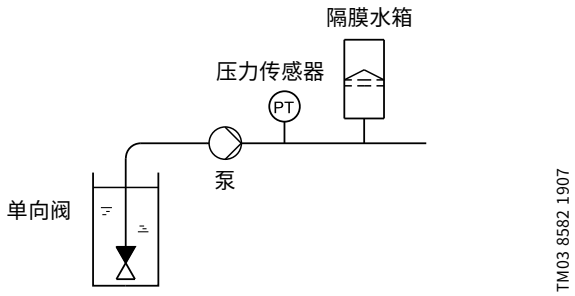


图 25 吸程运行中止回阀和压力传感器的位置

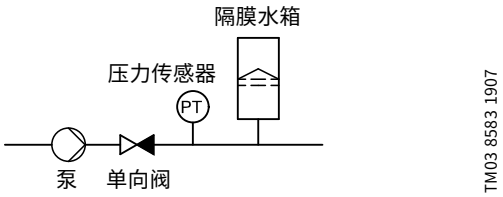


图 26 入口正压系统中止回阀和压力传感器的位置

隔膜水箱

停机功能要求配置一个一定大小的隔膜水箱。水箱必须紧接水泵安装，并且预加压力必须为0.7 x 实际设定值。

建议的隔膜水箱尺寸:

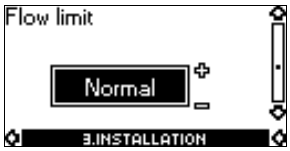
泵的额定流量 [立方米/小时]	CRE泵	标准隔膜水箱尺寸 [升]
0-6	1s, 1, 3, 5	8
7-24	10, 15, 20	18
25-40	32	50
41-70	45, 64	120
71-100	90	180

如果系统中安装的隔膜水箱符合以上建议大小， ΔH的出厂设置即为正确设置。

如果安装的水箱太小，水泵的启动和停机会过于频繁。这种情况可以通过增加ΔH来纠正。

9.3.9 停机功能的流量极限 （仅对于三相泵）

注意 停机功能的流量极限只有在系统未设置流量开关时才能起到作用。



如需设置系统从恒定压力下持续运行转入启动/停止运行的流量水平，请在以下四个值中选择对哪三个进行流量极限预先配置:

- 低
- 正常
- 高
- 自定义。

水泵的默认值是"正常"，代表泵额定流量的10 %左右。

如果需要一个低于正常的流量极限，或者水箱尺寸小于建议尺寸，选择低。

如果需要一个高于正常的流量极限，或者水箱尺寸较大，选择高。

自定值可以从R100找到，但也可以通过PC工具E-产品来设置。"自定义"用于客户化的设置，可根据过程优化。

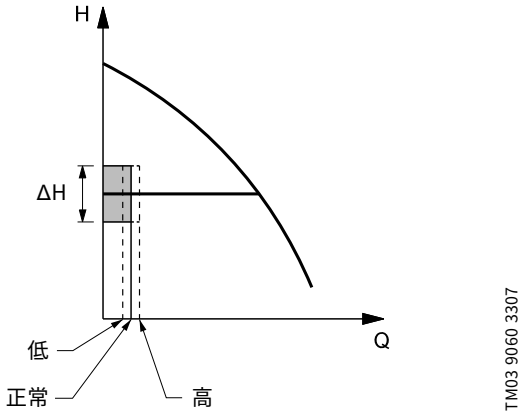
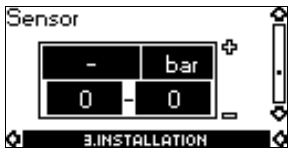


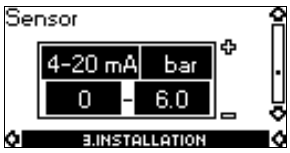
图 27 三个预配置的流量极限: 低、正常和高

9.3.10 传感器

未配传感器（非受控）



配压力传感器（受控）



传感器的设置只有在受控的运行中才有关。

在以下值之间选择:

- 传感器输出信号
  0-10 V
  0-20 mA
  4-20 mA,
- 传感器测量单位:
  bar, mbar, m, kPa, psi, ft, m^3/h, m^3/s, l/s, gpm, °C, °F, %
- 传感器测量范围。

9.3.11 工作/备用 （仅对于三相泵）

工作/备用功能适用于两个并联泵并通过GENIbus控制。

工作/备用功能可以设置到以下值:

- 激活
- 未激活。

当该功能设置到激活时，以下应用:

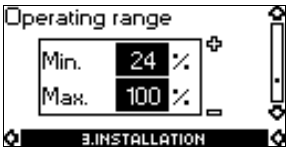
- 一次只有一台泵在运行。
- 运行泵 （工作）出现故障时停止泵 （备用）会自动切入。故障会被指示。
- 每24小时工作泵与备用泵互相轮换。

按以下步骤启用工作/备用功能:

1. 将其中一个泵与主电源连接。
   将工作/备用功能设置到未激活。
   使用R100，在运行菜单和安装菜单中进行必要的设置。
2. 在"运行"菜单中将运行模式设置到"停止"。
3. 将其它泵连接到主电源。
   使用R100，在运行菜单和安装菜单中进行必要的设置。
   将工作/备用功能设置到激活。

运行的那个泵会搜索其他泵并自动将该泵的工作/备用功能设置到激活。如果找不到另一个泵，一个故障会被指示。

9.3.12 工作范围



如何设置运行范围:

- 将最小曲线设置在最大曲线和最大性能的12 %范围之间。泵的出厂设置是最大性能的24 %。
- 在从最大性能 （100 %）到最小曲线的范围内设置最大曲线。

最小曲线和最大曲线之间的区域为运行范围。

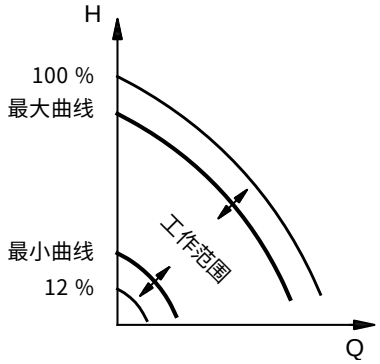


图 28 以最大性能的 % 来设置最小曲线和最大曲线

9.3.13 电机轴承监控 （仅对三相泵）

电机轴承监控功能可以被设置成以下值:

- **激活**
- 未激活。

当该功能设置到激活时，控制器内的一个计数器会开始计数轴承的迈数。见章节*9.2.7 电机轴承的润滑状态 （仅对于11-22 kW）*。

注意 如果该功能被切换到未激活，计数器会继续计时，但不会在应该重新润滑轴承的时间给出报警。
当该功能再次切换到激活时，累积的迈数会被计算在重新润滑的时间内。

9.3.14 电机轴承重新润滑/更换的确认 （仅对于三相泵）

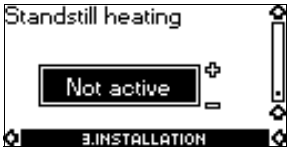
该功能可以设置成以下值:

- 已重新润滑 （11-22 kW）
- 已更换
- 工作未执行。

当电机轴承监控功能为激活状态时，控制器会在重新润滑电机轴承或电机轴承的更换时间到来时给出警告。见章节*9.1.3 故障指示*。
在完成轴承的润滑或更换工作之后，通过按"OK"在以上显示中确认此项工作。

注意 在确认润滑之后的一段时间内不可以选择已再次润滑。

9.3.15 停止时加热 （仅对于三相泵）



静止加热功能可以被设置为以下值:

- 激活
- **未激活。**

当该功能设置为"激活"时，一个交流电压会接通到电机线圈上。施加的电压可以确保足够的热量，以防电机内冷凝形成。

10. 通过PC工具E-产品进行设置

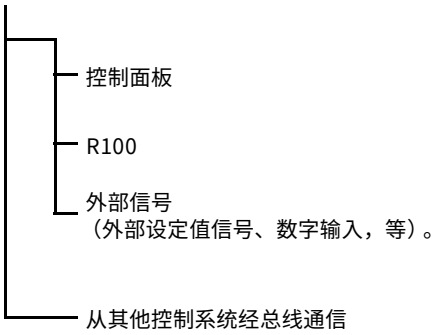
一些与R100所能提供的设置有所不同的设置则需要使用格兰富PC工具E-产品。这也需要格兰富维修技师或工程师的协助。详细信息请与用户当地的格兰富公司联系。

11. 设置的优先级

设置优先级由两个因素决定：

1. 控制源
2. 设置。

1. 控制源



2. 设置

- 运行模式"停止"
- 运行模式最大 （最大曲线）
- 运行模式最小 （最小曲线）
- 设置设定值。

可以在同一时间通过不同的控制源对一个E-泵进行控制，并可对每个控制源分别给予不同的设置。因而，有必要对控制源和设置进行优先权等级区分。

注意 如果有两个或两个以上的设置同时激活，水泵会按照具有最高优先级的功能项来运行。

无总线通信时的设置优先级

优先级	控制面板或R100	外部信号
1	停止	
2	最大	
3		停止
4		最大
5	最小	最小
6	设置设定值	设置设定值

示例：如果E-泵已通过一个外部信号设置到运行模式最大 （最大频率），比如说数字输入，则控制面板或R100只能将E-泵设置到运行模式停止。

总线通信时的设置优先级

优先级	控制面板或R100	外部信号	总线通信
1	停止		
2	最大		
3		停止	停止
4			最大
5			最小
6			设置设定值

示例：如果E-泵是按照一个由总线通信设置的设定值运行，那么控制面板或R100可以将E-泵设置成运行模式"停止"或"最大"，而外部信号则只能将E-泵设置成运行模式"停止"。

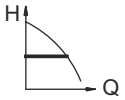
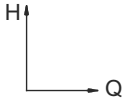
12. 外部强行控制信号

该泵具备可用于以下强行控制功能的外部信号输入:

- 泵的启动/停止次数
- 数字化功能。

12.1 启动/停止输入

功能图示: 启动/停止输入:

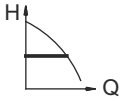
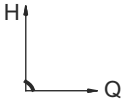
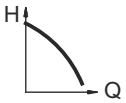
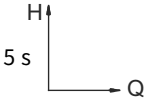
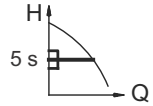
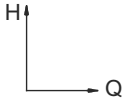
启动/停止 （端子2和3）		
		**正常工作**
		**停止**

12.2 数字输入

通过R100，可为数字输入选择以下功能之一:

- 正常工作
- 最小曲线
- 最大曲线
- 外部故障
- 流量开关
- 干转。

功能图示: 数字化功能的输入

数字化功能 （端子1和9）		
		**正常工作**
		**最小曲线**
		**最大曲线**
		**外部故障**
		**流量开关**
		**干转**

13. 外部设定值信号

可以通过将模拟信号发送器连接到设定值信号输入 （端子4）的方式来对设定值进行远程设置。

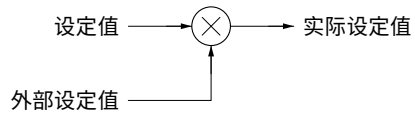


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图 29 实际设定值为设定值和外部设定值的乘积 （倍数值）

通过R100选择实际外部信号, 0-10 V, 0-20 mA, 4-20 mA 。
见章节*9.3.3 外部设定值*。

如果通过R100选择了"非受控"控制模式，则水泵可以通过任意的控制器来控制。

在"受控"控制模式中，可以由外部在自传感器测量范围的低限到在泵上设置的或是通过R100设置的设定值范围之内对设定值进行设置。

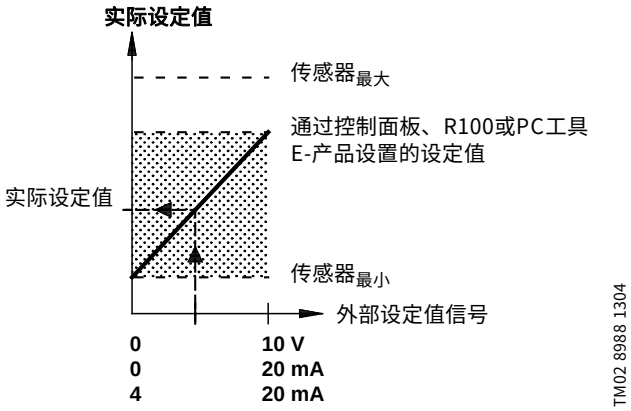

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图 30 受控控制模式中实际设定值和外部设定值信号之间的关系

示例：传感器$_{最小}$ 的值为0巴，设定值设置为3巴，外部设定值为80 %时，实际设定值如下：

实际设定值 =（设定值 - 传感器$_{最小}$）x %$_{外部设定值}$ + 传感器$_{最小}$
=（3 - 0）x 80 % + 0
= 2.4巴

在"非受控"控制模式中，可以由外部在自最小曲线到在泵上设置的或是通过R100设置的设定值范围之内对设定值进行设置。

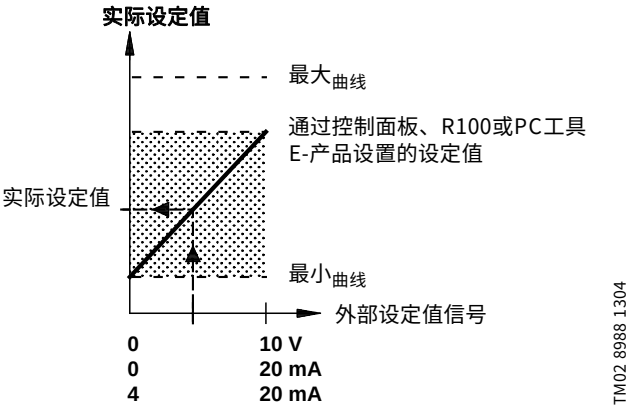

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图 31 非受控控制模式中实际设定值与外部设定值信号之间的关系

14. 总线信号

该泵支持经RS-485输入的串行通信。通信是根据格兰富总线协议（GENIbus 协议）来执行的，并允许与建筑物管理系统或另一个控制系统连接。

设定值、运行模式等运行参数可经由总线信号远程设置。与此同时，水泵也可以提供有关重要参数的状态信息，比如说控制参数的实际值、输入功率、故障指示等。

如需了解详细信息，请与格兰富联系。

注意 如果使用了总线信号，则可以通过R100来进行的设置数量将会减少。

15. 其它总线标准

格兰富提供根据其它总线标准实现的总线通信解决方案。

如需了解详细信息，请与格兰富联系。

16. 指示灯与信号继电器

泵的运行条件可以通过位于水泵控制面板上的以及接线盒内的绿色和红色指示灯来指示。见图32和33。

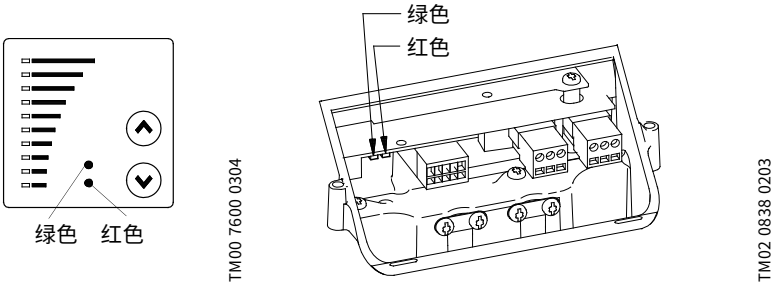


图 32 单相泵上的指示灯位置

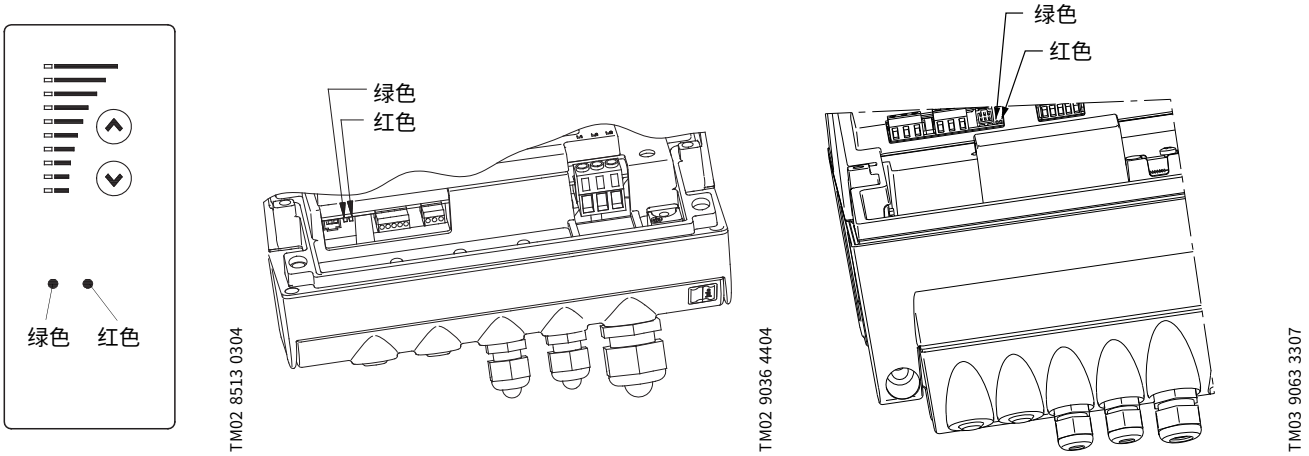
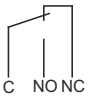
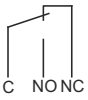
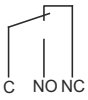


图 33 三相泵上的指示灯位置

此外，该泵还容纳一个输出，用于经内部继电器的无电位信号。

对于信号继电器的输出值，请见章节*9.3.4 信号继电器*。

两盏指示灯与信号继电器的功能如下表所示：

指示灯		在以下过程中，信号继电器被激活				描述
故障（红色）	运行（绿色）	故障/报警，警告和再次润滑	运行	就绪	水泵运行	
灭	灭					电源被切断。
灭	常亮					水泵运行中。
灭	常亮					水泵由停机功能停止。
灭	闪烁					水泵被设置到停止。
常亮	灭					水泵因出现故障/报警而停止，或者在警告或润滑指示下运行。 水泵停止后会尝试重新启动 （可能必须在故障指示复位后才能重新启动水泵）。 如果原因是 "外部故障"，则水泵必须在故障指示复位后重新手动启动。
常亮	常亮					水泵运行，但存在或出现过了一次允许水泵继续运行的故障/报警，或者是在一次警告或润滑指示下运行。 如果原因是"传感器信号超出信号范围"，则水泵继续按照最大曲线来工作，并且在信号回到信号范围内之前故障指示无法复位。 如果原因是"设定值信号超出信号范围"，则水泵继续按照最小曲线来工作，并且在信号回到信号范围内之前故障指示无法复位。
常亮	闪烁					水泵被设置到停止，但已经因为一次故障而停止。

复位故障指示

故障指示的复位可以通过以下任意方式完成:

- 在泵上短暂按下按钮㊈或㊇。这样做不会改变泵的设置。
  如果这些按钮被锁定，则故障不能通过㊈或㊇复位。
- 切断泵的电源直至指示灯熄灭。
- 先关掉外部启动/停止输入然后重新打开。
- 使用R100。见章节*9.1.3 故障指示*。

在R100与泵通信时，红色指示灯会快速闪烁。

17. 绝缘阻抗

0.37 - 7.5 kW

小心 不要用高电压兆欧表来测量电机绕组或容纳E-泵的安装的绝缘阻抗，因为这可能会损坏内部电子设备。

11-22 kW

小心 不要用高电压兆欧表来测量容纳E-泵的安装的绝缘阻抗，因为这可能会损坏内部电子设备。

电机的导线可以被单独断开，所以可以对电机绕组的绝缘阻抗进行测试。

18. 紧急运行 （仅对于11-22 kW）

警告

电源电路关闭至少5分钟后，才能连接泵接线盒。

请注意，信号继电器可能连接到一个外部开关，因此在工频电源切断后继电器仍可能有电。

如果水泵停止，而你无法以正常的故障处理方法启动水泵，其原因可能是变频器故障。如果出现以上情况，可以维持水泵的紧急运行。

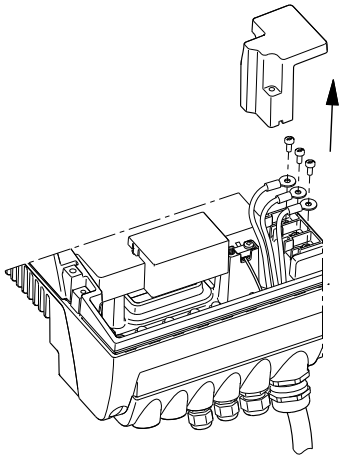
在更改为紧急运行之前我们建议您：

- 检查工频电源是否OK
- 检查控制信号是否工作 （启动/停止信号）
- 检查所有报警是否已经复位
- 对电机绕组进行一次阻抗测试 （从接线盒上断开电机导线）。

如果水泵仍然停止，则可能是变频器故障。

按以下操作建立紧急运行：

1. 断开三根工频电源线L1, L2, L3，但将保护性地线保留在PE端子原位上。



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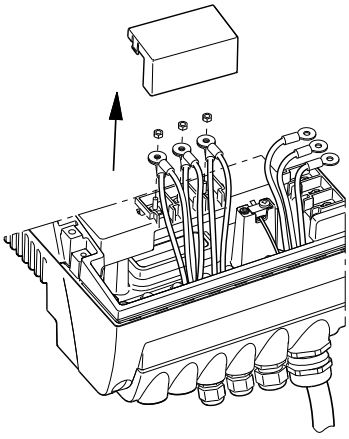
2. 从接线盒上断开电机电源线U/W1, V/U1, W/V1。



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3. 按照图34中所示连接导线。

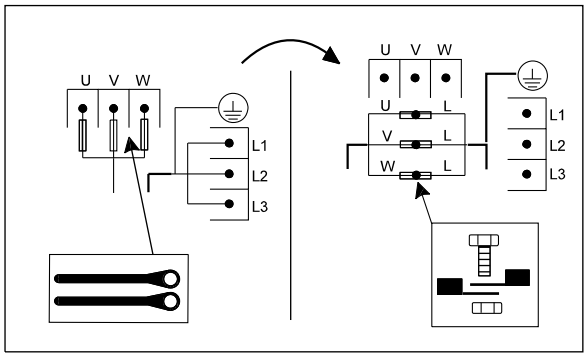

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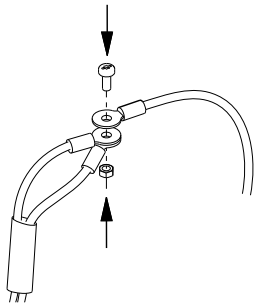
图 34 如何将E-泵从正常运行切换到紧急运行

使用工频电源端子的螺丝和电机端子的螺母。



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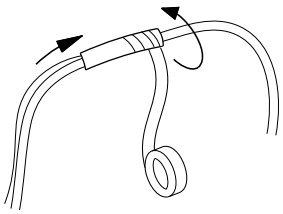
4. 采用绝缘胶带和类似材料将三根导线相互绝缘。



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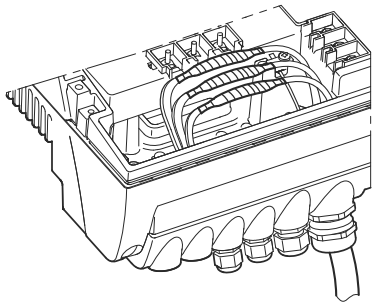

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警告

不要将工频电源线连接到U, V和W端子上以旁通变频器。

这样做可以引起人身伤害，因为工频电源的高电压可能会传递到接线盒上可以触摸的部件。

小心 在切换到紧急运行后启动时先检查转动方向。

19. 保养和服务

19.1 电机的清洁

保持电机散热片和风扇叶片的清洁，以确保电机和电子设备充分冷却。

19.2 电机轴承的再润滑

1.1 - 7.5 kW水泵

电机轴承属于闭式轴承，为终身润滑。该轴承无需再润滑。

11-22 kW水泵

电机轴承属于开式轴承，必须定期润滑。

电机轴承在交货时已预先润滑。当电机轴承应该再润滑的时间到来时，R100内置的电机轴承监控功能会发出一个警告指示。

注意 重新润滑前，取下电机法兰上的底部插头，插到轴承盖上，以确保排出旧的和多余的润滑油。

第一次再润滑时，因为润滑通道还是空的，所以需要使用两倍量的油脂。

机架尺寸	油脂用量 [毫升]	
	驱动端	非驱动端
MGE 160	13	13
MGE 180	15	15

建议使用聚尿素-基质类型润滑脂。

19.3 更换电机轴承

11-22 kW水泵配备内置型轴承监控功能，在电机轴承更换时间到来时，该功能会在R100上发出一个警告指示。

19.4 更换压敏电阻 （仅对于11-22 kW）

压敏电阻针对工频瞬变电压为泵提供保护。如果发生瞬变电压，压敏电阻会随时间的延续而老化，因而需要更换。瞬变电压越频繁，压敏电阻老化得越快。在更换压敏电阻的时间到来时，R100和PC-工具E-产品会发出警告。

压敏电阻的更换需由格兰富技术人员进行。与您当地的格兰富公司联络寻求支持。

19.5 服务零件和服务组件

对于服务零件及服务套件的更多信息，请登录www.grundfos.com，选择国家，选择WebCAPS。

20. 技术数据 - 三相泵，1.1 - 7.5 kW

20.1 电源电压

3 x 380-480 V - 10 %/+ 10 %, 50/60 Hz - 2 %/+ 2 %, PE。

电缆: 最大10 mm^2 / 8 AWG。

仅可使用最小70 °C的铜制导线。

建议保险丝型号

电机功率从1.1至5.5 kW：最大16 A。

电机功率7.5 kW：最大32 A。

标准型、快速熔断型或慢速熔断型保险丝均可使用。

20.2 过载保护

E-泵的过载保护功能与普通电机的保护功能性能相同。举例说来，E-泵可以对110 % $_{nom}$耐受1分钟。

20.3 漏电电流

电机功率 [kW]	漏电电流 [mA]
1.1至3.0 （电源电压< 460 V）	< 3.5
1.1至3.0 （电源电压> 460 V）	< 5
4.0 - 5.5	< 5
7.5	< 10

漏电电流根据EN 61800-5-1标准进行测量。

20.4 输入/输出

启动/停止

外部无电位触点。

电压: 5 VDC。

电流: < 5 mA。

屏蔽电缆: 0.5 - 1.5 mm^2 / 28-16 AWG。

数字

外部无电位触点。

电压: 5 VDC。

电流: < 5 mA。

屏蔽电缆: 0.5 - 1.5 mm^2 / 28-16 AWG。

设定值信号

- 电位计
  0-10 VDC, 10 kΩ （经由内部电压供应）。
  屏蔽电缆: 0.5 - 1.5 mm^2 / 28-16 AWG。
  电缆最大长度：100 m。
- 电压信号
  0-10 VDC，R_i > 50 kΩ。
  允许误差: 最大电压信号时，+ 0 %/- 3 %。
  屏蔽电缆: 0.5 - 1.5 mm^2 / 28-16 AWG。
  电缆最大长度：500 m。
- 电流信号
  DC 0-20 mA / 4-20 mA，R_i = 175 Ω。
  允许误差: 最大电流信号时，+ 0 %/ - 3 %。
  屏蔽电缆: 0.5 - 1.5 mm^2 / 28-16 AWG。
  电缆最大长度：500 m。

传感器信号

- 电压信号
  0-10 VDC，R_i > 50 kΩ （经由内部电压供应）。
  允许误差: 最大电压信号时，+ 0 %/- 3 %。
  屏蔽电缆: 0.5 - 1.5 mm^2 / 28-16 AWG。
  电缆最大长度：500 m。
- 电流信号
  DC 0-20 mA / 4-20 mA，R_i = 175 Ω。
  允许误差: 最大电流信号时，+ 0 %/ - 3 %。
  屏蔽电缆: 0.5 - 1.5 mm^2 / 28-16 AWG。
  电缆最大长度：500 m。

内部电源

- 外部电位计的10 V电源:
  最大负荷: 2.5 mA。
  短路保护。
- 传感器的24 V电源:
  最大负荷: 40 mA。
  短路保护。

信号继电输出

无电位转换触点。

最大触点负荷: 250 VAC, 2 A, cos φ 0.3 - 1。

最小触点负荷: 5 VDC, 10 mA。

屏蔽电缆: 0.5 - 2.5 mm^2 / 28-12 AWG。

电缆最大长度：500 m。

总线输入

格兰富总线协议，GENIbus协议, RS-485。

屏蔽三芯电缆: 0.2 - 1.5 mm^2 / 28-16 AWG。

电缆最大长度：500 m。

21. 技术数据 - 三相泵，11-22 kW

21.1 电源电压

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

电缆: 最大10 mm^2 / 8 AWG。

仅可使用最小70 °C的铜制导线。

建议保险丝型号

电机型号 [千瓦]	最大 [A]
11	32
15	36
18.5	43
22	51

标准型、快速熔断型或慢速熔断型保险丝均可使用。

21.2 过载保护

E-泵的过载保护功能与普通电机的保护功能性能相同。举例说来，E-泵可以对110 % $_{nom}$耐受1分钟。

21.3 漏电电流

漏地电流> 10 mA。

漏电电流根据EN 61800-5-1标准进行测量。

21.4 输入/输出

启动/停止

外部无电位触点。

电压: 5 VDC。

电流: < 5 mA。

屏蔽电缆: 0.5 - 1.5 mm^2 / 28-16 AWG。

数字

外部无电位触点。

电压: 5 VDC。

电流: < 5 mA。

屏蔽电缆: 0.5 - 1.5 mm^2 / 28-16 AWG。

设定值信号

- 电位计
  0-10 VDC, 10 kΩ （经由内部电压供应）。
  屏蔽电缆: 0.5 - 1.5 mm^2 / 28-16 AWG。
  电缆最大长度：100 m。
- 电压信号
  0-10 VDC，R_i > 50 kΩ。
  允许误差: 最大电压信号时，+ 0 %/- 3 %。
  屏蔽电缆: 0.5 - 1.5 mm^2 / 28-16 AWG。
  电缆最大长度：500 m。
- 电流信号
  DC 0-20 mA / 4-20 mA, R_i = 250 Ω。
  允许误差: 最大电流信号时 + 0 %/ - 3 %。
  屏蔽电缆: 0.5 - 1.5 mm^2 / 28-16 AWG。
  电缆最大长度：500 m。

传感器信号

- 电压信号
  0-10 VDC，R_i > 50 kΩ （经由内部电压供应）。
  允许误差: 最大电压信号时，+ 0 %/- 3 %。
  屏蔽电缆: 0.5 - 1.5 mm^2 / 28-16 AWG。
  电缆最大长度：500 m。
- 电流信号
  DC 0-20 mA / 4-20 mA, R_i = 250 Ω。
  允许误差: 最大电流信号时，+ 0 %/ - 3 %。
  屏蔽电缆: 0.5 - 1.5 mm^2 / 28-16 AWG。
  电缆最大长度：500 m。

内部电源

- 外部电位计的10 V电源:
  最大负荷: 2.5 mA。
  短路保护。
- 传感器的24 V电源:
  最大负荷: 40 mA。
  短路保护。

信号继电输出

无电位转换触点。

最大触点负荷: 250 VAC, 2 A, cos φ 0.3 - 1。

最小触点负荷: 5 VDC, 10 mA。

屏蔽电缆: 0.5 - 2.5 mm^2 / 28-12 AWG。

电缆最大长度：500 m。

总线输入

格兰富总线协议，GENIbus协议, RS-485。

屏蔽三芯电缆: 0.2 - 1.5 mm^2 / 28-16 AWG。

电缆最大长度：500 m。

21.5 其他技术数据

EMC （电磁兼容符合EN 61800-3标准）

电机 [kW]	排放/抗干扰
1.1 1.5 2.2 3.0 4.0 5.5 7.5	**排放:** 该泵可以在住宅区安装 （第一环境），不受限分布，适用于CISPR11, 1组, B级环境。 **抗干扰:** 该电机同时满足对一级环境和二级环境的要求。
11 15 18.5 22	**排放:** 该电机为C3类，适用于CISPR11, 2组, A级环境，可以在工业区安装 （第二环境）。 如果配置一个格兰富外部EMC 过滤器，则该泵归属C2类，适用于CISPR11, 1组, A级环境，可以在住宅区（第一环境）安装。 警告 如果电机是安装在住宅区，因为电机可能导致辐射干扰，因此可能需要采取额外措施。 电机功率11、18.5和22 kW满足EN 61000-3-12标准，其前提是在用户电气安装和公共电网之间交界点处的短路容量高于或等于以下表所列数值。确保电机所连接电源的短路容量大于或等于这些数值是安装者或用户的责任。如有必要，请咨询供电单位。

电机功率 [kW]	短路容量 [kVA]
11	1500
15	-
18.5	2700
22	3000

注意 15 kW电机不符合EN 61000-3-12标准。

在电机和电源之间安装一个合适的谐波滤波器可以减小谐波含量电流。这样的话15 kW电机即可满足EN 61000-3-12标准。

抗干扰:
该电机同时满足对一级环境和二级环境的要求。

如需了解进一步信息，请与格兰富联系。

防护等级

- 三相泵，1.1 - 7.5 kW：IP55 （IEC 34-5）。
- 三相泵，11-22 kW：IP55 （IEC 34-5）。

绝缘等级

F （IEC 85）。

环境温度

工作期间:

- 最低-20 °C
- 最大+40 °C，无降额。

存放/运输时:

- -30 °C至+60 °C （0.37 - 7.5 kW）
- -25 °C至+70 °C （11-22 kW）。

相对空气湿度

最大为95 %。

声压级

三相泵:

电机 [kW]	铭牌标称速度 [min^{-1}]	声压等级 [dB(A)]
1.1	2800-3000	60
	3400-3600	65
1.5	2800-3000	65
	3400-3600	70
2.2	2800-3000	65
	3400-3600	70
3.0	2800-3000	65
	3400-3600	70
4.0	2800-3000	70
	3400-3600	75
5.5	2800-3000	75
	3400-3600	80
7.5	2800-3000	65
	3400-3600	69
11	2800-3000	63
	3400-3600	68
15	2800-3000	64
	3400-3600	68
18.5	2800-3000	66
	3400-3600	70
22	2800-3000	66
	3400-3600	70

22. 回收处理

必须按如下规定处理该产品或其部件：

1. 使用当地的公共和个人废物处理设施。
2. 如果当地没有公立或私立废品回收设施，请联系最近的格兰富公司或者维修站。

1. Installation in the USA and Canada

Note

In order to maintain the UL/cURus approval, follow these additional installation instructions.
The UL approval is according to UL508C.

1.1 Electrical connection

1.1.1 Conductors

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

1.1.2 Torques

Power terminals

Motor size [kW]	Thread size	Torque [Nm]
Up to 7.5 kW	M4	2.35
11-22 kW	M4	Min. 2.2 Max. 2.8

Relay, M2.5: 0.5 Nm.
Input control, M2: 0.2 Nm.

1.1.3 Line reactors

Max line reactor size must not exceed 2 mH.

1.1.4 Fuse size/circuit breaker

If a short circuit happens the pump can be used on a mains supply delivering not more than 5000 RMS symmetrical amperes, 600 V maximum.

Fuses

When the pump is protected by fuses they must be rated for 480 V. Maximum sizes are stated in table below.

Motors up to and including 7.5 kW require class K5 UL-listed fuses. Any UL-listed fuse can be used for motors from 11 to 22 kW.

Circuit breaker

When the pump is protected by a circuit breaker this must be rated for a maximum voltage of 480 V. The circuit breaker must be of the "Inverse time" type.
The interrupting rating (RMS symmetrical amperes) must not be less than the values stated in table below.

USA - hp

2-pole	4-pole	Fuse size	Circuit breaker type/model
1	1	25 A	25 A / Inverse time
1.5	1.5	25 A	25 A / Inverse time
2	2	25 A	25 A / Inverse time
3	3	25 A	25 A / Inverse time
5	5	40 A	40 A / Inverse time
7.5	-	40 A	40 A / Inverse time
10	7.5	50 A	50 A / Inverse time
15	15	80 A	80 A / Inverse time
20	20	110 A	110 A / Inverse time
25	25	125 A	125 A / Inverse time
30	-	150 A	150 A / Inverse time

Europe - kW

2-pole	4-pole	Fuse size	Circuit breaker type/model
-	0.55	25 A	25 A / Inverse time
0.75	0.75	25 A	25 A / Inverse time
1.1	1.1	25 A	25 A / Inverse time
1.5	1.5	25 A	25 A / Inverse time
2.2	2.2	25 A	25 A / Inverse time
3	3	25 A	25 A / Inverse time
4	4	40 A	40 A / Inverse time
5.5	-	40 A	40 A / Inverse time
7.5	5.5	50 A	50 A / Inverse time
11	11	80 A	80 A / Inverse time
15	15	110 A	110 A / Inverse time
18.5	18.5	125 A	125 A / Inverse time
22	-	150 A	150 A / Inverse time

1.1.5 Overload protection

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

1.2 General considerations

For installation in humid environment and fluctuating temperatures, it is recommended to keep the pump connected to the power supply continuously. This will prevent moisture and condensation build-up in the terminal box.

Start and stop must be done via the start/stop digital input (terminal 2-3).

产品中有害物质的名称及含量

部件名称	有害物质					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr6+)	多溴联苯 (PBB)	多溴联苯醚 (PBDE)
泵壳	X	O	O	O	O	O
印刷电路板	X	O	O	O	O	O
紧固件	X	O	O	O	O	O
管件	X	O	O	O	O	O
定子	X	O	O	O	O	O
转子	X	O	O	O	O	O

本表格依据 SJ/T 11364 的规定编制

O：表示该有害物质在该部件所有均质材料中的含量均在 GB/T 26572 规定的限量要求以下。
X： 表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 该规定的限量要求。

该产品环保使用期限为 10 年，标识如左图所示。
此环保期限只适用于产品在安装与使用说明书中所规定的条件下工作

GB: EC/EU Declaration of Conformity

We, Grundfos, declare under our sole responsibility that the products CRE, CRIE, CRNE, CRTE, SPKE, MTRE, CME and BMS hp, to which this declaration relates, are in conformity with these Council directives on the approximation of the laws of the EC/EU member states:

CN: EC/EU 产品合格声明书

我们格兰富在我们的全权责任下声明，产品 CRE, CRIE, CRNE, CRTE, SPKE, MTRE, CME 和 BMS hp，即该合格证所指之产品，符合欧共体使其成员国法律趋于一致的以下欧共理事会指令：

— Machinery Directive (2006/42/EC).
Standard used: EN 809: 1998 + A1:2009.

— EMC Directive (2014/30/EU).
Standard used: EN 61800-3:2004/A1:2012.

— Ecodesign Directive (2009/125/EC).

— RoHS Directives: 2011/65/EU and 2015/863/EU
Standard used: EN IEC 63000:2018

This EC/EU declaration of conformity is only valid when published as part of
the Grundfos installation and operating instructions
(publication number 96812943, 98168949 and 96780071).

Bjerringbro, October 1, 2021

Jimm Feldborg
Head of PD Industry
GRUNDFOS Holding A/S
Poul Due Jensens Vej 7
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Person authorized to compile technical file and
empowered to sign the EC/EU declaration of conformity.

UK declaration of conformity

We, Grundfos, declare under our sole responsibility that the products to which the declaration below relates, is in conformity with UK regulations, standards and specifications to which conformity is declared, as listed below:

Valid for Grundfos products:
CRE, CRIE, CRNE, CRTE, SPKE, MTRE, CME and BMS

—Supply of Machinery (Safety) Regulations 2008.
Standard used: BS EN 809: 1998 + A1:2009.

—Electromagnetic Compatibility Regulations 2016.
Standard used: BS EN 61800-3:2004/A1:2012.

—The Ecodesign for Energy-Related Products and Energy Information Regulations 2021

—The Ecodesign for Energy-Related Products and Energy Information (Amendment) (EU Exit) Regulations 2019

—The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2019.
Standard used: BS EN IEC 63000:2018.

This UK declaration of conformity is only valid when accompanying Grundfos instructions.
(Used in publication number 96780071).

Bjerringbro, October 1, 2021

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