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MGE 71, MGE 80, MGE 90

Installation and operating instructions



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GRUNDFOS

GB: EC declaration of conformity

We, Grundfos, declare under our sole responsibility that the products MGE 71, MGE 80 and MGE 90, to which this declaration relates, are in conformity with these Council directives on the approximation of the laws of the EC member states:

— Low Voltage Directive (2006/95/EC).
  Standard used: EN 61800-5-1:2007.
— EMC Directive (2004/108/EC).
  Standard used: EN 61800-3:2005.
— R&TTE Directive (1999/5/EC).
  Standard used: ETSI EN 300 328 V1.7.1 (2006-10).

This EC declaration of conformity is only valid when published as part of the Grundfos installation and operating instructions (publication number 98418360 0813).

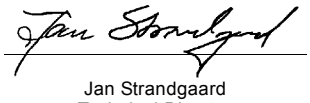
CN: EC 产品合格声明书

我们格兰富在我们的全权责任下声明，产品 MGE 71, MGE 80 和 MGE 90。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：

— 低电压指令 (2006/95/EC)。
  所用标准：EN 61800-5-1:2007。
— 电磁兼容性指令 (2004/108/EC)。
  所用标准：EN 61800-3:2005。
— 无线电设备和电信线端设备指令 (1999/5/EC)。
  所用标准：ETSI EN 300 328 V1.7.1 (2006-10)。

本EC合格性声明仅在作为格兰富安装与操作指导手册 （出版号 98418360 0813）的一部分时有效。

Bjerringbro, 6th March 2013



Jan Strandgaard
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Person authorised to compile technical file and empowered to sign the EC declaration of conformity.

Original installation and operating instructions.

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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

If these instructions are not observed, it may lead to electric shock with consequent risk of serious personal injury or death.



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. Abbreviations and definitions

AI	Analog input.
AL	Alarm, out of range at lower limit.
AO	Analog output.
AU	Alarm, out of range at upper limit.
CIM	Communication interface module.
Current sinking	The ability to draw current into the terminal and guide it towards GND in the internal circuitry.
Current sourcing	The ability to push current out of the terminal and into an external load which must return it to GND.
DI	Digital input.
DO	Digital output.
ELCB	Earth leakage circuit breaker.
FM	Functional module.
GDS	Grundfos Digital Sensor. Factory-fitted sensor in some Grundfos pumps.
GENIbus	Proprietary Grundfos fieldbus standard.
GFCI	Ground fault circuit interrupter.
GND	Ground.
Grundfos Eye	Status indicator light.
LIVE	Low voltage with the risk of electric shock if the terminals are touched.
OC	Open collector: Configurable open-collector output.
PE	Protective earth.
PELV	Protective extra-low voltage. A voltage that cannot exceed ELV under normal conditions and under single-fault conditions, except earth faults in other circuits.
SELV	Safety extra-low voltage. A voltage that cannot exceed ELV under normal conditions and under single-fault conditions, including earth faults in other circuits.

3. General description

Grundfos MGE 71, MGE 80 and MGE 90 are frequency-controlled permanent-magnet motors for single-phase or three-phase mains connection. The motors incorporate a PI controller.

The motors can be connected to a signal from an external sensor and a setpoint signal enabling control in closed loop. The motors can also be used for an open-loop system in which the setpoint signal is used as a speed control signal.

The motors are only intended for machines with a square torque characteristic, such as ventilators and centrifugal pumps.

The motors incorporate a control panel which is available in various versions. See section *8. User interfaces* for further information.

Detailed motor settings are made with the wireless Grundfos R100 remote control or Grundfos GO Remote.
Furthermore, important operating parameters can be read via the R100 or Grundfos GO Remote.

The motors incorporate a functional module. The functional module is available in various versions with different inputs and outputs. See section *6.5 Functional modules* for further information.

As an accessory option, the motors can be fitted with a Grundfos CIM module. A CIM module is an add-on communication interface module. The CIM module enables data transmission between the motor and an external system, for example a BMS or SCADA system. The CIM module communicates via fieldbus protocols.

3.1 Radio communication

This product incorporates a radio module for remote control which is a class 1 device and can be used anywhere in the EU member states without restrictions.

For use in USA and Canada, see page 35.

Note ***Some variants of this product and products sold in China and Korea have no radio module.***

This product can communicate with the Grundfos GO Remote and other MGE motors of the same type via the built-in radio module.

In some cases, an external antenna may be required.
Only Grundfos-approved external antennas may be connected to this product, and only by a Grundfos-approved installer.

3.2 Battery

A Li-ion battery is fitted in the FM 300 functional module.

The Li-ion battery of the FM 300 module complies with the Battery Directive (2006/66/EC). The battery does not contain mercury, lead and cadmium.

4. Identification

The motor can be identified by means of the nameplate on the terminal box.

4.1 Nameplate

The motor nameplate is located on the side of the terminal box. See fig. 1, pos. A.

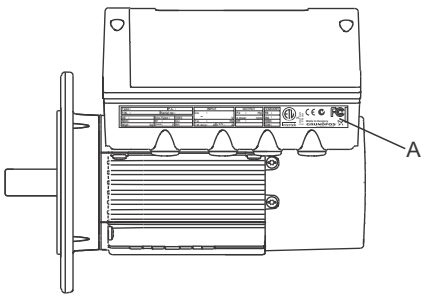


Fig. 1 Nameplate location

Figure 2 shows the nameplate. The position numbers refer to the table below.

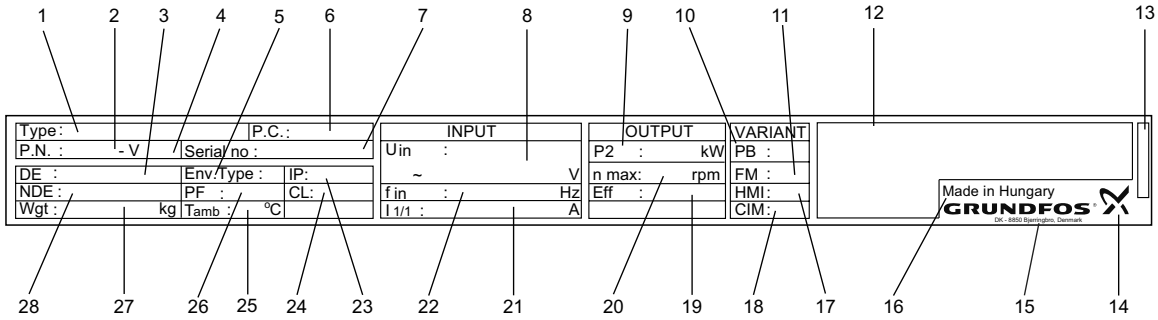


Fig. 2 Nameplate, MGE motors

Pos.	Description
1	Type designation
2	Product number
3	Drive-end bearing
4	Version number
5	Environmental type
6	Production code (year and week)
7	Serial number
8	Supply voltage [V]
9	Rated power output [kW]
10	Power board
11	Functional module type
12	CE mark and approvals
13	Part number of nameplate
14	Grundfos logo

Pos.	Description
15	Grundfos company address
16	Country of manufacture
17	Human Machine Interface type
18	CIM module type
19	Motor efficiency
20	Maximum motor speed [min^{-1}]
21	Maximum input current [A]
22	Mains frequency [Hz]
23	Enclosure class according to IEC 60034-5
24	Insulation class according to IEC 62114
25	Maximum ambient temperature [°C]
26	Power factor
27	Weight [kg]
28	Non-drive-end bearing

4.2 Type key

Code	Example	MG	E	71	M	A	2-	14	FT	85	-H	A

Type of motor unit

[ ]	Complete motor with terminal box
B	Basic motor unit without terminal box
K	Kit for basic motor unit without terminal box

MG	Motor Grundfos
E	Electronic control
71 80 90	Frame size according to IEC (centre line height of motor shaft in mm, foot-mounted motor)

Size of foot

[ ]	Not defined for frame sizes 71 and 80
S	Small
M	Medium
L	Large

	Length of stator core	Rated motor power, P2 [kW] 1450-2000 min^{-1}	2900-4000 min^{-1}	4000-5900 min^{-1}
A	30 mm	0.37	0.75	1.1
B	45 mm	0.55	1.1	1.5
C	60 mm	0.75	1.5	2.2
D	85 mm	1.1	2.2	-

Maximum speed

1	5900 min^{-1}
2	4000 min^{-1}
3	3600 min^{-1}
4	2000 min^{-1}

Shaft end diameter [mm]

Flange version

[ ]	Foot-mounted (B3)
FT	Tapped-hole flange
FF	Free-hole flange

Pitch circle diameter [mm], flange version

[ ]	B3

Model designation

H	Single-phase
I	Three-phase

Version designation

A	First version

5. Mechanical installation

Warning

Installation and operation must comply with local regulations and accepted codes of good practice.

5.1 Handling

Warning

Observe local regulations setting limits for manual lifting or handling.

Warning

Before lifting the motor, pay attention to the motor weight stated on the nameplate.

Caution ***Do not lift the motor by the terminal box.***

When lifting the motor, always use the eyebolts, if fitted. Alternatively, lift the motor with both hands.

5.2 Mounting

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

Note ***In order to maintain the UL mark, additional installation procedures must be followed.***
See page 35.

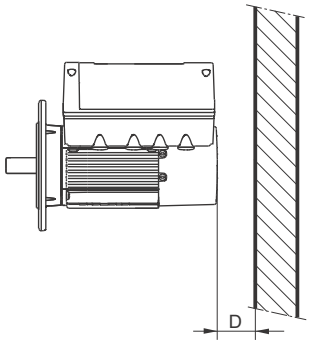
5.3 Cable entries

The motor has four M20 screwed cable entries fitted with blind plugs from factory. Various cable glands can be ordered from Grundfos as accessory kits.

5.4 Ensuring motor cooling

Note

In order to ensure sufficient cooling of the motor, the distance (D) between the end of the fan cover and a wall or other fixed objects must always be at least 50 mm, irrespective of motor size. See fig. 3.



TM05 5236 3512

Fig. 3 Minimum distance (D) from the motor to a wall or other fixed objects

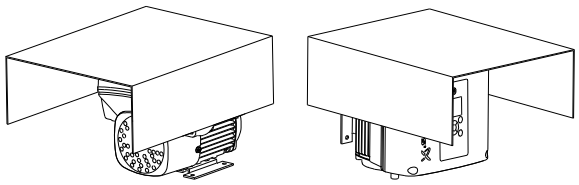
5.5 Outdoor installation

When installed outdoors, the motor must be provided with a suitable cover to avoid condensation on the electronic components. See fig. 4.

Note

When fitting a cover to the motor, observe the guideline in section 5.4 Ensuring motor cooling.

The cover must be sufficiently large to ensure that the motor is not exposed to direct sunlight, rain or snow. Grundfos does not supply covers. We therefore recommend that you have a cover built for the specific application. In areas with high air humidity, we recommend that you enable the built-in standstill heating function. See section *Standstill heating*, page 27.



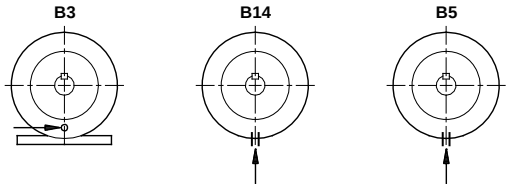
TM05 3496 3512

Fig. 4 Examples of covers (not supplied by Grundfos)

5.6 Drain holes

When the motor is installed in moist surroundings or areas with high air humidity, the bottom drain hole should be open.
The enclosure class of the motor will then be lower. This helps prevent condensation in the motor as it will make the motor self-venting and allow water and humid air to escape.

The motor has a plugged drain hole on the drive side. The flange can be turned 90 ° to both sides or 180 °.



TM02 9037 1604

Fig. 5 Drain holes

6. Electrical installation

Carry out the electrical connection according to local regulations.

Check that the supply voltage and frequency correspond to the values stated on the nameplate.

Warning

Do not make any connections in the terminal box unless the power supply has been switched off for at least 5 minutes.



Make sure that the power supply cannot be accidentally switched on.

The motor must be earthed and protected against indirect contact in accordance with local regulations.

If the power supply cable is damaged, it must be replaced by the manufacturer, the manufacturer's service partner or a similarly qualified person.

Note

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

6.1 Protection against electric shock, indirect contact

Warning



The motor must be earthed and protected against indirect contact in accordance with local regulations.

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

6.1.1 Protection against mains voltage transients

The motor is protected against mains voltage transients in accordance with EN 61800-3.

6.1.2 Motor protection

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

6.2 Cable requirements

6.2.1 Cable size

Single-phase supply

1.5 mm^2 / 12-14 AWG.

Three-phase supply

6-10 mm^2 / 10-8 AWG.

6.2.2 Conductors

Type

Stranded copper conductors only.

Temperature rating

Temperature rating for conductor insulation: 60 °C (140 °F).

Temperature rating for outer cable sheath: 75 °C (167 °F).

6.3 Mains supply

6.3.1 Single-phase supply voltage

Single-phase motors are available for the voltages below:

- 1 x 200-240 V - 10 %/+ 10 %, 50/60 Hz, PE
- 1 x 90-240 V - 10 %/+ 10 %, 50/60 Hz, PE or 30-300 VDC (power supply from a renewable-energy source).

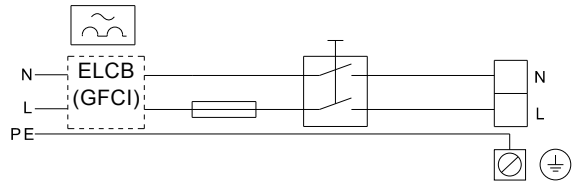
Check that the supply voltage and frequency correspond to the values stated on the nameplate.

Note ***If the motor is supplied through an IT network, a dedicated IT network motor should be used. Contact Grundfos.***

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

For maximum backup fuse, see section *15.1 Supply voltage*.

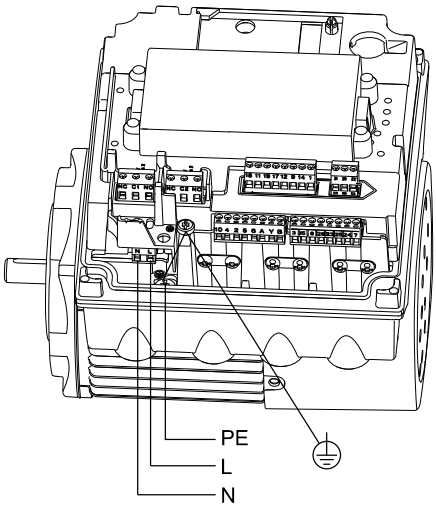
MGE 71 and MGE 80



TM05 4034 1912

Fig. 6 Example of a mains-connected motor with mains switch, backup fuse and additional protection

MGE 71 and MGE 80



TM05 3494 1512

Fig. 7 Mains connection, single-phase motors

6.3.2 Three-phase supply voltage

- 3 x 380-500 V - 10 %/+ 10 %, 50/60 Hz, PE.

Caution ***In order to avoid loose connections, ensure that the terminal block for L1, L2 and L3 is pressed home in its socket when the supply cable has been connected.***

Note ***Corner grounding is not allowed for supply voltages above 3 x 480 V, 50/60 Hz.***

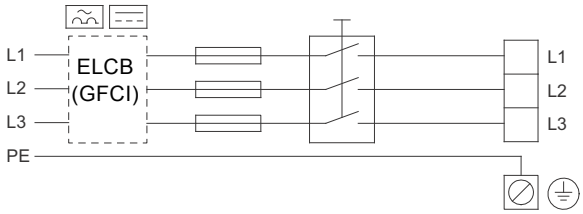
Check that the supply voltage and frequency correspond to the values stated on the nameplate.

Note ***If the motor is supplied through an IT network, a dedicated IT network motor should be used. Contact Grundfos.***

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

For maximum backup fuse, see section *16.1 Supply voltage*.

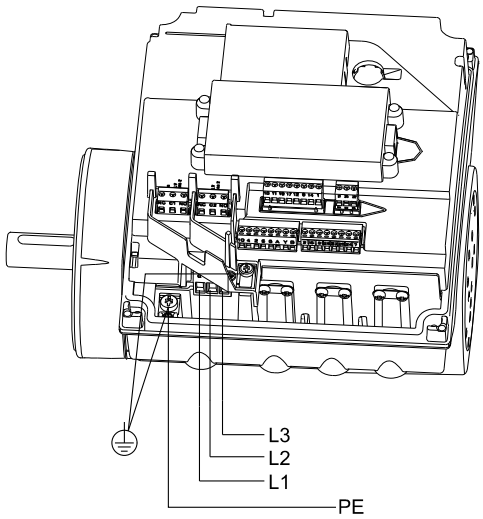
MGE 90



TM05 3942 1812

Fig. 8 Example of a mains-connected motor with mains switch, backup fuses and additional protection

MGE 90



TM05 3495 1512

Fig. 9 Mains connection, three-phase motors

6.4 Additional protection

6.4.1 Single-phase motors

If the motor is connected to an electric installation where an earth leakage circuit breaker (ELCB) or ground fault circuit interrupter (GFCI) is used as additional protection, this circuit breaker or interrupter must be marked with the following symbol:



ELCB
(GFCI)

Note

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

The leakage current of the motor can be found in section *15.2 Leakage current*.

6.4.2 Motors supplied from a renewable-energy source

This section only applies to motor variants designed for supply from a renewable-energy source (1 x 90-240 V - 10 %/+ 10 %, 50/60 Hz, PE or 30-300 VDC).

Overvoltage and undervoltage protection

Overvoltage and undervoltage may occur in case of unstable power supply or a faulty installation. The motor will be stopped if the voltage falls outside the permissible voltage range. The motor will automatically be restarted when the voltage is again within the permissible voltage range. Therefore, no additional protection relay is required.

Note

The motor is protected against transients from the power supply according to EN 61800-3. In areas with high lightning intensity, we recommend external lightning protection.

Overload protection

If the upper load limit is exceeded, the motor will automatically compensate for this by reducing the speed and stop if the overload condition persists.

The motor will remain stopped for 8 seconds. After this period, the motor will automatically attempt to restart. The overload protection prevents damage to the motor. Consequently, no additional motor protection is required.

Overtemperature protection

The electronic unit has a built-in temperature sensor as an additional protection. When the temperature rises above a certain level, the motor will automatically compensate for this by reducing the speed and stop if the temperature keeps rising. The motor will remain stopped for 8 seconds. After this period, the motor will automatically attempt to restart.

6.4.3 Three-phase motors

If the motor is connected to an electric installation where an earth leakage circuit breaker (ELCB) or ground fault circuit interrupter (GFCI) is used as additional protection, this circuit breaker or interrupter must be of the following type:

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

For these motors an earth leakage circuit breaker or ground fault circuit interrupter, type B, must be used.
This circuit breaker or interrupter must be marked with the following symbols:



ELCB
(GFCI)

Note

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

The leakage current of the motor can be found in section *16.2 Leakage current*.

Protection against phase unbalance

The motor must be connected to a power supply with a quality corresponding to IEC 60146-1-1, class C, to ensure correct motor operation at phase unbalance.
This also ensures long life of the components.

6.5 Functional modules

Various functional modules are available for this product.
The selection of module depends on the application and the required number of inputs and outputs.

Possible functional modules:

- Basic functional module (FM 100)
- Standard functional module (FM 200)
- Advanced functional module (FM 300).

6.6 Connection terminals on functional modules

The descriptions and terminal overviews in this section apply to both single- and three-phase motors.

For maximum tightening torques, see section *Torques*, page 33.

6.6.1 Basic functional module (FM 100)

The FM 100 has only the most necessary inputs for closed- and open-loop operation. The module also enables communication via a GENIbus connection.

The FM 100 has these connections:

- analog voltage input
- two digital inputs or one digital input and one open-collector output
- GENIbus connection.

See fig. 10.

Note

Digital input 1 is factory-set to be start/stop input where open circuit will result in stop. A jumper has been factory-fitted between terminals 2 and 6. Remove the jumper if digital input 1 is to be used as external start/stop or any other external function.

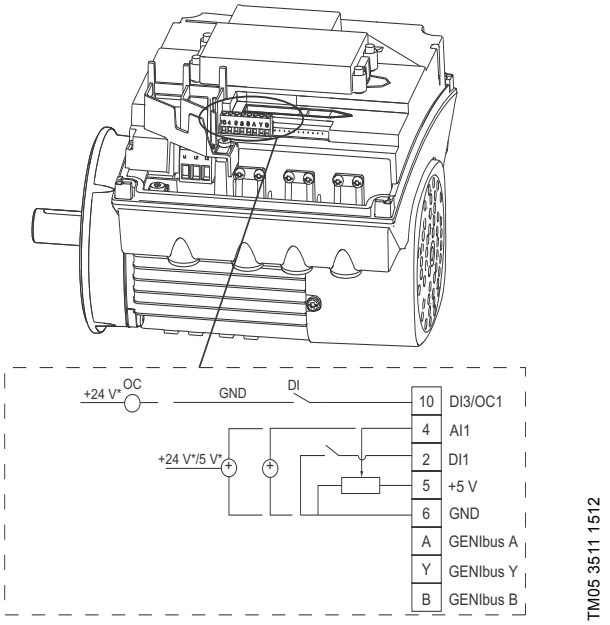
Note

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

- **Inputs and output**

  The inputs and output are internally separated from the mains-conducting parts by reinforced insulation and galvanically separated from other circuits.
  All control terminals are supplied by safety extra-low voltage (SELV), thus ensuring protection against electric shock.
- **Mains supply** (terminals N, PE, L or L1, L2, L3, PE).

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



* If an external supply source is used, there must be a connection to GND.

Fig. 10 Connection terminals, FM 100

Terminal	Type	Function
10	DI3/OC1	Digital input/output, configurable. Open collector: Max. 24 V resistive or inductive.
4	AI1	Analog input: 0.5 - 3.5 V / 0-5 V / 0-10 V
2	DI1	Digital input, configurable
5	+5 V	Supply to potentiometer and sensor
6	GND	Ground
A	GENIbus, A	GENIbus, A (+)
Y	GENIbus, Y	GENIbus, GND
B	GENIbus, B	GENIbus, B (-)

6.6.2 Standard functional module (FM 200)

The FM 200 has more inputs and outputs than the FM 100 and is suitable for even more demanding applications.

The FM 200 has these connections:

- two analog inputs
- two digital inputs or one digital input and one open-collector output
- Grundfos Digital Sensor input and output
- two signal relay outputs
- GENIbus connection.

See fig. 11.

Note

Digital input 1 is factory-set to be start/stop input where open circuit will result in stop. A jumper has been factory-fitted between terminals 2 and 6. Remove the jumper if digital input 1 is to be used as external start/stop or any other external function.

Note

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

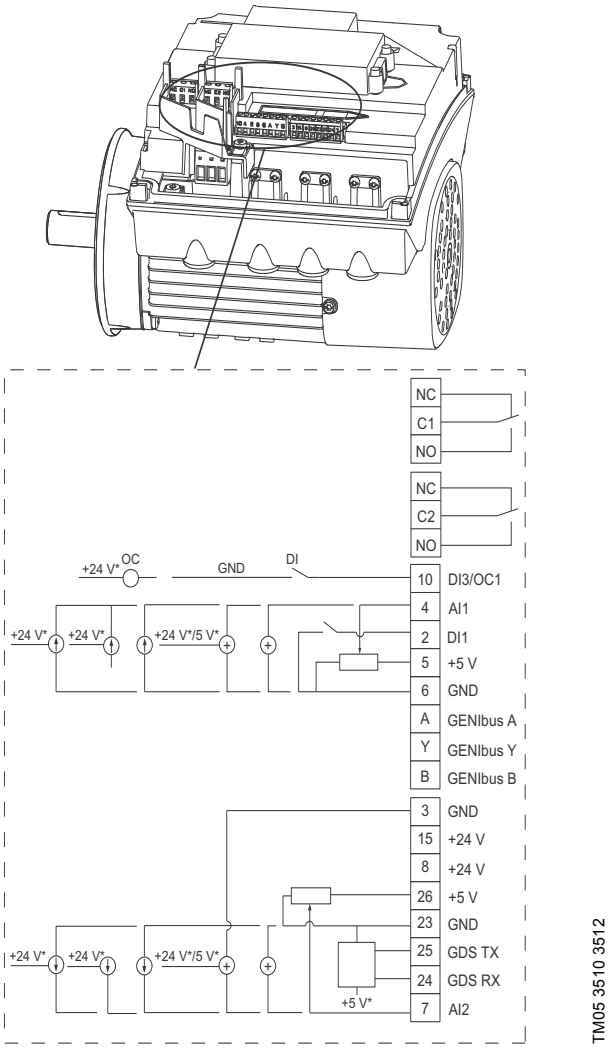
- **Inputs and outputs**

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

- **Signal relay outputs**
  - **Signal relay 1:**
    LIVE:
    Mains supply voltages up to 250 VAC can be connected to this output.
    SELV:
    The output is galvanically separated from other circuits. Therefore, the supply voltage or safety extra-low voltage can be connected to the output as desired.
  - **Signal relay 2:**
    SELV:
    The output is galvanically separated from other circuits. Therefore, the supply voltage or safety extra-low voltage can be connected to the output as desired.

- **Mains supply** (terminals N, PE, L or L1, L2, L3, PE).

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



* If an external supply source is used, there must be a connection to GND.

Fig. 11 Connection terminals, FM 200

Terminal	Type	Function
NC	Normally closed contact	Signal relay 1 (LIVE or SELV)
C1	Common	
NO	Normally open contact	
NC	Normally closed contact	Signal relay 2 (SELV only)
C2	Common	
NO	Normally open contact	
10	DI3/OC1	Digital input/output, configurable. Open collector: Max. 24 V resistive or inductive.
4	AI1	Analog input: 0-20 mA / 4-20 mA 0.5 - 3.5 V / 0-5 V / 0-10 V
2	DI1	Digital input, configurable
5	+5 V	Supply to potentiometer and sensor
6	GND	Ground
A	GENIbus, A	GENIbus, A (+)
Y	GENIbus, Y	GENIbus, GND
B	GENIbus, B	GENIbus, B (-)
3	GND	Ground
15	+24 V	Supply
8	+24 V	Supply
26	+5 V	Supply to potentiometer and sensor
23	GND	Ground
25	GDS TX	Grundfos Digital Sensor output
24	GDS RX	Grundfos Digital Sensor input
7	AI2	Analog input: 0-20 mA / 4-20 mA 0.5 - 3.5 V / 0-5 V / 0-10 V

6.6.3 Advanced functional module (FM 300)

The FM 300 has a number of inputs and outputs enabling the motor to be used in advanced applications where many inputs and outputs are required.

The FM 300 has these connections:

- three analog inputs
- one analog output
- two dedicated digital inputs
- two configurable digital inputs or open-collector outputs
- Grundfos Digital Sensor input and output
- two Pt100/1000 inputs
- LiqTec sensor inputs
- two signal relay outputs
- GENIbus connection.

See fig. 12.

Note

Digital input 1 is factory-set to be start/stop input where open circuit will result in stop. A jumper has been factory-fitted between terminals 2 and 6. Remove the jumper if digital input 1 is to be used as external start/stop or any other external function.

Note

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

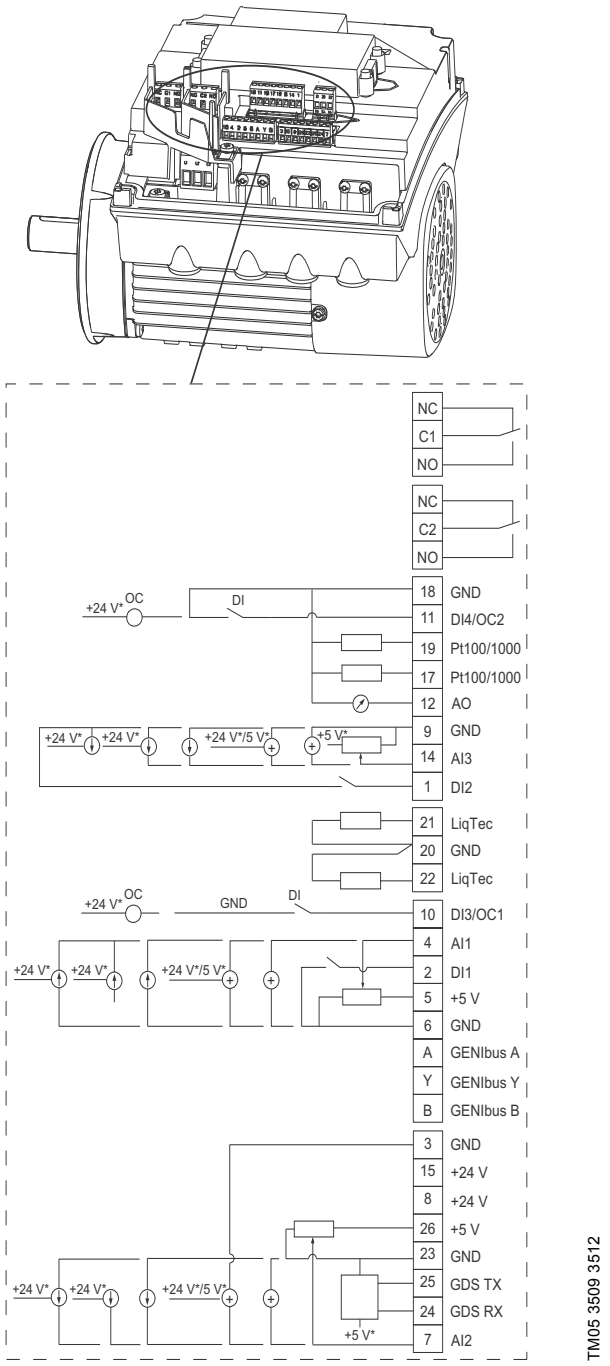
- **Inputs and outputs**

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

- **Signal relay outputs**
  - **Signal relay 1:**
    LIVE:
    Mains supply voltages up to 250 VAC can be connected to this output.
    SELV:
    The output is galvanically separated from other circuits. Therefore, the supply voltage or safety extra-low voltage can be connected to the output as desired.
  - **Signal relay 2:**
    SELV:
    The output is galvanically separated from other circuits. Therefore, the supply voltage or safety extra-low voltage can be connected to the output as desired.

- **Mains supply** (terminals N, PE, L or L1, L2, L3, PE).

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



* If an external supply source is used, there must be a connection to GND.

Fig. 12 Connection terminals, FM 300

Terminal	Type	Function
NC	Normally closed contact	Signal relay 1 (LIVE or SELV)
C1	Common	
NO	Normally open contact	
NC	Normally closed contact	Signal relay 2 (SELV only)
C2	Common	
NO	Normally open contact	
18	GND	Ground
11	DI4/OC2	Digital input/output, configurable. Open collector: Max. 24 V resistive or inductive.
19	Pt100/1000 input 2	Pt100/1000 sensor input
17	Pt100/1000 input 1	Pt100/1000 sensor input
12	AO	Analog output: 0-20 mA / 4-20 mA 0-10 V
9	GND	Ground
14	AI3	Analog input: 0-20 mA / 4-20 mA 0-10 V
1	DI2	Digital input, configurable
21	LiqTec sensor input 1	LiqTec sensor input (white conductor)
20	GND	Ground (brown and black conductors)
22	LiqTec sensor input 2	LiqTec sensor input (blue conductor)
10	DI3/OC1	Digital input/output, configurable. Open collector: Max. 24 V resistive or inductive.
4	AI1	Analog input: 0-20 mA / 4-20 mA 0.5 - 3.5 V / 0-5 V / 0-10 V
2	DI1	Digital input, configurable
5	+5 V	Supply to potentiometer and sensor
6	GND	Ground
A	GENIbus, A	GENIbus, A (+)
Y	GENIbus, Y	GENIbus, GND
B	GENIbus, B	GENIbus, B (-)
3	GND	Ground
15	+24 V	Supply
8	+24 V	Supply
26	+5 V	Supply to potentiometer and sensor
23	GND	Ground
25	GDS TX	Grundfos Digital Sensor output
24	GDS RX	Grundfos Digital Sensor input
7	AI2	Analog input: 0-20 mA / 4-20 mA 0.5 - 3.5 V / 0-5 V / 0-10 V

6.7 Signal cables

- Use screened cables with a cross-sectional area of min. 0.5 mm^2 and max. 1.5 mm^2 for external on/off switch, digital inputs, setpoint and sensor signals.
- Connect the screens of the cables to frame at both ends with good connection. The screens must be as close as possible to the terminals. See fig. 13.

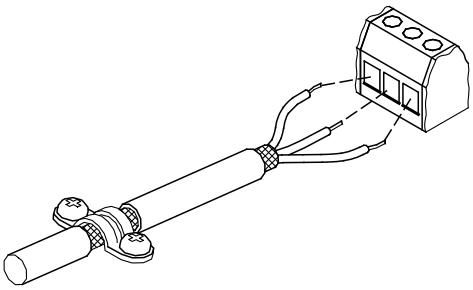


Fig. 13 Stripped cable with screen and wire connections

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

6.8 Bus connection cable

6.8.1 New installations

For the bus connection, use a screened 3-core cable with a cross-sectional area of min. 0.5 mm^2 and max. 1.5 mm^2.

- If the motor is connected to a unit with a cable clamp which is identical to the one on the motor, connect the screen to this cable clamp.
- If the unit has no cable clamp as shown in fig. 14, leave the screen unconnected at this end.

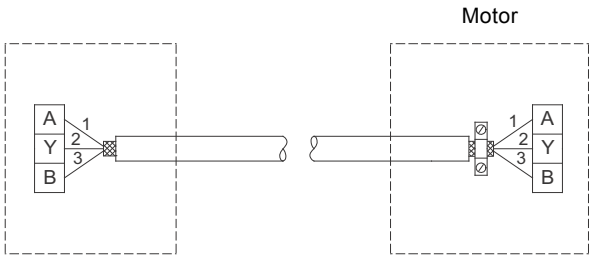


Fig. 14 Connection with screened 3-core cable

6.8.2 Replacing an existing motor

- If a screened 2-core cable is used in the existing installation, connect it as shown in fig. 15.

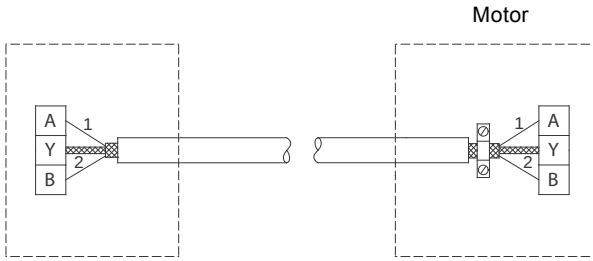


Fig. 15 Connection with screened 2-core cable

- If a screened 3-core cable is used in the existing installation, follow the instructions in section *6.8.1 New installations*.

7. Operating conditions

7.1 Maximum number of starts and stops

The number of starts and stops via the power supply must not exceed four times per hour.

When switched on via the power supply, the motor will start after approx. 5 seconds.

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

When started via an external on/off switch, the motor will start immediately.

7.2 Ambient temperature

7.2.1 Ambient temperature during storage and transportation

Minimum -30 °C

Maximum +60 °C.

7.2.2 Ambient temperature during operation

Minimum -20 °C

Maximum +50 °C.

The motor can operate with the rated power output (P2) at 50 °C, but continuous operation at higher temperatures will reduce the expected product life. If the motor is to operate at ambient temperatures between 50 and 60 °C, an oversized motor must be selected. Contact Grundfos for further information.

7.3 Installation altitude

Caution ***The motor must not be installed more than 2000 metres above sea level.***

Installation altitude is the height above sea level of the installation site.

- Motors installed up to 1000 metres above sea level can be loaded 100 %.
- Motors installed more than 1000 metres above sea level must not be fully loaded due to the low density and consequent low cooling effect of the air. See fig. 16.

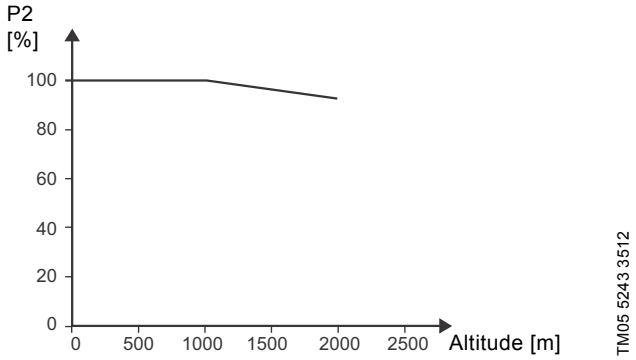


Fig. 16 Derating of motor output (P2) in relation to altitude above sea level

7.4 Air humidity

Maximum air humidity: 95 %.

If the air humidity is constantly high and above 85 %, the drain holes in the drive-end flange should be open.
See section *5.6 Drain holes*.

7.5 Motor cooling

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

- Position the motor in such a way that adequate cooling is ensured. See section *5.4 Ensuring motor cooling*.
- The temperature of the cooling air must not exceed 50 °C.
- Keep cooling fins and fan blades clean.

8. User interfaces

Warning

The product may be so hot that only the buttons should be touched to avoid burns.

Motor settings can be made by means of the following user interfaces:

Control panels

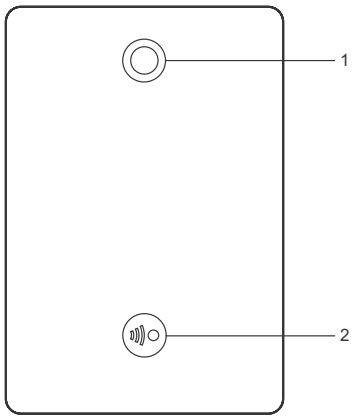
- Basic control panel.
  See section *8.1 Basic control panel*.
- Standard control panel.
  See section *8.2 Standard control panel*.

Remote controls

- Grundfos R100 remote control.
  See section *8.4 R100 remote control*.
- Grundfos GO Remote.
  See section *8.5 Grundfos GO Remote*.

If the power supply to the motor is switched off, the motor settings will be stored.

8.1 Basic control panel



TM05 4847 2712

Fig. 17 Basic control panel

Pos.	Symbol	Description
1		Grundfos Eye Shows the operating status of the motor. See section *12. Grundfos Eye* for further information.
2		Enables radio communication with the Grundfos GO Remote and other MGE motors of the same type.

8.1.1 Settings

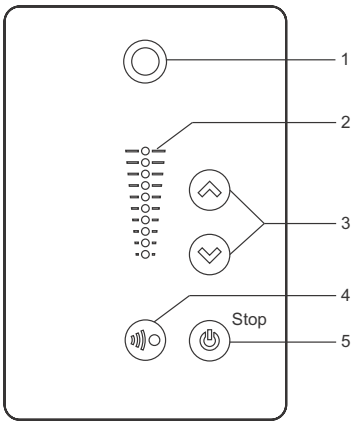
All settings are to be made with the Grundfos R100 or Grundfos GO Remote.

8.1.2 Resetting of alarms and warnings

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

- Via the digital input if it has been set to "Alarm resetting".
- Switch off the power supply until the indicator lights are off.
- Switch the external start/stop input off and then on again.
- With the R100. See section *Alarm*, page 19.
- With the Grundfos GO Remote.

8.2 Standard control panel



TM05 4848 3512

Fig. 18 Standard control panel

Pos.	Symbol	Description
1		Grundfos Eye Shows the operating status of the motor. See section *12. Grundfos Eye* for further information.
2	-	Light fields for indication of setpoint.
3		Changes the setpoint.
4		Enables radio communication with the Grundfos GO Remote and with other MGE motors of the same type.
5		Makes the motor ready for operation/starts and stops. **Start:** If the button is pressed when the motor is stopped, the motor will only start if no other functions with higher priority have been enabled. See section *11. Priority of settings*. **Stop:** If the button is pressed when the motor is running, the motor will always be stopped. When the motor is stopped, the "Stop" text next to the button will illuminate.

8.2.1 Setpoint setting

Set the desired setpoint of the motor by pressing ⌃ or ⌄. The green light fields on the control panel will indicate the setpoint set.

Motor in controlled-operation mode

The following example applies to a pump in an application where a pressure sensor gives a feedback to the pump. The sensor is set up manually, and the pump does not automatically register a connected sensor.

Figure 19 shows that the light fields 5 and 6 are activated, indicating a desired setpoint of 3 bar with a sensor measuring range from 0 to 6 bar. The setting range is equal to the sensor measuring range.

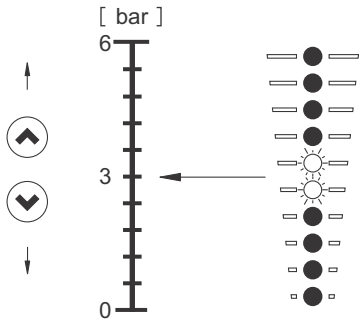


Fig. 19 Setpoint set to 3 bar, pressure-control mode

Motor in uncontrolled-operation mode

In uncontrolled-operation mode, the motor output will lie between max. and min. speed. See fig. 20.

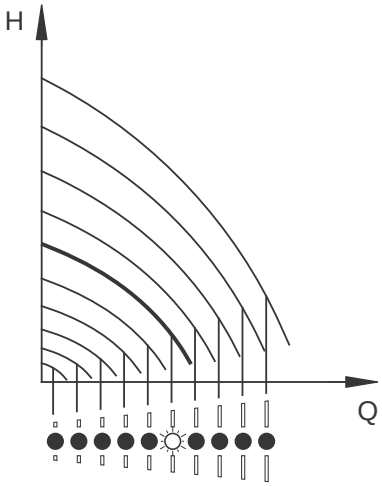


Fig. 20 Motor in uncontrolled-operation mode

Setting to max. speed

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

To change back, press ⌄ continuously until the desired setpoint is indicated.

Example: Motor set to max. speed.

Figure 21 shows that the top light field is flashing, indicating max. speed.

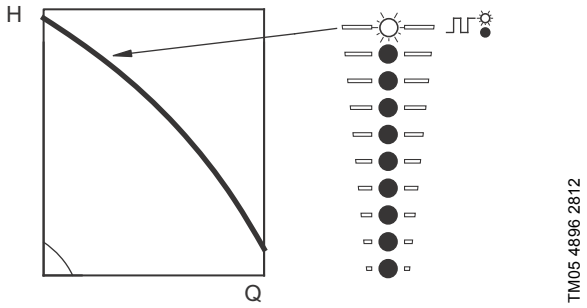


Fig. 21 Max. speed duty

Setting to min. speed

Press ⌄ continuously to change over to the min. speed (bottom light field flashes). When the bottom light field is on, press ⌄ for 3 seconds until the light field starts flashing.

To change back, press ⌃ continuously until the desired setpoint is indicated.

Example: Motor set to min. speed.

Figure 22 shows that the bottom light field is flashing, indicating min. speed.

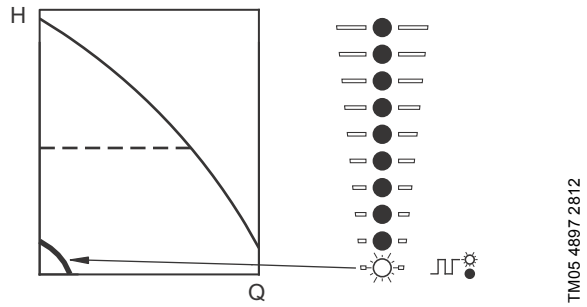


Fig. 22 Min. speed duty

8.2.2 Start/stop of motor

Stop the motor by pressing ⏻. When the motor is stopped, the "Stop" text next to the button will illuminate. The motor can also be stopped by continuously pressing ⌄ until none of the light fields are on.

Start the motor by pressing ⏻ or by continuously pressing ⌃ until the desired setpoint is indicated.

If the motor has been stopped by pressing ⏻, it can only be given free to operation by pressing ⏻ again.

If the motor has been stopped by pressing ⌄, it can only be restarted by pressing ⌃.

The motor can also be stopped with the R100, Grundfos GO Remote or via a digital input set to "External stop". See section *11. Priority of settings*.

8.2.3 Resetting of alarms and warnings

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

- Via the digital input if it has been set to "Alarm resetting".
- Briefly press ⌃ or ⌄ on the motor. This will not change the setting of the motor.
  A fault indication cannot be reset by pressing ⌃ 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.
- With the R100. See section *Alarm*, page 19.
- With the Grundfos GO Remote.

8.3 Changing the position of the control panel

It is possible to turn the control panel 180 °. Follow the instructions below.

1. Loosen the four screws (TX25) holding the terminal box cover.

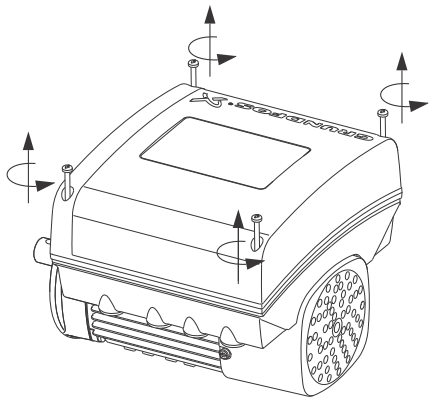


Fig. 23 Loosening the screws

2. Remove the terminal box cover.

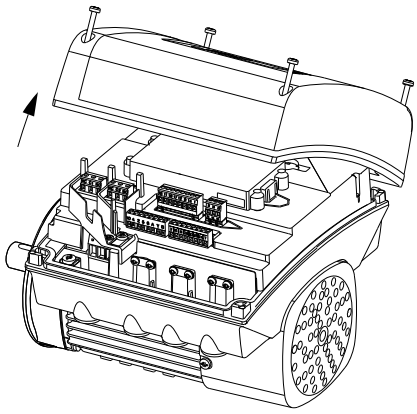


Fig. 24 Removing the terminal box cover

3. Press and hold in the two locking tabs (pos. A) while gently lifting the plastic cover (pos. B).

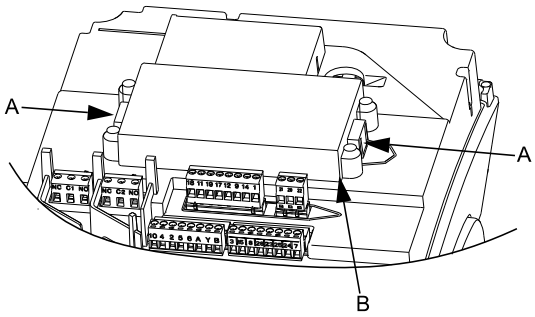


Fig. 25 Lifting the plastic cover

4. Turn the plastic cover 180 °.

Note ***Do not twist the cable more than 90 °.***

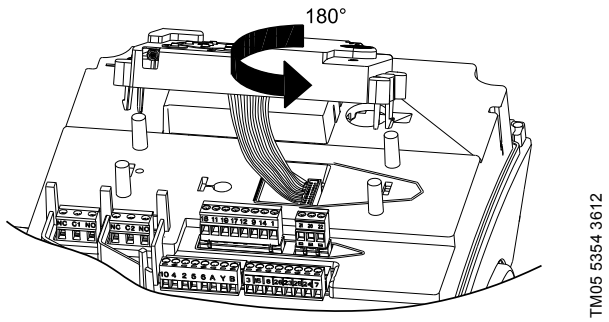


Fig. 26 Turning the plastic cover

5. Re-position the plastic cover correctly on the four rubber pins (pos. C). Make sure that the locking tabs (pos. A) are placed correctly.

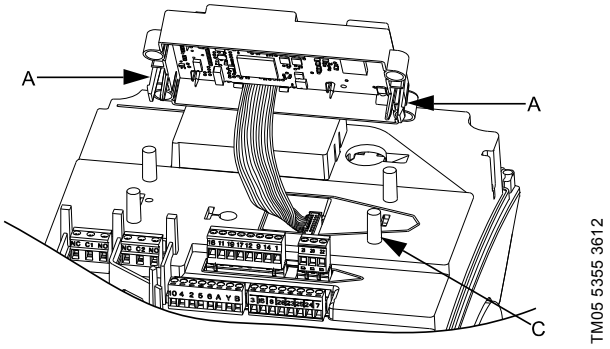


Fig. 27 Re-positioning the plastic cover

6. Fit the terminal box cover, and make sure that it is also turned 180 ° so that the buttons on the control panel are aligned with the buttons on the plastic cover.
   Tighten the four screws (TX25) with 5 Nm.

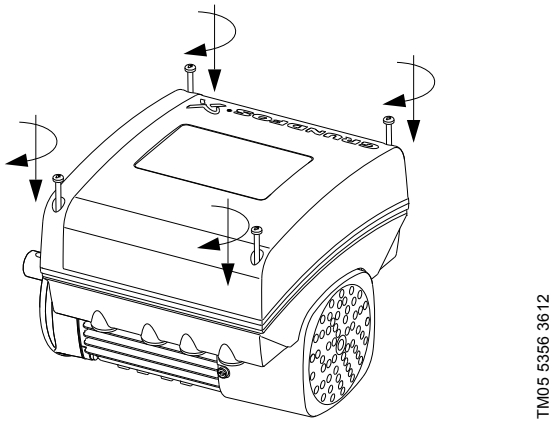
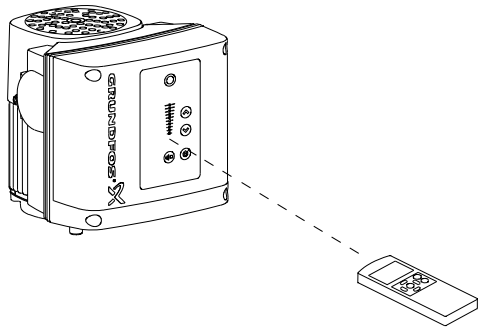


Fig. 28 Fitting the terminal box cover

8.4 R100 remote control

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



TM05 3933 1712

Fig. 29 R100 communicating with the motor via infrared light

During communication, the R100 must be pointed at the control panel. When the R100 communicates with the motor, the indicator light in the middle of the Grundfos Eye will flash green. See page 30.

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

The displays are divided into four parallel menus:

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

See section *8.4.1 R100 menu structure*.

8.4.1 R100 menu structure

0. GENERAL

- Switch off R100
- Return to start
- Delete all changes
- Store settings
- Call up settings
- Store status data
- Call up status data

1. OPERATION

- *Setpoint*
- *Operating mode*
- *Manual speed*
- *Alarm*
- *Warning*
- *Alarm log 1 to 5*
- *Warning log 1 to 5*

2. STATUS

- *Actual setpoint and external setpoint*
- *Operating mode*
- *Actual controlled value*
- *Analog input 1, 2 and 3*
- *Pt100/1000 input 1 and 2*
- *Speed*
- *Power input and power consumption*
- *Operating hours*
- *Replace motor bearings*
- *Motor current*

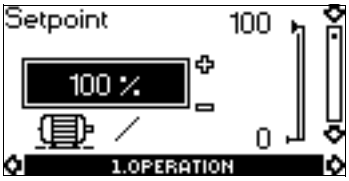
3. INSTALLATION

- *Control mode*
- *Controller*
- *Signal relay 1 and 2*
- *Buttons on motor*
- *Number*
- *Radio communication*
- *Digital input 1 and 2, Function*
- *Digital input/output 3 and 4, State*
- *Digital input/output 3 and 4, Function*
- *Analog input 1, 2 and 3, Function*
- *Analog input 1, 2 and 3, Measured parameter*
- *Analog input 1, 2 and 3*
- *Pt100/1000 input 1 and 2, Function*
- *Pt100/1000 input 1 and 2, Measured parameter*
- *Operating range*
- *Ramps*
- *Direction of rotation*
- *Skip band 1*
- *Skip band 2*
- *Motor bearing monitoring*
- *Motor bearings*
- *Standstill heating*

8.4.2 OPERATION menu

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

Setpoint



Set the desired setpoint in this display.

- Setpoint set
- Actual setpoint
- Actual value

The following symbols of motor operating condition may appear in the display:

Symbol	Operating condition
	Acceleration
	Deceleration
	Reduced operation during acceleration
	Reduced operation during deceleration
	Reduced setpoint
	Setpoint
	Stop

Open-loop operation

If the motor has been set to open-loop operation, the setpoint is set in % of the maximum possible speed of the motor.

The setting range will lie between min. speed and max. speed, for instance between 12 and 67 % of the maximum possible speed. See the example in fig. 30.

Closed-loop operation

If the motor has been set to closed-loop operation, the setpoint is set in the measuring unit used by the sensor.

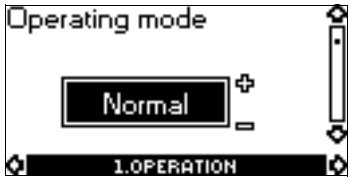
The setting range lies between the set minimum and maximum sensor values.

If the motor is connected to an external setpoint signal, the value in this display will be the maximum value of the external setpoint signal. See section *9. External setpoint signal*.

If the motor is controlled via external signals or a bus, this will be indicated in the display if setpoint setting is attempted.

In this case, the number of possible settings will be reduced. See section *11. Priority of settings*.

Operating mode

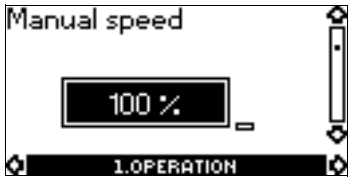


Select one of the following operating modes:

- Stop
- Min. (min. speed)
- Normal (duty)
- Max. (max. speed)
- Manual (operation).

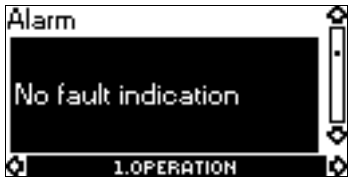
The operating modes can be selected without changing the setpoint setting.

Manual speed



In this display, the motor speed can be set in %. When the operating mode has been set to "Manual", the motor will run at the set speed.

Alarm



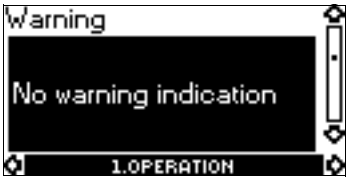
In case of an alarm, the cause will appear in the display together with a fault code.

Possible alarms:

Alarm	Fault code
Blocked pump	51
Internal communication fault	76
Internal fault	83, 85, 163
Electronics temperature too high	66
Sensor signal outside signal range	88
Undervoltage	40
Overvoltage	32
Overload	49
Too high motor temperature	65
External fault	3
Signal outside range, analog input 1	165
Signal outside range, analog input 2	166
Signal outside range, analog input 3	167
Temperature sensor 1 outside signal range	91
Temperature sensor 2 outside signal range	175
Too many restarts	4
Limit 1 exceeded	190
Limit 2 exceeded	191

A fault indication can be reset in this display by pressing [OK] if the cause of the fault has disappeared.

Warning



In case of a warning, the cause will appear in this display together with a fault code.

Possible warnings:

Warning	Fault code
No contact to pump	10
Internal fault	83, 85, 163
Electronics temperature too high	66
Sensor signal outside signal range	88
Sensor supply fault, 5 V	161
Sensor supply fault, 24 V	162
Too high motor temperature	65
Signal outside range, analog input 1	165
Signal outside range, analog input 2	166
Signal outside range, analog input 3	167
Temperature sensor 1 outside signal range	91
Temperature sensor 2 outside signal range	175
Limit 1 exceeded	190
Limit 2 exceeded	191
Replace motor bearings	30

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

Alarm log 1 to 5

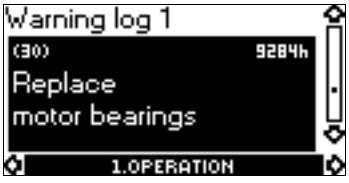


In case of "alarm" faults, the last five alarm indications will appear in the alarm log. "Alarm log 1" shows the latest fault, "Alarm log 2" shows the latest fault but one, etc.

The example above gives this information:

- The alarm indication "Other fault".
- The fault code "(73)".
- The number of minutes the motor has been connected to the power supply after the fault occurred.

Warning log 1 to 5



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 "Replace motor bearings".
- The fault code "(30)".
- The number of minutes the motor has been connected to the power supply after the fault occurred.

8.4.3 STATUS menu

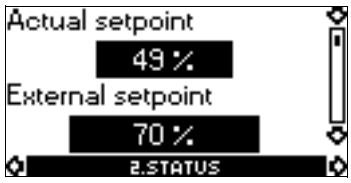
The displays appearing in this menu are status displays only. It is not possible to change or set values.

The displayed values are the values that applied when the last communication between the motor 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, for example 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.

Actual setpoint and external setpoint

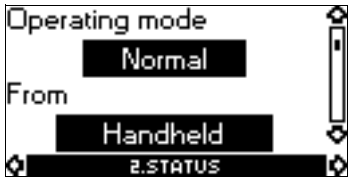


Tolerance: ± 2 %

This display shows the actual setpoint and the external setpoint in % of the range from minimum value of sensor measuring range to the setpoint set.

At a min. speed of 12 %, a set setpoint of 65 % and an external setpoint of 70 %, the actual setpoint will be
0.70 x (65 - 12) + 12 = 49 %.

Operating mode



This display shows the actual operating mode (Stop, Min., Normal (duty), Max. or Manual (operation)). Furthermore, it shows where this operating mode was selected (Handheld, Motor, Bus, External or Start/stop button).

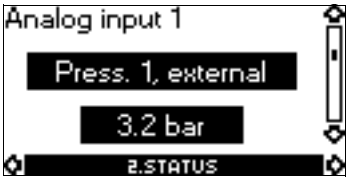
Actual controlled value

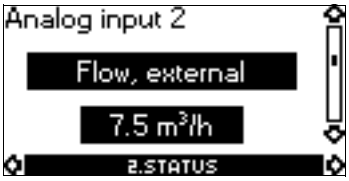


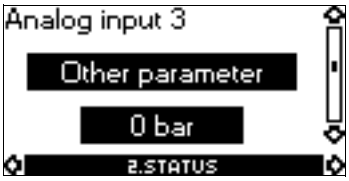
The actual controlled value will appear in this display if a sensor has been connected and the function of the analog input has been set to "Feedback sensor".

See section *Analog input 1, 2 and 3, Function*, page 24.

Analog input 1, 2 and 3





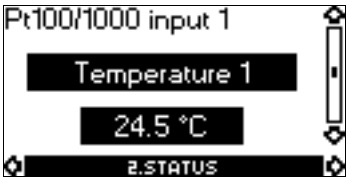


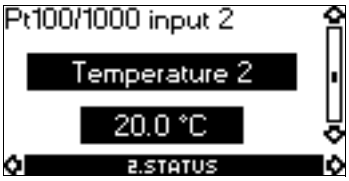
These displays show the measured parameter and the corresponding value.

The number of available displays depends on the functional module fitted in the motor. See below.

Function (terminal)	FM 100	FM 200	FM 300
Analog input 1 (4)	●	●	●
Analog input 2 (7)	-	●	●
Analog input 3 (14)	-	-	●

Pt100/1000 input 1 and 2





These displays show the measured parameter and the corresponding value. The measured temperatures will appear in these displays if Pt100 or Pt1000 sensors have been connected.

The number of available displays depends on the functional module fitted in the motor. See below.

Function (terminal)	FM 100	FM 200	FM 300
Pt100/1000 input 1 (17)	-	-	●
Pt100/1000 input 2 (19)	-	-	●

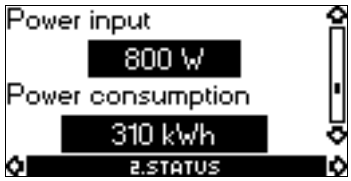
Speed



Tolerance: ± 5 %.

This display shows the actual speed.

Power input and power consumption



Tolerance: ± 10 %

- "Power input" indicates the actual power consumption.
- "Power consumption" indicates an accumulated value which cannot be reset.

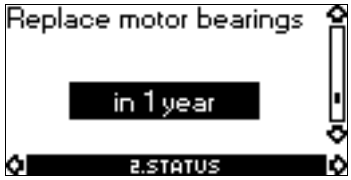
Operating hours



Tolerance: ± 2 %

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

Replace motor bearings

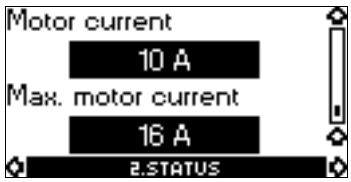


This display shows when to replace the motor bearings.
The controller monitors the operating pattern of the motor and calculates the period between bearing replacements.

Displayable values:

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

Motor current

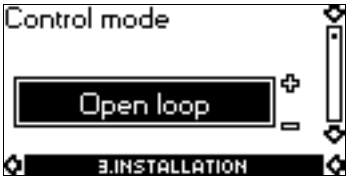


Tolerance: ± 5 %

- "Motor current" indicates the actual motor input current from the frequency converter.
- "Max. motor current" indicates the maximum motor current limit.

8.4.4 INSTALLATION menu

Control mode



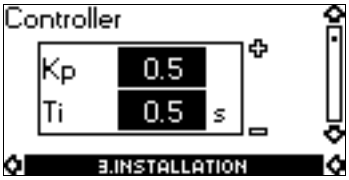
Select one of the following control modes:

- Closed loop
- Open loop.

Note

If the motor is connected to a bus (see section 10. Bus signal), it is not possible to select the control mode via the R100.

Controller



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

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

Setting the PI controller

1. Start the motor and adjust the system so that the motor is operating in the typical operating situation.
2. Set the integral-action time (T_i) to 3600 s.
3. Increase the gain (K_p) until the motor operation becomes unstable, i.e. until the actual value starts fluctuating.
   See section *Actual controlled value*, page 20. Instability can also be heard because the motor starts adjusting the speed up and down. Some systems react slowly, for example during temperature control. Therefore, several minutes may pass before the motor operation becomes unstable.
4. Set the gain (K_p) to half of the value that made the motor unstable. Then the gain has been set.
5. Reduce the integral-action time (T_i) until the motor becomes unstable.
6. Set the integral-action time (T_i) to twice the value that made the motor unstable. The PI controller has now been set.

Inverse control

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

Signal relay 1 and 2





The signal relays can be configured to be activated by one of the following incidents:

- Ready
- Operation
- Alarm
- Warning
- Limit 2 exceeded
- Limit 1 exceeded
- Running
- Not active.

The number of available displays depends on the functional module fitted in the motor. See below.

Function (terminal)	FM 100	FM 200	FM 300
Signal relay 1 (NC, C1, NO)	-	●	●
Signal relay 2 (NC, C2, NO)	-	●	●

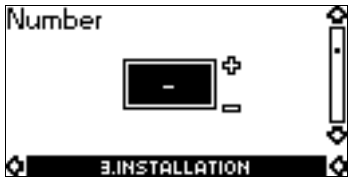
Buttons on motor



The buttons ⊙ and ⊙ on the motor can be set to the following:

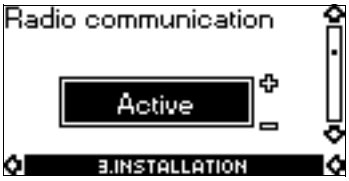
- Active
- Not active.

Number



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

Radio communication

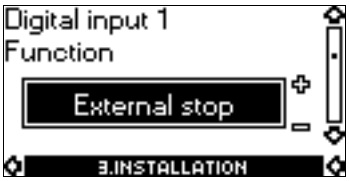


In this display, wireless radio communication can be enabled or disabled. The wireless, infrared communication will not be affected by the settings made in this display.

Possible settings:

- Active
- Not active.

Digital input 1 and 2, Function





The digital inputs 1 and 2 can be set to various functions.

Select one of these functions:

- "Not active":
  When set to "Not active", the input has no function.
- "External fault":
  When the input is activated, a timer will be started. If the input is activated for more than 5 seconds, the motor will be stopped and a fault will be indicated. If the connection is disconnected for more than 5 seconds, the fault condition will cease and the motor will start if automatic restarting has been selected via PC Tool.
- "Alarm resetting":
  When the input is activated, a possible fault indication will be reset.
- "Reversing":
  When the input is activated, the direction of rotation of the motor will be reversed compared to the setting made in *Direction of rotation*, page 27.
- "External stop":
  When the input is deactivated (open circuit), the motor will stop.
- "Max." (max. speed):
  When the input is activated, the motor will run at the set max. speed.
- "Min." (min. speed):
  When the input is activated, the motor will run at the set min. speed.

The priority of the selected functions in relation to each other appears from section *11. Priority of settings*.
A stop command will always have the highest priority.

The number of available displays depends on the functional module fitted in the motor. See below.

Function (terminal)	FM 100	FM 200	FM 300
Digital input 1, Function (2 and 6)	●	●	●
Digital input 2, Function (1 and 9)	-	-	●

Digital input/output 3 and 4, State





The digital input/output 3 and 4 can be set to act as digtial input or digital output.

Possible settings:

- Digital input
- Digital output.

The number of available displays depends on the functional module fitted in the motor. See below.

Function (terminal)	FM 100	FM 200	FM 300
Digital input/output 3, State (10 and 6)	●	●	●
Digital input/output 4, State (11 and 18)	-	-	●

Digital input/output 3 and 4, Function





The digital input/output 3 and 4 can be set to these functions:

Possible functions, digital input/output 3

Set to digital input	Set to digital output
• Not active • External fault • Alarm resetting • Reversing • External stop • Max. • Min.	• Ready • Operation • Alarm • Warning • Limit 2 exceeded • Limit 1 exceeded • Running • Not active

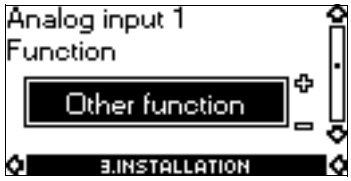
Possible functions, digital input/output 4

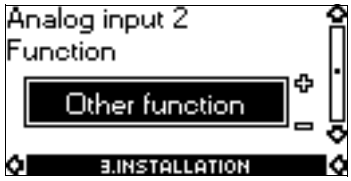
Set to digital input	Set to digital output
• Not active • External fault • Alarm resetting • Reversing • External stop • Max. • Min.	• Ready • Operation • Alarm • Warning • Limit 2 exceeded • Limit 1 exceeded • Running • Not active

The number of available displays depends on the functional module fitted in the motor. See below.

Function (terminal)	FM 100	FM 200	FM 300
Digital input/output 3, Function (10 and 6)	•	•	•
Digital input/output 4, Function (11 and 18)	-	-	•

Analog input 1, 2 and 3, Function







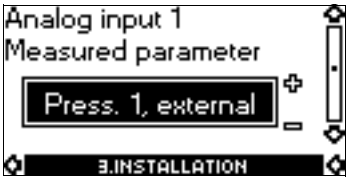
The analog inputs can be set to these functions:

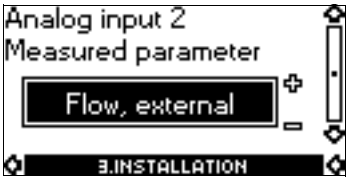
- Not active
- Feedback sensor
- Ext. setpoint infl.
  For further description, see section *9. External setpoint signal*.
- Other function.

The number of available displays depends on the functional module fitted in the motor. See below.

Function (terminal)	FM 100	FM 200	FM 300
Analog input 1, Function (4)	•	•	•
Analog input 2, Function (7)	-	•	•
Analog input 3, Function (14)	-	-	•

Analog input 1, 2 and 3, Measured parameter







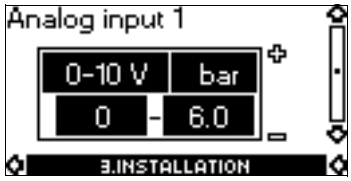
The analog inputs can be set to these measured parameters:

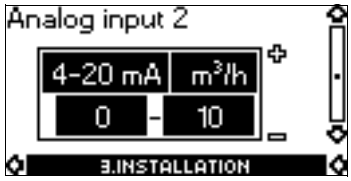
- Inlet pressure
- Diff. press., inlet
- Discharge press.
- Diff. press., outlet
- Diff. press., pump
- Press. 1, external
- Press. 2, external
- Diff. press., external
- Feed tank level
- Storage tank level
- Flow, pump
- Flow, external
- Liquid temp.
- Diff. temp., external
- Temperature 1
- Temperature 2
- Ambient temp.
- Other parameter.

The number of available displays depends on the functional module fitted in the motor. See below.

Function (terminal)	FM 100	FM 200	FM 300
Analog input 1, Measured parameter (4)	●	●	●
Analog input 2, Measured parameter (7)	-	●	●
Analog input 3, Measured parameter (14)	-	-	●

Analog input 1, 2 and 3







Select the following:

- Signal type (0.5 - 3.5 V, 0-5 V, 0-10 V, 0-20 mA or 4-20 mA). The FM 100 analog input only supports voltage signals.
- Measuring units for the measured parameters. Available measuring units:

Parameter	Possible units
Pressure	bar, m, kPa, psi, ft
Flow rate	m^3/h, l/s, yd^3/h, gpm
Temperature	°C, °F
Other	%

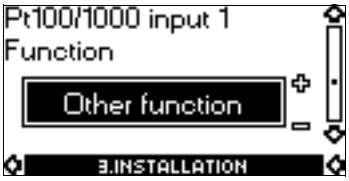
- Sensor measuring range.

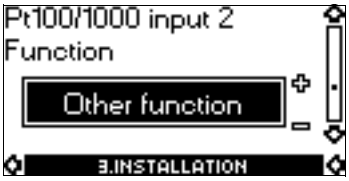
Note ***The setting of the sensor is only relevant in the case of closed-loop operation.***

The number of available displays depends on the functional module fitted in the motor. See below.

Function (terminal)	FM 100	FM 200	FM 300
Analog input 1 (4)	●	●	●
Analog input 2 (7)	-	●	●
Analog input 3 (14)	-	-	●

Pt100/1000 input 1 and 2, Function





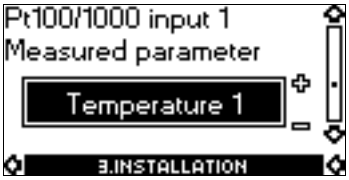
The Pt100/1000 inputs can be set to these functions:

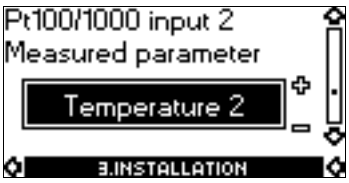
- Not active
- Feedback sensor
- Ext. setpoint infl.
  For further description, see section *9. External setpoint signal*.
- Other function.

The number of available displays depends on the functional module fitted in the motor. See below.

Function (terminal)	FM 100	FM 200	FM 300
Pt100/1000 input 1, Function (17 and 18)	-	-	•
Pt100/1000 input 2, Function (19 and 18)	-	-	•

Pt100/1000 input 1 and 2, Measured parameter





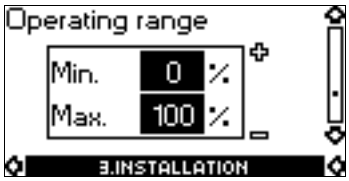
The Pt100/1000 inputs can be set to these measured parameters:

- Liquid temp.
- Temperature 1
- Temperature 2
- Ambient temp.
- DE bearing temp.
- NDE bearing temp.

The number of available displays depends on the functional module fitted in the motor. See below.

Function (terminal)	FM 100	FM 200	FM 300
Pt100/1000 input 1, Measured parameter (17 and 18)	-	-	•
Pt100/1000 input 2, Measured parameter (19 and 18)	-	-	•

Operating range



Set the operating range as follows:

- Set the min. speed within the range from fixed min. speed to user-set max. speed.
- Set the max. speed within the range from user-set min. speed to fixed max. speed.

The range between the user-set min. and max. speeds is the operating range. See fig. 30.

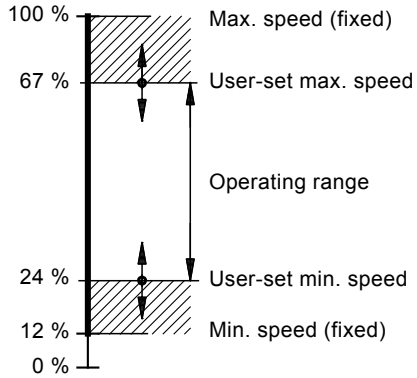
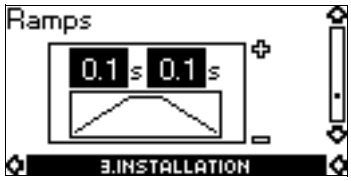


Fig. 30 Example of min. and max. settings

Ramps



The setting of ramps is only relevant in the case of open-loop operation.

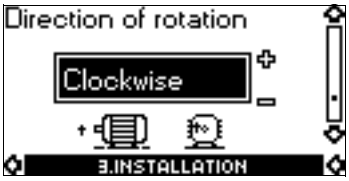
The ramps determine how quickly the motor can accelerate and decelerate, respectively, during start/stop or setpoint changes.

The following can be set:

- acceleration time, 0.1 to 300 s
- deceleration time, 0.1 to 300 s.

The times apply to the acceleration from stop to rated speed and the deceleration from rated speed to stop, respectively.
At short deceleration times, the deceleration of the motor may depend on load and inertia as there is no possibility of actively braking the motor.
If the power supply is switched off, the deceleration of the motor will only depend on load and inertia.

Direction of rotation

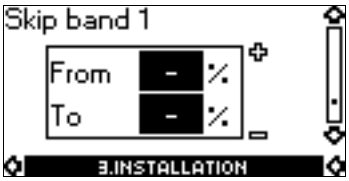


Select the desired direction of rotation of the motor when seen from the drive end:

- Clockwise
- Anti-clockwise.

The displayed direction of rotation will apply when the digital input for reversing is not active. See section *Digital input 1 and 2, Function*, page 23.

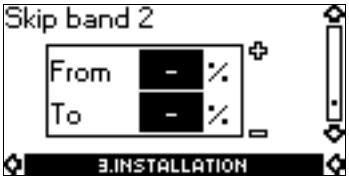
Skip band 1



Select a skip speed band within the range from user-set min. speed to user-set max. speed if continuous operation is not required. The upper and lower speeds are stated in % of rated speed.

The purpose of the skip band is to avoid certain speeds which may cause noise or vibrations. If no skip band is required, select "-".

Skip band 2



Select another skip band within the range from user-set min. to max. speed.

Motor bearing monitoring



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.

Note

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

When the function is changed to "Active" again, the accumulated mileage will again be used to calculate the replacement time.

Motor bearings



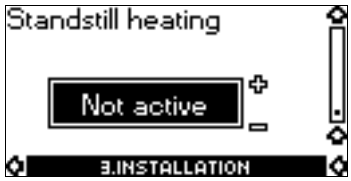
This function can be set to these values:

- 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 replaced. See section *Alarm*, page 19.

When the motor bearings have been replaced, confirm this action in the above display by pressing [OK].

Standstill heating



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.

8.5 Grundfos GO Remote

The motor is designed for wireless radio or infrared communication with the Grundfos GO Remote.

The Grundfos GO Remote enables setting of functions and gives access to status overviews, technical product information and actual operating parameters.

The Grundfos GO Remote offers three different mobile interfaces (MI). See fig. 31:

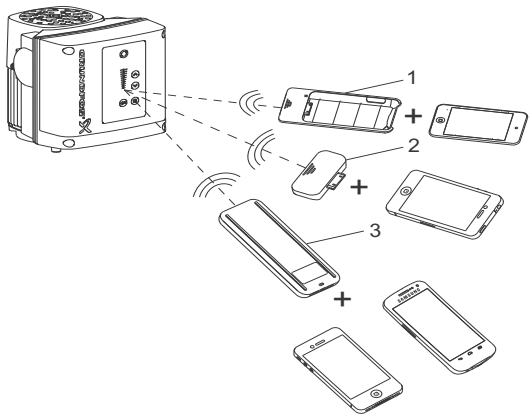


Fig. 31 Grundfos GO Remote communicating with the motor via radio or infrared light

Pos.	Description
1	Grundfos MI 201 for Apple iPod
2	Grundfos MI 202 for Apple iPhone
3	Grundfos MI 301 for Android and iOS (Bluetooth communication is required).

8.5.1 Communication

When the Grundfos GO Remote communicates with the motor, the indicator light in the middle of the Grundfos Eye will flash green. See section *12. Grundfos Eye*.

Communication must be established using one of these communication types:

- radio communication
- infrared communication.

Radio communication

Radio communication can take place at distances up to 30 metres. It is necessary to enable communication by pressing or OK on the motor control panel.

Infrared communication

When communicating via infrared light, the Grundfos GO Remote must be pointed at the motor control panel.

8.5.2 Navigation

Navigation can be done from the dashboard. See fig. 32.

Dashboard

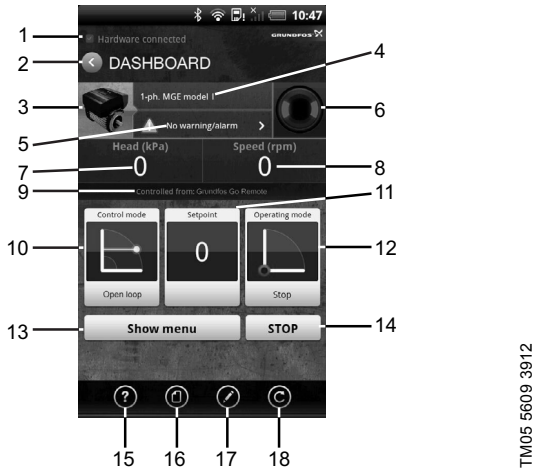


Fig. 32 Example of dashboard

Pos.	Description	Action
1	Connection indicator	This text appears when the Grundfos GO Remote app has connected to an MI 201, MI 202 or MI 301. If the hardware is not connected, it will not be possible to communicate with a Grundfos product.
2	Back button	Returns to the previous display.
3	Product information	Provides technical information about the product.
4	Product name	Name of the product communicating with the Grundfos GO Remote.
5	Alarms and warnings	Shows alarms and warnings.
6	Grundfos Eye	Shows the operating condition of the product.
7	Primary status value	Shows the primary status value.
8	Secondary status value	Shows the secondary status value.
9	Control source	Shows by which interface the product is controlled.
10	Control mode	Shows the control mode of the product.
11	Actual setpoint value	Shows the actual setpoint value.
12	Operating mode	Shows the operating mode.
13	Show menu	Gives access to other menus.
14	Stop	Stops the product.
Tool bar		
15	Help	The help function describes the menus making it easy for the user to change settings, etc.
16	Documentation	Gives access to installation and operating instructions and quick guides.
17	Report	Enables the creation of user-defined reports.
18	Update	Enables update of the Grundfos GO Remote app.

9. External setpoint signal

It is possible to remote-set the setpoint by connecting an analog signal transmitter to the input for the setpoint signal.

The actual external signal (0.5 - 3.5 V, 0-5 V, 0-10 V, 0-20 mA, 4-20 mA) must be selected with the R100 or Grundfos GO Remote.

If open-loop operation is selected with the R100 or Grundfos GO Remote, the motor can be controlled by any controller.

9.1 Closed-loop operation (controlled)

If closed-loop operation is selected, the setpoint can be set externally within the range from the lower value of the sensor measuring range to the setpoint set on the motor or with the R100 or Grundfos GO Remote. See fig. 33.

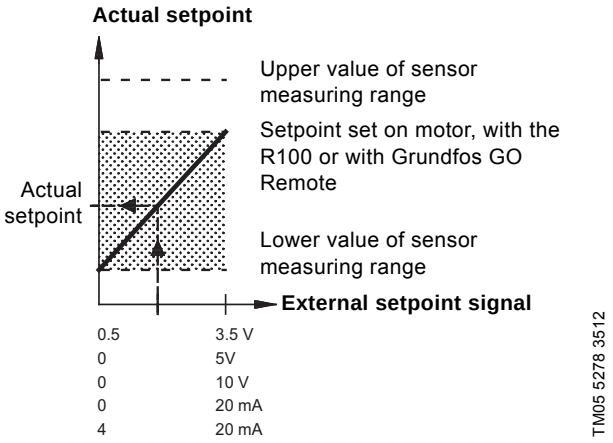


Fig. 33 Relation between the actual setpoint and the external setpoint signal in controlled-operation mode

Example: At a lower sensor value of 0 bar, a set setpoint of 5 bar and an external setpoint of 70 %, the actual setpoint is 0.70 x (5 - 0) + 0 = 3.5 bar.

9.2 Open-loop operation (uncontrolled)

If open-loop operation is selected, the setpoint can be set externally within the range from the min. speed to the setpoint set on the motor or with the R100 or Grundfos GO Remote. See fig. 34.

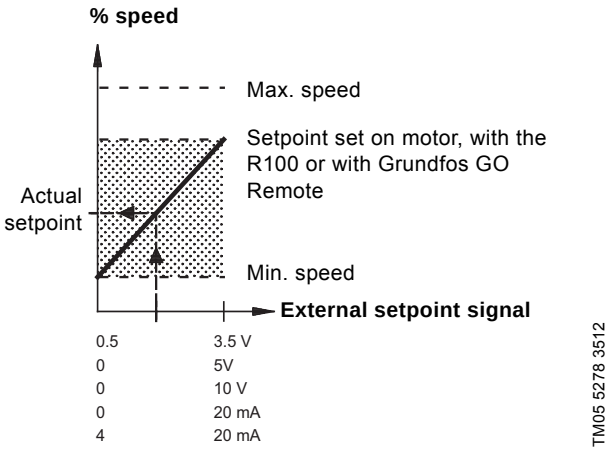


Fig. 34 Relation between the actual setpoint and the external setpoint signal in uncontrolled-operation mode

Example: At a set setpoint of 65 % of $n_{max.}$ and an external setpoint of 70 %, the actual setpoint is 0.70 x (65 - 12) + 12 = 49 %.

10. Bus signal

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

Via a bus signal, it is possible to remote-set motor operating parameters, such as setpoint and operating mode. At the same time, the motor can, via the bus, provide status information about important parameters, such as actual value of control parameter, input power and fault indications.

Contact Grundfos for further information.

Note ***If a bus signal is used, the number of settings available via the R100 or Grundfos GO Remote will be reduced.***

11. Priority of settings

The motor can always be set to operation at max. speed or to stop with the R100 or Grundfos GO Remote.

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

Example: If, via the digital input, the motor has been set to max. speed, the motor control panel, the R100 or Grundfos GO Remote can only set the motor to "Manual" or "Stop".

The priority of the settings appears from the table below:

Priority	Start/stop button	R100, Grundfos GO Remote or control panel on motor	Digital input	Bus communication
1	Stop			
2		Stop*		
3		Manual		
4		Max. speed*		
5			Stop	
6				Stop
7				Max. speed
8				Min. speed
9				Start
10			Max. speed	
11		Min. speed		
12			Min. speed	
13			Start	
14		Start		

* "Stop" and "Max. speed" settings made with the R100, Grundfos GO Remote or on the motor control panel can be overruled by another operating-mode command sent from bus, for example "Start". If the bus communication is interrupted, the motor will resume its previous operating mode, for example "Stop", selected with the R100, Grundfos GO Remote or on the motor control panel.

12. Grundfos Eye

The operating condition of the motor is indicated by the Grundfos Eye on the motor control panel. See fig. 35, pos. A.

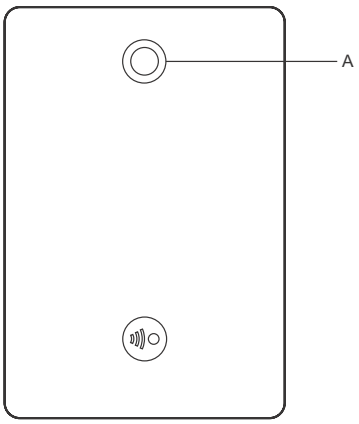
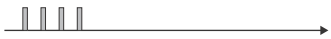


Fig. 35 Grundfos Eye

Grundfos Eye	Indication	Description
	No lights on.	**Power off.** Motor not running.
	Two opposite green indicator lights rotating in the direction of rotation of the motor when seen from the non-drive end.	**Power on.** Motor running.
	Two opposite green indicator lights permanently on.	**Power on.** Motor not running.
	One yellow indicator light rotating in the direction of rotation of the motor when seen from the non-drive end.	**Warning.** Motor running.
	One yellow indicator light permanently on.	**Warning.** Motor stopped.
	Two opposite red indicator lights flashing simultaneously.	**Alarm.** Motor stopped.
	The green indicator light in the middle flashes quickly four times. 	**Remote control with the Grundfos GO Remote via radio** The motor is trying to communicate with the Grundfos GO Remote. The motor in question is highlighted in the Grundfos GO Remote display to inform the user of the location of the motor.
	The green indicator light in the middle flashes continuously. 	When the motor in question is selected in the Grundfos GO Remote menu, the green indicator light in the middle will flash continuously. Press on the motor control panel to allow remote control and data exchange via the Grundfos GO Remote.
	The green indicator light in the middle is permanently on. 	**Remote control with the Grundfos GO Remote via radio** The motor is communicating with the Grundfos GO Remote via radio connection.
	The green indicator light in the middle flashes quickly while the R100 or Grundfos Go Remote is exchanging data with the motor. It will take a few seconds. 	**Remote control with the R100 or Grundfos GO Remote via infrared light** The motor is receiving data from the R100 or Grundfos GO Remote via infrared communication.

13. Signal relays

The motor has two outputs for potential-free signals via two internal relays.

The signal outputs can be set to "Operation", "Running", "Ready", "Alarm" and "Warning".

The functions of the two signal relays appear from the table below:

Description	Grundfos Eye	Contact position for signal relays when activated					Operating mode
		Operation	Running	Ready	Alarm	Warning	
Power off.	 Off						-
Motor running in "Normal" mode in open or closed loop.	 Green, rotating						Normal, Min. or Max.
Motor running in "Manual" mode.	 Green, rotating						Manual
Motor in operating mode "Stop".	 Green, steady						Stop
Warning, but the motor is running.	 Yellow, rotating						Normal, Min. or Max.
Warning, but the motor is running in "Manual" mode.	 Yellow, rotating						Manual
Warning, but the motor was stopped via "Stop" command.	 Yellow, steady						Stop
Alarm, but the motor is running.	Red, rotating						Normal, Min. or Max.
Alarm, but the motor is running in "Manual" mode.	Red, rotating						Manual
Motor stopped due to an alarm.	Red, flashing						Stop

14. Megging

Caution ***Megging of an installation incorporating MGE motors is not allowed, as the built-in electronics may be damaged.***

15. Technical data, single-phase motors

15.1 Supply voltage

Single-phase motors are available for the voltages below.

- 1 x 200-240 V - 10 %/+ 10 %, 50/60 Hz, PE
- 1 x 90-240 V - 10 %/+ 10 %, 50/60 Hz, PE or 30-300 VDC (power supply from a renewable-energy source).

Check that the supply voltage and frequency correspond to the values stated on the nameplate.

Recommended fuse size

Motor size [kW]	Min. [A]	Max. [A]
0.25 to 0.75	6	10
1.1 to 1.5	10	16

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

15.2 Leakage current

Earth leakage current < 3.5 mA (AC supply).

Earth leakage current < 10 mA (DC supply).

The leakage currents are measured in accordance with EN 61800-5-1:2007.

16. Technical data, three-phase motors

16.1 Supply voltage

- 3 x 380-500 V - 10 %/+ 10 %, 50/60 Hz, PE.

Check that the supply voltage and frequency correspond to the values stated on the nameplate.

Recommended fuse size

Motor size [kW]	Min. [A]	Max. [A]
0.25 to 1.1	6	6
1.5 to 2.2	6	10

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

16.2 Leakage current

Motor size [kW]	Leakage current [mA]
0.75 to 2.2 (supply voltage < 400 V)	< 3.5
0.75 to 2.2 (supply voltage > 400 V)	< 5

The leakage currents are measured in accordance with EN 61800-5-1:2007.

17. Inputs/outputs

Ground reference (GND)

All voltages refer to GND.

All currents return to GND.

Absolute maximum voltage and current limits

Exceeding the following electrical limits may result in severely reduced operating reliability and motor life:

Relay 1:

Maximum contact load: 250 VAC, 2 A or 30 VDC, 2 A.

Relay 2:

Maximum contact load: 30 VDC, 2 A.

GENI terminals: -5.5 to 9.0 VDC or < 25 mADC.

Other input/output terminals: -0.5 to 26 VDC or < 15 mADC.

Digital inputs (DI)

Internal pull-up current > 10 mA at V_i = 0 VDC.

Internal pull-up to 5 VDC (currentless for V_i > 5 VDC).

Certain low logic level: V_i < 1.5 VDC.

Certain high logic level: V_i > 3.0 VDC.

Hysteresis: No.

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

Maximum cable length: 500 m.

Open-collector digital outputs (OC)

Current sinking capability: 75 mADC, no current sourcing.

Load types: Resistive or/and inductive.

Low-state output voltage at 75 mADC: Max. 1.2 VDC.

Low-state output voltage at 10 mADC: Max. 0.6 VDC.

Overcurrent protection: Yes.

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

Maximum cable length: 500 m.

Analog inputs (AI)

Voltage signal ranges:

- 0.5 - 3.5 VDC, AL AU.
- 0-5 VDC, AU.
- 0-10 VDC, AU.

Voltage signal: R_i > 100 kΩ at +25 °C.

Leak currents may occur at high operating temperatures. Keep the source impedance low.

Current signal ranges:

- 0-20 mADC, AU.
- 4-20 mADC, AL AU.

Current signal: R_i = 292 Ω.

Current overload protection: Yes. Change to voltage signal.

Measurement tolerance: - 0/+ 3 % of full scale (max.-point coverage).

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

Maximum cable length: 500 m (excl. potentiometer).

Potentiometer connected to +5 V, GND, any AI:

Use maximum 10 kΩ.

Maximum cable length: 100 m.

Analog output (AO)

Current sourcing capability only.

Voltage signal:

- Range: 0-10 VDC.
- Minimum load between AO and GND: 1 kΩ.
- Short-circuit protection: Yes.

Current signal:

- Ranges: 0-20 and 4-20 mADC.
- Maximum load between AO and GND: 500 Ω.
- Open-circuit protection: Yes.

Tolerance: - 0/+ 4 % of full scale (max-point coverage).

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

Maximum cable length: 500 m.

Pt100/1000 inputs (PT)

Temperature range:

- Minimum -30 °C (88 Ω/882 Ω).
- Maximum +180 °C (168 Ω/1685 Ω).

Measurement tolerance: ± 1.5 °C.

Measurement resolution: < 0.3 °C.

Automatic range detection (Pt100 or Pt1000): Yes.

Sensor fault alarm: Yes.

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

Use Pt100 for short wires.

Use Pt1000 for long wires.

LiqTec sensor inputs

Use Grundfos LiqTec sensor only.

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

Grundfos Digital Sensor input and output (GDS)

Use Grundfos Digital Sensor only.

Power supplies (+5 V, +24 V)

+5 V:

- Output voltage: 5 VDC - 5 %/+ 5 %.
- Maximum current: 50 mADC (sourcing only).
- Overload protection: Yes.

+24 V:

- Output voltage: 24 VDC - 5 %/+ 5 %.
- Maximum current: 60 mADC (sourcing only).
- Overload protection: Yes.

Digital outputs (relays)

Potential-free changeover contacts.

Minimum contact load when in use: 5 VDC, 10 mA.

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

Maximum cable length: 500 m.

Bus input

Grundfos GENIbus protocol, RS-485.

Screened 3-core cable: 0.5 - 1.5 mm^2 / 28-16 AWG.

Maximum cable length: 500 m.

18. Other technical data

EMC (electromagnetic compatibility)

EN 61800-3.

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

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

Contact Grundfos for further information.

Enclosure class

Standard: IP55 (IEC 34-5).

Optional: IP66 (IEC 34-5).

Insulation class

F (IEC 85).

Torques

Terminal	Thread size	Max. torque [Nm]
L1, L2, L3, L, N	M4	1.8
NC, C1, C2, NO	M2.5	0.5
1 to 26 and A, Y, B	M2	0.5

18.1 Sound pressure level

Motor [kW]	Max. speed stated on nameplate [min^{-1}]	Speed [min^{-1}]	Sound pressure level ISO 3743 [dB(A)]	
			1-phase motors	3-phase motors
0.25 to 0.75	2000	1500	38	38
		2000	42	42
	4000	3000	53	53
		4000	58	58
	5900	4000	58	58
		5900	68	68
1.1	2000	1500		38
		2000		42
	4000	3000	53	53
		4000	58	58
	5900	4000	58	58
		5900	68	68
1.5	2000	1500		
		2000		
	4000	3000	57	57
		4000	64	64
	5900	4000	58	58
		5900	68	68
2.2	2000	1500		
		2000		
	4000	3000		57
		4000		64
	5900	4000		58
		5900		68

The grey fields indicate that the motor is not yet available in this MGE motor range, but is available in the previous MGE motor range.

19. 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.

The waste battery should be disposed of through the national collective schemes. If in doubt, contact your local Grundfos company.

Subject to alterations.

1. Installation in the USA and Canada

Note

In order to maintain the cURus approval, follow these additional installation instructions. The UL approval is according to UL 1004-1.

1.1 Electrical codes

For USA

This product complies with the Canadian Electrical Code and the US National Electrical Code.

This product has been tested according to the national standards for Electronically Protected Motors:

CSA 22.2 100.04: 2009 (applies to Canada only).

UL 1004-1: June 2011 (applies to USA only).

Pour le Canada

Codes de l'électricité

Ce produit est conforme au Code canadien de l'électricité et au Code national de l'électricité américain.

Ce produit a été testé selon les normes nationales s'appliquant aux moteurs protégés électroniquement:

CSA 22.2 100.04: 2009 (s'applique au Canada uniquement).

UL 1004-1: Juin 2011 (s'applique aux États-Unis uniquement).

1.2 Radio communication

For USA

This device complies with part 15 of the FCC rules and RSS210 of IC rules.

Operation is subject to the following two conditions:

- This device may not cause interference.
- This device must accept any interference, including interference that may cause undesired operation of the device.

Pour le Canada

Communication radio

Ce dispositif est conforme à la partie 15 des règles de la FCC et aux normes RSS210 de l'IC.

Son fonctionnement est soumis aux deux conditions suivantes:

- Ce dispositif ne doit pas provoquer de brouillage préjudiciable.
- Il doit accepter tout brouillage reçu, y compris le brouillage pouvant entraîner un mauvais fonctionnement.

1.3 Identification numbers

For USA

Grundfos Holding A/S

Contains FCC ID: OG3-RADIOM01-2G4.

For Canada

Grundfos Holding A/S

Model: RADIOMODULE 2G4

Contains IC: 10447A-RA2G4M01.

Pour le Canada

Numéros d'identification

Grundfos Holding A/S

Modèle: RADIOMODULE 2G4

Contient IC: 10447A-RA2G4M01.

Location of identification numbers

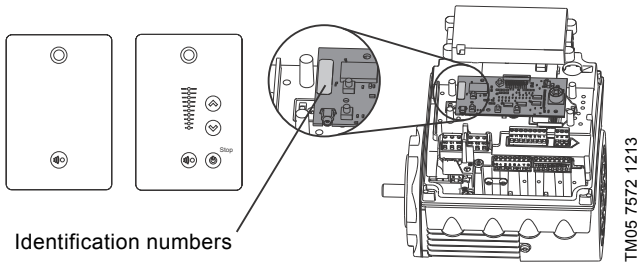


Fig. 1 Identification numbers

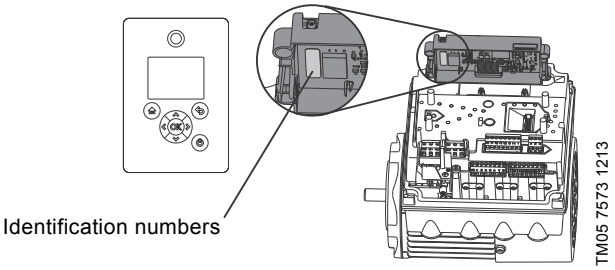


Fig. 2 Identification numbers

1.4 Electrical connection

1.4.1 Conductors

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

1.4.2 Torques

Maximum tightening torques for the terminals can be found in section *Torques*, page 33.

1.4.3 Line reactors

Maximum line reactor size must not exceed 1.5 mH.

1.4.4 Fuse size/circuit breaker

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

Motor size	Fuse size	Circuit breaker type/model
0.25 to 2.2 kW	25 A	25 A / inverse time

Fuses

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

Motors up to and including 2.2 kW require class K5 UR fuses.

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 the table above.

1.4.5 Overload protection

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

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