Hydro Multi-E

Installation and operating instructions

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WATER QUALITY
Drinking Water System Component
NSF / ANSI 61
NSF / ANSI 372

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GRUNDFOS

Original installation and operating instructions

These installation and operation instructions apply to the Grundfos Hydro Multi-E pump systems.

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Read this document before installing the product. Installation and operation must comply with local regulations and accepted codes of good practice.

1. Limited Warranty

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

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

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

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

2. Symbols used in this document

2.1 Warnings against hazards involving risk of death or personal injury

DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious personal injury.

WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious personal injury.

CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate personal injury.

The text accompanying the three hazard symbols DANGER, WARNING and CAUTION is structured in the following way:

SIGNAL WORD

Description of hazard

Consequence of ignoring the warning.

- Action to avoid the hazard.

2.2 Other important notes

A blue or grey circle with a white graphical symbol indicates that an action must be taken.

A red or grey circle with a diagonal bar, possibly with a black graphical symbol, indicates that an action must not be taken or must be stopped.

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

Tips and advice that make the work easier.

3. Product introduction

3.1 Product description

Hydro Multi-E incorporates Grundfos CRE pumps with integrated frequency-controlled single- or three-phase MLE motors and a breaker cabinet.

Grundfos Hydro Multi-E pump systems are designed for pressure boosting of clean water.

Typical applications:

- apartments
- hotels
- hospitals
- schools
- office buildings.

The system adjusts its performance to the demand by cutting the required number of pumps in or out and through parallel control of the pumps in operation.

3.2 Intended use

Hydro Multi-E is a range of factory-assembled pump systems ready for installation and operation.

The system maintains a constant pressure through continuous variable adjustment of the speed of the connected pumps.

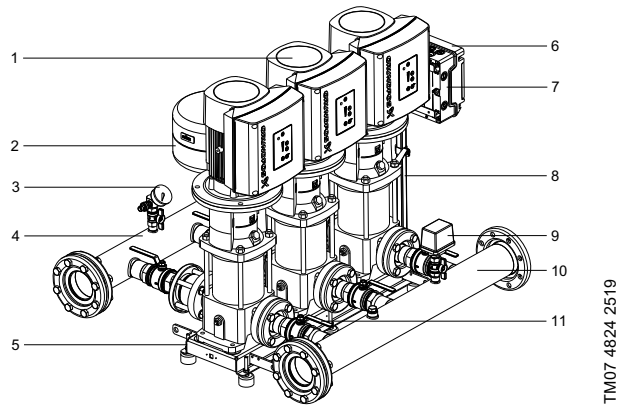

Fig. 1 Hydro Multi-E components

Pos.	Description	Qty
1	Pump	2-3
2	Diaphragm tank (optional)	
3	(2) Pressure sensors and a gauge on discharge manifold	1
4	Discharge manifold	1
5	Base frame (304 SS)	1
6	Breaker cabinet*	1
7	Nameplate	1
8	Check valve	1 per pump
9	(2) Pressure sensors and a gauge or (1) pressure switch and gauge on suction manifold.	1
10	Suction manifold	1
11	Isolating valve	2 per pump

* The breaker cabinet incorporates a main switch and circuit breakers.

4. Receiving the product

4.1 Transporting the product

The pump system is delivered wrapped on a pallet that is designed for transport by forklift truck or similar vehicle. Depending on the size, the booster system is delivered in a wooden crate, closed wooden box, wrapped on a pallet that is designed for transport by forklift truck or similar vehicle.

4.2 Inspecting the product

Before installing the product, check the following:

- The pump system corresponds to the order.
- All visible parts are intact.

4.3 Scope of delivery

The pallet contains the following:

- 1 Hydro Multi-E system
- installation and operating instructions for Hydro Multi-E
- quick guide for Hydro Multi-E
- installation and operating instructions for CRE, CRIE, CRNE, SPKE, MTRE, CME.

4.4 Handling and lifting the product

DANGER

Overhead load

Death or serious personal injury

- When lifting the pump system, do not use the eyebolts of the motors.
- Do not lift the pump system by the manifolds.
- Do not stand on the manifolds.

WARNING

Crushing of feet

Death or serious personal injury

- Use the supplied wooden beams delivered to support the system when mounting machine shoes.

WARNING

Overhead load

Death or serious personal injury

- Use safety equipment when mounting the base frame.
- Restrict access to the area.
- Installation must be carried out by trained personnel.

CAUTION

Overhead load

Minor or moderate personal injury

- Use appropriate lifting equipment when placing the system.

When lifting the product, the lifting point must always be above the center of gravity to ensure stability.

- Use lifting gear that ensures a vertical lift.
- Use a safety strap around one of the pump motors to prevent the system from tilting.

Do not stand on the manifolds.

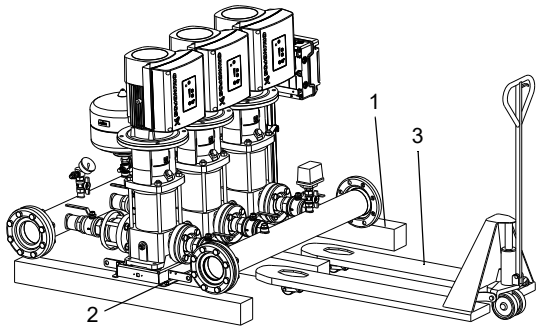

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Fig. 2 Lifting a Hydro Multi-E system correctly with a fork lift

Pos.	Description
1	Wooden pallet (included)
2	Wood screws (included)
3	Fork lift

5. Identification

5.1 Nameplate

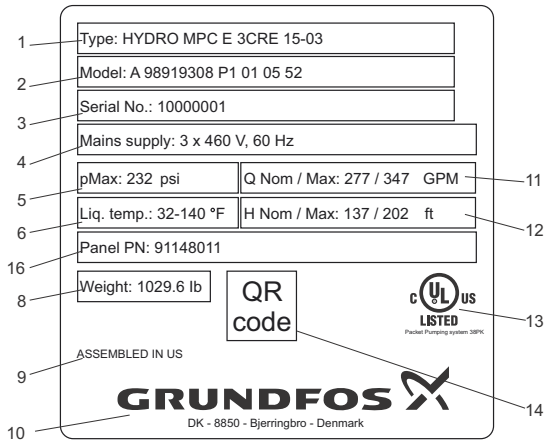

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Fig. 3 Hydro Multi-E nameplate

Pos.	Description
1	Type designation
2	Model
3	Serial number
4	Supply voltage
5	Maximum operating pressure in pound per square inch [psi]
6	Liquid temperature
7	Panel part number
8	Weight in pound [lb]
9	Country of origin
10	Company logo
11	Maximum flow rate in gallon per minute (GPM)
12	Nominal head in foot [ft]
13	Approval mark
14	QR code

5.2 Type key

Code	Example	Hydro Multi	-E	2 CRE 15-02	3 x 460 V, 60 Hz
	Type range				
	System type				
E	All pumps, E-motor				
	Number of pumps with integrated frequency drive and pump type				
	Number of fixed-speed pumps and pump type				
	Supply voltage, frequency				

6. Installation

See section *9.1 Drinking water systems*.

WARNING

Overhead load

Death or serious personal injury
- Use safety equipment when mounting the base frame.
- Restrict access to area.
- Installation must be carried out by trained personnel.

WARNING

Crushing of feet

Death or serious personal injury
- Use safety equipment when replacing the flange.
- Restrict access to the area.
- Installation must be carried out by trained personnel.

CAUTION

Crushing of feet

Minor or moderate personal injury
- Use safety equipment when installing the tank.

6.1 Location

Observe the following to ensure adequate cooling of the motor and electronics:

- Position Hydro Multi-E in a way to ensure adequate cooling. See section *6.2.1 Motor cooling*.
- The ambient temperature must not exceed 122 °F (50 °C).
- Keep motor cooling fins and fan blades clean.

The pump system must have a 3-foot (1-meter) clearance in front and on the two sides.

For outdoor installation, always place the system under a roof to avoid exposing the system to direct sunlight. See section *28. Inputs and outputs*.

6.2 Mechanical installation

Arrows on the pump base show the direction of the flow of water through the pump.

1. The pipes connected to the pump system must be of adequate size. Fit expansion joints in the inlet and outlet pipes to avoid resonance. See fig. 4.

- Connect the pipes to the manifolds of the pump system.
- The manifold comes with a screw cap fitted to one end. If this end is to be used, remove the screw cap, apply sealing compound to the other end of the manifold, and fit the screw. Fit a blanking flange with gasket on flanged manifolds.
- Fasten all screws and bolts before starting the pump.
- If the pump system is installed in an apartment complex or the first consumer on the line is close to the pump system, we recommend that you fit expansion joints on the inlet and outlet pipes to prevent vibration being transmitted through the pipes. See fig. 4.

2. Position the pump system on a level and solid surface, for example a concrete floor or foundation. If the pump system is not fitted with vibration dampers, it must be bolted to the floor or the foundation.
3. Fasten the pipes to parts of the building to ensure that they cannot move or be twisted.

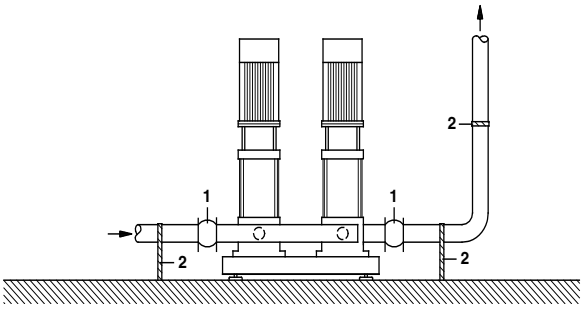

Fig. 4 Installation example with expansion joints and pipe supports

Pos.	Description
1	Expansion joint
2	Pipe supports (and recommended location for isolating valve)

The expansion joints and pipe supports shown in fig. 4 are not included in the standard pump system.

6.2.1 Motor cooling

Leave at least 2 inches (50 mm) between the end of the fan cover and a wall or other fixed objects. See fig. 5.

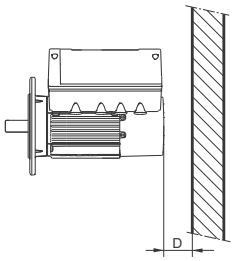

Fig. 5 Minimum distance (D) from the motor to a wall or other fixed objects

6.3 Drain holes

When the motor is installed in moist surroundings or areas with high humidity, the bottom drain hole must be open. If the humidity is constantly above 85 %, open the drain holes in the drive-end flange. The enclosure class of the motor will then be lower. This helps prevent condensation in the motor as the motor becomes self-venting, and it allows water and humid air to escape.

The motor has a plugged drain hole on the drive side. You can turn the flange 90 ° to either side or 180 °.

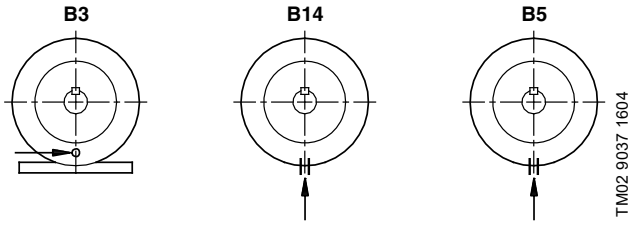

Fig. 6 Drain holes

6.4 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.

DANGER

Electric shock

Death or serious personal injury

- Switch off the power supply and wait at least five minutes before you make any connections in the breaker cabinet or terminal boxes. Make sure that the power supply cannot be accidentally switched on.
- Connect the motor to ground and protect against indirect contact according to local regulations.
- Use skilled personnel when installing the system.

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

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.

The pump system must be stationary and installed permanently. Furthermore, connect the pump system permanently to the power supply.

Ground connection should be ensured by running duplicate conductors.

The system should be installed according to National Electrical Code (NEC) requirements.

6.4.1 Protection against electric shock, indirect contact

WARNING

Electric shock

Death or serious personal injury

- Connect the motor to ground and protect against indirect contact according to local regulations.

Protection against mains voltage transients

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

Motor protection

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

6.4.2 Insulation resistance

Do not measure the insulation resistance of motor windings or an installation incorporating motors with integrated frequency converters using high-voltage megger as this may damage the built-in electronics.

6.5 Mains supply

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

Use dedicated IT network motors if the pump system is supplied through an IT network. Contact Grundfos.

The wires in the breaker cabinet must be as short as possible, except for 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 feeder overcurrent protective device (FOPD) ratings, see section *25.1 Supply voltage*.

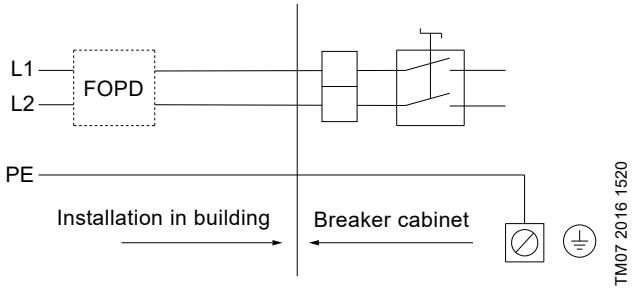

Fig. 7 Example of a mains-connected Hydro Multi-E with feeder overcurrent protective device (applies only for systems with single-phase motors)

For feeder overcurrent protective device ratings, see section *26.1 Supply voltage*.

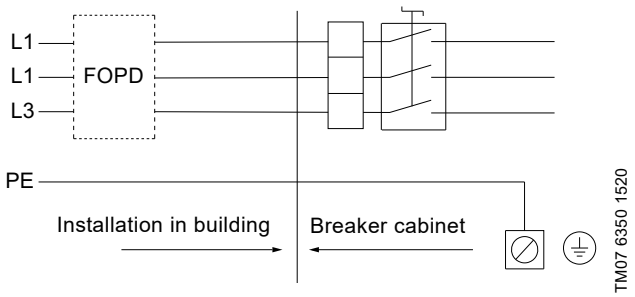

Fig. 8 Example of a mains-connected Hydro Multi-E with feeder overcurrent protective device (applies only for systems with three-phase motors)

6.6 Connection terminals

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

For maximum torques, see section *25.3 Torques*.

6.6.1 Connection terminals for CRE pumps

CRE pumps have a number of inputs and outputs enabling the pumps to be used in advanced applications where many inputs and outputs are required.

The pumps have 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
- two LiqTec sensor inputs
- two signal relay outputs
- GENIbus connection.

See fig. 9.

Digital input 1 is factory-set to be the start-stop input when open circuit results 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.

DANGER

Electric shock

Death or serious personal injury

- Make sure that the wires to be connected to the connection groups below are 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 are galvanically separated from other circuits. All control terminals are supplied by protective extra-low voltage (PELV) to ensure protection against electric shock.

- Signal relay outputs
  - Signal relay 1:
    LIVE:
    You can connect supply voltages up to 250 VAC.
    PELV:
    The output is galvanically separated from other circuits. Therefore, you can connect the supply voltage or protective extra-low voltage to the output as desired.
  - Signal relay 2:
    PELV:
    The output is galvanically separated from other circuits. Therefore, you can connect the supply voltage or protective extra-low voltage to the output as desired.
- Mains supply (terminals N, PE, L or L1, L2, L3, PE).

* If you use an external supply source, there must be a connection to GND.

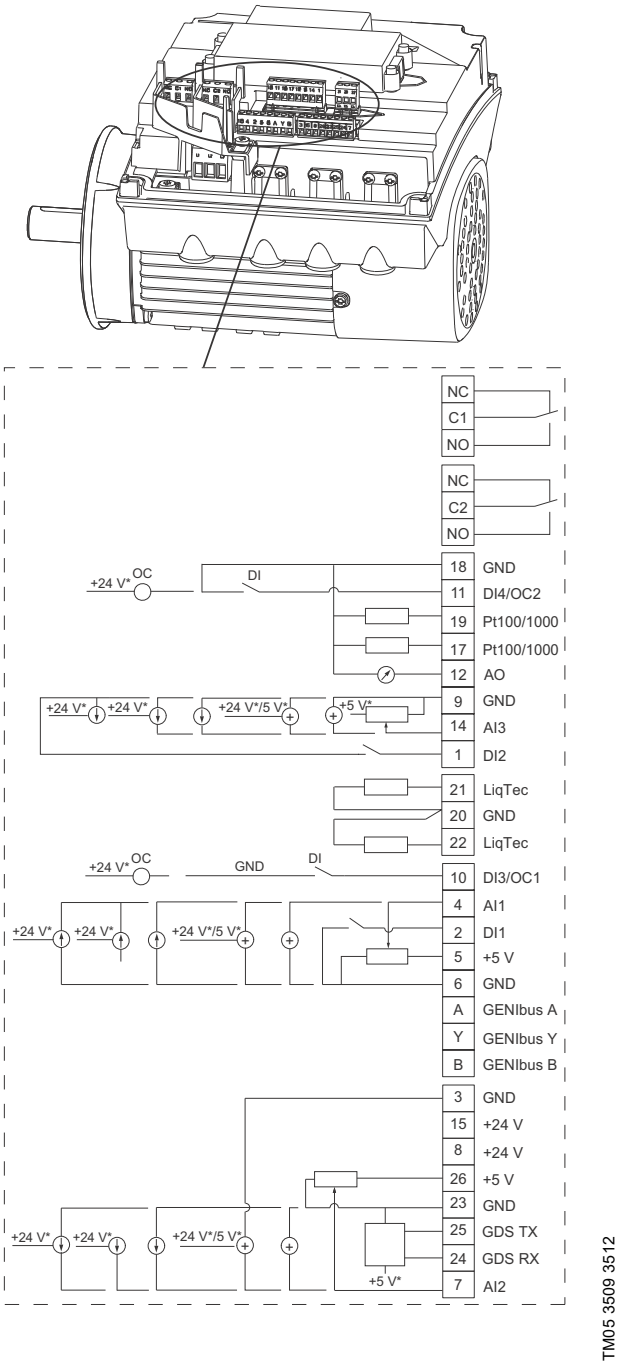

Fig. 9 Connection terminals, CRE pumps

Terminal	Type	Function
NC	Normally closed contact	Signal relay 1 (LIVE or PELV)
C1	Common	
NO	Normally open contact	

Terminal	Type	Function
NC	Normally closed contact	Signal relay 2 (PELV 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 minimum 0.5 mm^2 and maximum 1.5 mm^2 for the external on/off switch, digital inputs, setpoint and sensor signals.
- Connect the screens of the cables to the frame at both ends. The screens must be as close to the terminals as possible. See fig. 10.

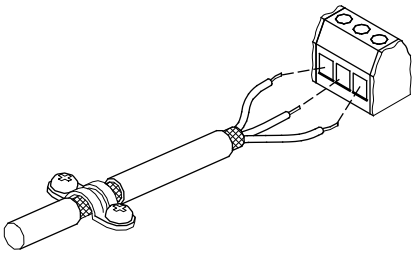

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Fig. 10 Stripped cable with screen and wire connections

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

7. Optional bus communication via Grundfos CIM modules

7.1 Installing a Communication Interface Module

DANGER

Electric shock

Death or serious personal injury

- Switch off the power supply to the motor and to the signal relays. Wait at least 5 minutes before starting any work on the motor. Make sure that the power supply cannot be accidentally switched on.

Always use an antistatic service kit when handling electronic components. This prevents static electricity from damaging the components.

When unprotected, place the component on the antistatic cloth.

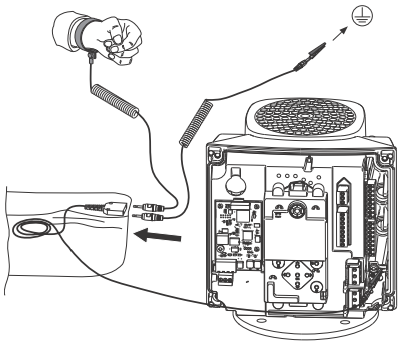

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Fig. 11 Antistatic service kit

1. Loosen the four screws (fig. 12, A) and remove the terminal box cover (fig. 12, B).

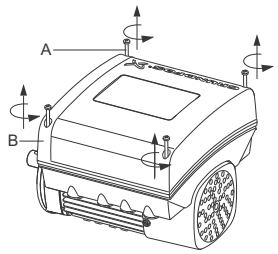

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Fig. 12 Removing the terminal box cover

2. Remove the CIM cover (fig. 13, A) by pressing the locking tab (fig. 13, B) and lifting the end of the cover (fig. 13, C). Then lift the cover off the hooks (fig. 13, D).

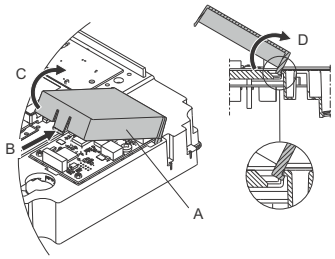

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Fig. 13 Removing the CIM cover

3. Remove the securing screw (fig. 14, A).

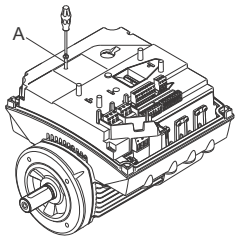

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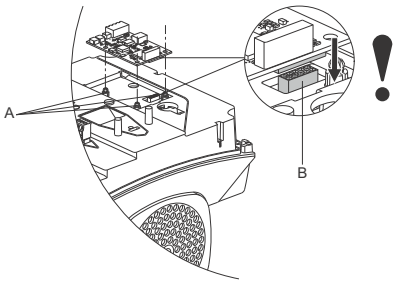
Fig. 14 Removing the securing screw

4. Fit the CIM module by aligning it with the three plastic holders (fig. 15, A) and the connecting plug (fig. 15, B). Press the module home with your fingers.



TM06 4083 1515

Fig. 15 Fitting the CIM module

5. Fit and tighten the securing screw (fig. 14, A) to 0.96 ft-lb (1.3 Nm).
6. Make the electrical connections to the CIM module as described in the instructions supplied with the module.

7. Connect the cable screens of the bus cables to earth via one of the earth clamps (fig. 16, A).

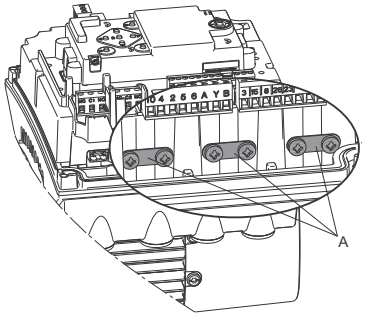


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Fig. 16 Connecting the cable screens to earth

8. Route the wires for the CIM module. See the example in fig. 17.

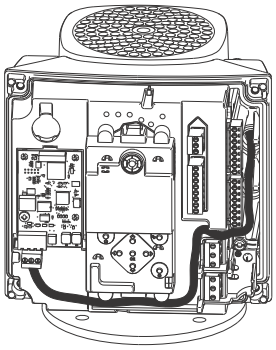

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Fig. 17 Example of wire routing

9. Fit the CIM cover.
10. If the CIM module is supplied with an FCC label, then place the label on the terminal box. See fig. 18.

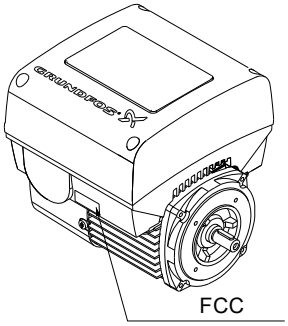

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Fig. 18 FCC label

11. Fit the terminal box cover (fig. 12, B) and cross-tighten the four mounting screws (fig. 12, A) to 6 Nm.

Make sure that the terminal box cover is aligned with the control panel.

8. Identification of functional module

You can identify the fitted module in one of the following ways:

Grundfos GO Remote

You can identify the functional module in the "Fitted modules" menu under "Status".

Pump display

For pumps fitted with the HMI300, you can identify the functional module in the "Module type" menu under "Status".

Motor nameplate

You can identify the fitted module on the motor nameplate. See fig. 19.

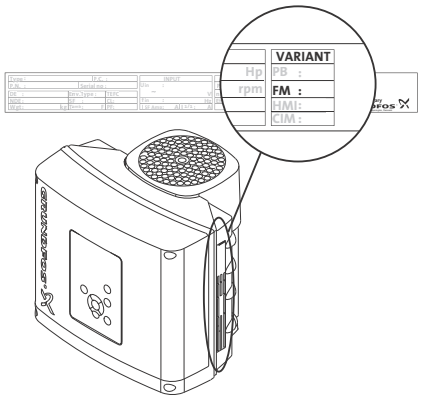

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Fig. 19 Identification of functional module

Variant	Description
FM 200	Standard functional module
FM 300	Advanced functional module

9. Startup

DANGER

Electric shock

Death or serious personal injury

- Make sure that the wires to be connected to the connection groups below are separated from each other by reinforced insulation in their entire lengths.

DANGER

Contaminated drinking water

Death or serious personal injury

- Flush the system before starting it or after a standstill period.

WARNING

Electric shock

Death or serious personal injury

- Switch off the power supply and wait at least five minutes before you make any connections in the breaker cabinet.
- Tighten the screws.

WARNING

High noise level

Death or serious personal injury

- Use ear protection.

9.1 Drinking water systems

Hygiene

Grundfos pressure pump systems are functionally tested by running water through the system. During the test, Grundfos continuously surveys the quality of the test water. Since it is not possible to completely drain and dry the system after the test, the system must be rinsed or flushed thoroughly before being used for drinking water applications, due to risk of bacteria growth. This also applies if the system has been shut down for a long period of time. Rinsing and flushing must always be done in accordance with local regulations.

Contaminated drinking water endangers health.

9.2 Hydro Multi-E in system with positive inlet pressure

Make sure that the power is switched off on the main switch and the circuit breakers.

Do not start the pumps until they have been filled with liquid.

When you have carried out the mechanical and electrical installation described in section *6. Installation*, proceed as follows:

1. Confirm that Hydro Multi-E corresponds to the order and that no part has been damaged.
2. Confirm that the precharge pressure in the diaphragm tank is 70 % of the required outlet pressure (setpoint).

Measure the precharge pressure when the water side of tank does not have system pressure on it.

3. Connect water and power supplies to the system.
4. Open all pump inlet and outlet valves.

Vent all pumps by means of the vent screws.

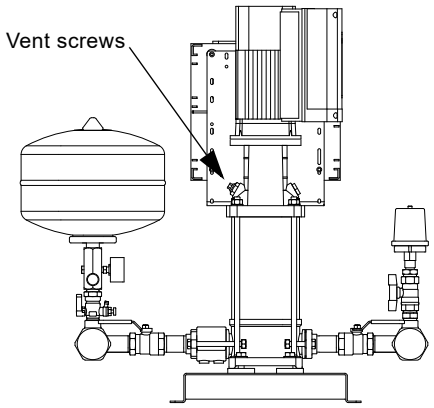

Fig. 20 Position of vent screws in CRE pump systems

5. Switch on the power supply with the main switch.
6. Start pump 1 by pressing the start/stop button on the pump control panel.
7. Vent pump 1 using the vent screw.
8. Repeat steps 9 and 10 for the other pumps in the system.
9. Set the desired outlet pressure.

If you change the outlet pressure, change the diaphragm tank precharge pressure accordingly.

10. Confirm that the pumps are cutting in and out, thus adjusting the performance to the demand.

Hydro Multi-E is now in automatic mode and ready for operation. The standard settings can be changed using Grundfos Go Remote, see *11. Multimaster function* or HMI300.

9.3 Hydro Multi-E in system without inlet pressure

Make sure that the power is switched off on the main switch and the circuit breakers.

Do not start the pumps until they have been filled with liquid.

Ensure that the dry-run protection device is appropriate for no or low inlet pressure.

When you have carried out the mechanical and electrical installation described in section *6. Installation*, proceed as follows:

1. Confirm that Hydro Multi-E corresponds to the order and that no part has been damaged.
2. Confirm that the precharge pressure in the diaphragm tank is 70 % of the required outlet pressure (setpoint).

Measure the precharge pressure when there is no pressure on water side of tank.

3. Connect water and power supplies to the system.
4. Open all pump inlet valves.
5. Close all pump outlet valves, and prime all pumps and the inlet pipe.

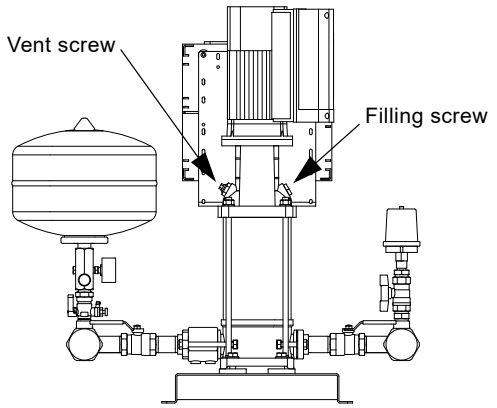

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Fig. 21 Position of vent screw and filling screw

6. Switch on the power supply with the main switch.
7. Start pump 1 by pressing the start/stop button on the pump control panel.
8. Vent pump 1 using the vent screw.
9. Slowly open the outlet valve approximately 50 %.
10. Repeat steps 9 and 11 for the other pumps in the system.
11. Slowly fully open all pump outlet valves.
12. Wait for a few minutes.
13. Set the desired outlet pressure.

If you change the outlet pressure, change the diaphragm tank precharge pressure accordingly.

14. Confirm that the pumps are cutting in and out, thus adjusting the performance to the demand.

Hydro Multi-E is now in automatic mode and ready for operation.

The standard settings can be changed using Grundfos Go Remote, see *11. Multimaster function* or HMI300.

10. User interfaces

WARNING

Hot surface

Death or serious personal injury

- Only touch the buttons on the display as the product may be very hot.

You can configure pump settings using the following user interfaces:

- HMI200
  See section *10.1 HMI200*.
- HMI300 (graphical display)
  See section *10.2 HMI300 (graphical display)*.
- Grundfos GO Remote
  See section *11. Multimaster function*.

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

10.1 HMI200

The HMI200 is standard control interface on non-system control motors (slave motors).

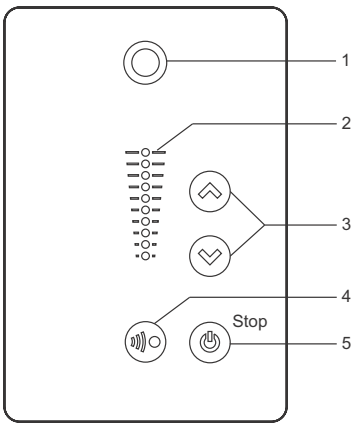

Fig. 22 HMI200

Pos.	Symbol	Description
1		Grundfos Eye Shows the operating status of individuals pump. See section *17. Grundfos Eye* for further information.
2	-	Light fields for indication of setpoint.
3		Changes the setpoint and resets alarms and warnings.
4		Enables radio communication with Grundfos GO Remote and other products of the same type.
5		Makes the pump ready for operation or starts and stops the pump. **Start:** If the button is pressed when the pump is stopped, the pump will only start if no other functions with higher priority have been enabled. See section *16. Priority of settings*. **Stop:** If the button is pressed when the pump is running, the pump will always be stopped. When the pump is stopped by this button, the "Stop" text next to the button will illuminate.

10.1.1 Setpoint setting

Set the desired setpoint by pressing ⌃ or ⌄. The setpoint can be set on any of the pumps in the system and applies to the complete pump system.

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

Pump in constant-pressure control mode

Hydro Multi-E systems are set up from factory as pressure boosting systems, but can be set up to other control modes. See CRE installation and operating instructions. The following example applies to a pump in an application where a pressure sensor gives a feedback to the pump. If the sensor is retrofitted to the pump, it must be set manually as the pump does not automatically register a connected sensor.

Figure 23 shows that the light fields 5 and 6 are activated, indicating a desired setpoint of 43.5 psi (3 bar) with a sensor measuring range from 0 to 87.0 psi (0 to 6 bar). The setting range is equal to the sensor measuring range.

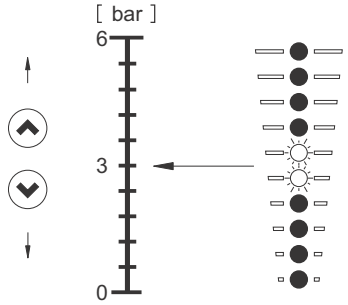

Fig. 23 Setpoint set to 43.5 psi (3 bar), constant-pressure control mode

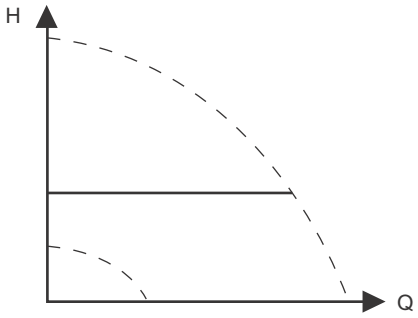

Fig. 24 Constant pressure curve

Setting to maximum curve:

- Press ⌃ continuously to change over to the maximum curve of the pump (top light field flashes). When the top light field is on, press and hold for ⌃ for 3 seconds until the light field starts flashing.
- To change back, press ⌄ continuously until the desired setpoint is indicated.

Example: Pump set to maximum curve.

Figure 25 shows that the top light field is flashing, indicating maximum curve.

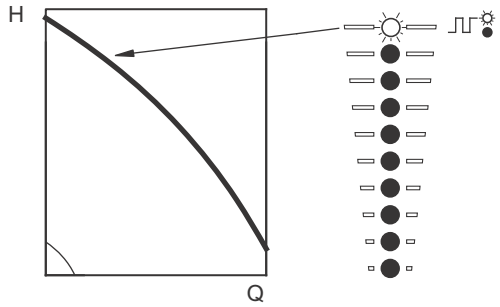

Fig. 25 Maximum curve duty

Setting to minimum curve:

- Press ⌄ continuously to change over to the minimum curve of the pump (bottom light field flashes). When the bottom light field is on, press and hold ⌄ for 3 seconds until the light field starts flashing.
- To change back, press ⌃ continuously until the desired setpoint is indicated.

Example: Pump is set to minimum curve.

Figure 26 shows that the bottom light field is flashing, indicating minimum curve.

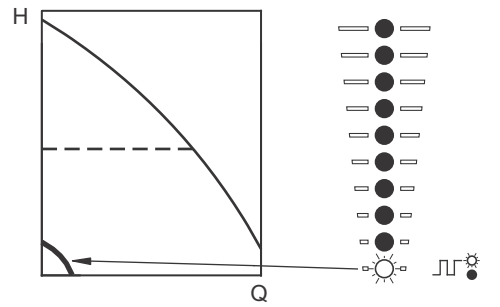

Fig. 26 Minimum curve duty

10.1.2 Start or stop the system

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

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

If a pump has been stopped by pressing ⏻, it can only be released for operation by pressing ⏻ again.

If a pump has been stopped by pressing ⌄, it can only be restarted by pressing ⌃.

The pump can also be stopped with Grundfos GO Remote or via a digital input set to "External stop". See section *16. Priority of settings*.

10.1.3 Resetting of fault indications

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 one of the pumps. This will not change the setpoint.
  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 Grundfos GO Remote.

10.2 HMI300 (graphical display)

(2) motors on pump system are capable of pump system control (master motors), and have the HMI 300 graphical control interface as standard.

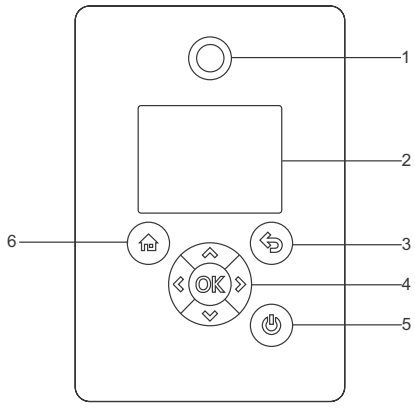

Fig. 27 HMI300

Pos.	Symbol	Description
1		Grundfos Eye Shows the operating status of individual pumps. For further information, see section *17. Grundfos Eye*.
2	-	Graphical color display.
3		Goes one step back.
4		Navigates between main menus, displays and digits. When you change the menu, the display always shows the top display of the new menu.
		Navigates between submenus. Changes value settings. **Note:** If you have disabled the function to configure settings with the Enable/Disable Settings function, you can temporarily enable it again by pressing these buttons simultaneously for at least 5 seconds. See section *"Buttons on product"*.
	OK	Saves changed values, resets alarms and expands the value field. Enables radio communication with Grundfos GO Remote and other products of the same type. When you try to establish radio communication between the pump and Grundfos GO Remote or another pump, the green indicator light in Grundfos Eye flashes. A note also appears in the pump display stating that a wireless device wants to connect to the pump. Press OK on the pump control panel to allow radio communication with Grundfos GO Remote and other products of the same type.
5		Makes the pump ready for operation, and starts and stops the pump. **Start:** If you press the button when the pump is stopped, the pump only starts if no other functions with higher priority have been enabled. See section *16. Priority of settings*. **Stop:** If you press the button when the pump is running, the pump will always stop. When you stop the pump via this button, the icon appears in the bottom of the display.
6		Return to the Home menu.

10.2.1 Home display

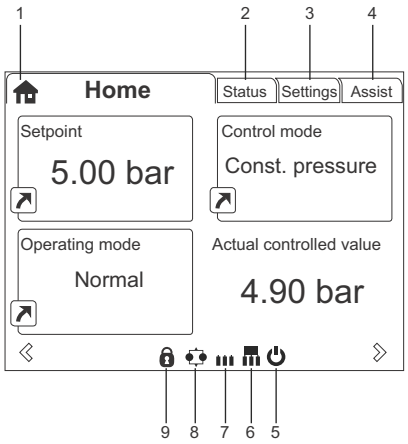

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Fig. 28 Example of **Home** display

Pos.	Symbol	Description
1		Home This menu shows up to four user-defined parameters. You can select parameters shown as shortcut icon, and when pressing OK you go directly to the "Settings" display for the selected parameter.
2	-	Status This menu shows the status of the pump and system as well as warnings and alarms.
3	-	Settings This menu gives access to all setting parameters. You can make detailed settings of the pump in this menu. See section *13. Description of functions for pumps*.
4	-	Assist This menu enables assisted pump setup, provides a short description of the control modes and offers fault advice. See section *Assist*.
5		Indicates that the pump has been stopped via the button.
6		Indicates that the pump is functioning as master pump in a multi-pump system.
7		Indicates that the pump is functioning as a slave pump in a multi-pump system.
8		Indicates that the pump is operating in a multi-pump system. See section *13.11 "Multi-pump setup"*.
9		Indicates that the function to configure settings has been disabled for safety reasons. See section *"Buttons on product"*.

11. Multimaster function

11.1 Systems with two or more outlet-pressure sensors

If two or more pumps in the system are configured with an outlet-pressure sensor (standard option), they can all function as master pumps. By default, the pump with the lowest number will be the master pump. From factory, the master pump is marked with number 1.

If master pump 1 is switched off or stopped due to an alarm, one of the other master pumps will automatically take control of the system.

12. Description of functions for the system

Hydro Multi-E offers the following functions via Grundfos GO Remote or the HMI300.

12.1 Settings

12.1.1 Setpoint

You can set the setpoint for all control modes when you have selected the desired control mode. See section *12.3 Control mode*.

Factory setting

See section *29. Factory settings*.

12.2 Operating mode

The operating modes are the operating conditions to which the pump system can be set by the user.

Possible operating modes:

- "Stop"
  All pumps stop.
- "Normal" (factory setting)
  One or more pumps are operating to maintain the set pressure.
- "Max."
  All pumps run at maximum speed.

The operating modes can be selected on the control panel, with Grundfos GO Remote or via bus.

12.2.1 Normal operation

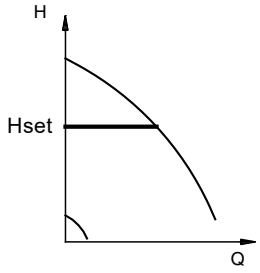

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Fig. 29 Hydro Multi-E in normal operation, that is, constant-pressure mode

In constant-pressure mode, Hydro Multi-E adjusts its performance to the desired setpoint.

12.2.2 "Stop" or "Max." operation

In addition to "Normal" operating mode, you can select the operating modes "Stop" or "Max.". See the example in fig. 30.

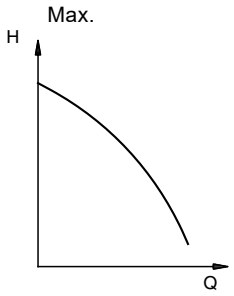

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Fig. 30 Hydro Multi-E in operating mode "Max."

"Max." operation can be used, for instance, in connection with the venting and startup procedures.

12.2.3 Operating condition in case of disconnection of power supply

If the power supply to Hydro Multi-E disconnects, the settings will be stored. Hydro Multi-E will restart in the same operating condition it was in before the disconnection.

12.2.4 Further settings

You can make further settings with Grundfos GO Remote. See section *11. Multimaster function*.

12.3 Control mode

Here you can choose between the different control modes.

12.3.1 Constant pressure

We recommend this control mode if the pump is to deliver a constant pressure, independently of the flow in the system. See fig. 31.

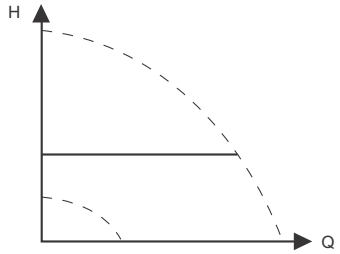


Fig. 31 "Constant pressure"

This control mode uses the factory-fitted pressure sensor, if any, which measures the outlet pressure of the pump.

For pumps without a factory-fitted sensor, you must connect a pressure sensor to one of the analog inputs of the pump. You can set the pressure sensor in the "Assist" menu. See section *Assist*.

Examples

- One external pressure sensor.

Fig. 32 "Constant pressure"

Controller settings

For recommended controller settings, see section *12.6 Controller*.

Factory setting

See section *29. Factory settings*.

12.3.2 Proportional pressure

For proportional pressure, see *12.9 Proportional pressure*.

12.4 Pipe-filling function

This function is typically used in pressure-boosting applications, and it ensures a smooth startup of systems with, for instance, empty pipes.

Startup takes place over two phases. See fig. 33.

1. Filling phase.
   The pipes are slowly filled with water. When the pressure sensor of the system detects that the pipes have been filled, phase two begins.
2. Pressure build-up phase.
   The system pressure is increased until the setpoint is reached. The pressure build-up takes place over a pressure build-up period. If the setpoint is not reached within the given time, a warning or an alarm can be given, and the pumps can be stopped at the same time.

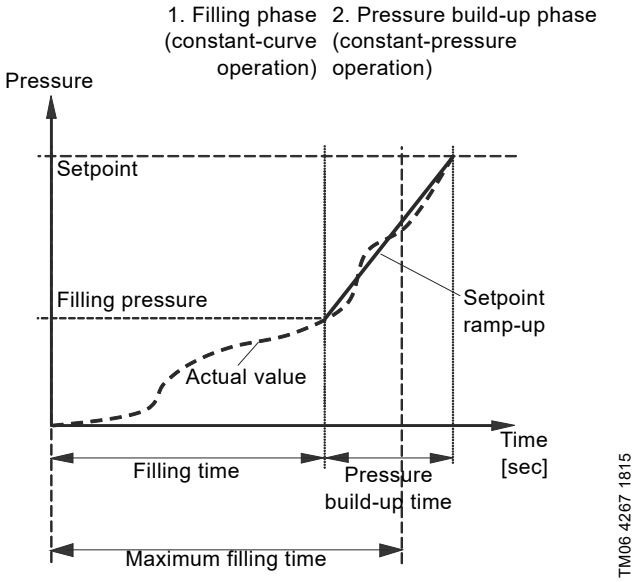


Fig. 33 Filling and pressure build-up phases

Setting range

- Filling speed
  Fixed speed of the pump during the filling phase.
- Filling pressure
  The pressure that the pump must reach before the maximum filling time.
- Max. filling time
  The time in which the pump must reach the filling pressure.
- Max. time reaction
  Reaction of the pump if the maximum filling time is exceeded:
  – warning
  – alarm (pump stops).
- Pressure build-up time
  Ramp time from when the filling pressure is reached until the setpoint must be reached.

When you activate this function, the function always starts when the pump changes from operating mode "Stop" to "Normal".

Factory setting

See section *29. Factory settings*.

12.5 Stop function

You can set the "Low-flow stop function" to the following values:

- Not active
- Energy-optimal mode
- High-comfort mode
- User-defined mode

When the "Low-flow stop function" is active, the flow is monitored. If the flow becomes lower than the set minimum flow (Q_{min}), the pump changes from continuous operation at constant pressure to start-stop operation, and stops if the flow reaches zero.

The advantages of enabling the "Low-flow stop function" are the following:

- no unnecessary heating of the pumped liquid
- reduced wear of the shaft seals
- reduced noise from operation.

The disadvantages of enabling the "Low-flow stop function" may be the following:

- The delivered pressure is not completely constant as it fluctuates between the start and stop pressures.
- The frequent starts/stops of the pump may in some applications cause acoustic noise.

The impact of the above disadvantages very much depends on the setting selected for the stop function.

The "High-comfort mode" setting minimizes pressure fluctuations and acoustic noise.

Select "Energy-optimal mode" if the main priority is to reduce the energy consumption as much as possible.

Possible settings of the stop function:

- "Energy-optimal mode"
  The pump automatically adjusts the parameters for the stop function so that the energy consumption during the start-stop operation period is minimized.
  In this case, the stop function uses the factory-set values of the minimum flow (Q_{min1}) and other internal parameters. See fig. 34.
- "High-comfort mode"
  The pump automatically adjusts the parameters for the stop function so that the disturbances during the start-stop operation period are minimized.
  In this case, the stop function uses the factory-set values of the minimum flow (Q_{min2}) and other internal parameters. See fig. 34.
- "User-defined mode":
  The pump uses the parameters set for ΔH or minimum flow (Q_{min3}) to influence the stop function. See fig. 34.

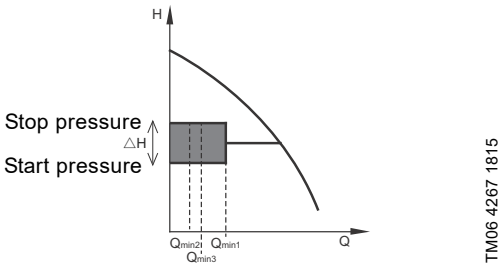


Fig. 34 Difference between start and stop pressures (ΔH) and minimum flow rate

In start-stop operation, the pressure varies between the start and stop pressures. See fig. 34.

In "User-defined mode", ΔH is factory-set to 10 % of the actual setpoint. ΔH can be set within the range from 5 to 30 % of actual setpoint.

The pump changes to start-stop operation if the flow becomes lower than the minimum flow.

The minimum flow is set in percentage of the nominal flow of the pump (see the pump nameplate).

In "User-defined mode", the minimum flow has been factory-set to 10 % of nominal flow.

Factory setting

See section *29. Factory settings*.

"Low-flow detection"

Low flow can be detected in two ways:

1. A built-in low-flow detection function which is active if none of the digital inputs is set for flow switch.
2. A flow switch connected to one of the digital inputs.

1. Low-flow detection function:
   The pump checks the flow regularly by reducing the speed for a short time. If there is no or only a small change in pressure, this means that there is low flow. The speed is increased until the stop pressure (actual setpoint + 0.5 x ΔH) is reached and the pump stops. When the pressure falls to the start pressure (actual setpoint - 0.5 x ΔH), the pump restarts.
   – If the flow is higher than the set minimum flow, the pump returns to continuous operation at constant pressure.
   – If the flow is still lower than the set minimum flow (Q_{min}), the pump continues in start-stop operation until the flow is higher than the set minimum flow (Q_{min}). When the flow is higher than the set minimum flow rate (Q_{min}), the pump returns to continuous operation.
2. Flow switch:
   When the digital input is activated for more than 5 seconds due to low flow, the speed is increased until the stop pressure (actual setpoint + 0.5 x ΔH) is reached, and the pump stops. When the pressure falls to start pressure, the pump restarts. If there is still no flow, the pump quickly reaches the stop pressure and stops. If there is flow, the pump continues operating according to the setpoint.

"Set minimum flow"

Set the minimum flow (Q_{min}) in this display. This setting determines the flow rate at which the system will change from continuous operation at constant pressure to start-stop operation. The setting range is 5 to 30 % of the rated flow.

Factory setting

See section *29. Factory settings*.

"Diaphragm tank volume"

The stop function requires a diaphragm tank of a certain minimum size. Set the size of the installed tank in this display.

In order to reduce the number of start-stops per hour or to reduce the ΔH, install a large tank.

Install the tank immediately after the pump. The precharge pressure must be 70 % of the actual setpoint.

Factory setting

See section *29. Factory settings*.

12.6 Controller

The pumps have a factory default setting of gain (K_p) and integral time (T_i).

However, if the factory setting is not the optimum setting, you can change the gain and the integral time:

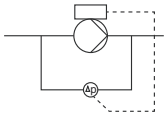
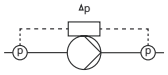
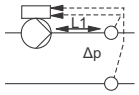
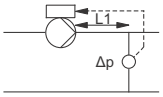
- Set the gain within the range of 0.1 to 20.
- Set the integral-action time within the range of 0.1 to 3600 seconds.
  If you select 3600 seconds, the controller functions as a P controller.

Furthermore, you can set the controller to inverse control.

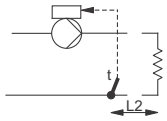
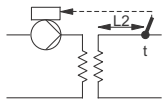
This means that if you increase the setpoint, the speed is reduced. In the case of inverse control, you must set the gain within the range of - 0.1 to - 20.

Guidelines for setting of PI controller

The tables below show the recommended controller settings:

Constant differential pressure	K_p	T_i
	0.5	0.5
		
	0.5	L1 < 5 m: 0.5 L1 > 5 m: 3 L1 > 10 m: 5
		

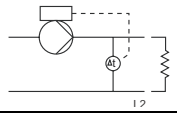
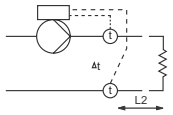
L1: Distance in meters between pump and sensor.

Constant temperature	K_p		T_i
	Heating system[1)]	Cooling system[2)]	
	0.5	-0.5	10 + 5L2
	0.5	-0.5	30 + 5L2

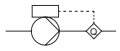
1) In heating systems, an increase in pump performance results in a rise in temperature at the sensor.

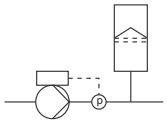
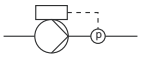
2) In cooling systems, an increase in pump performance results in a drop in temperature at the sensor.

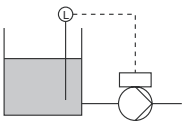
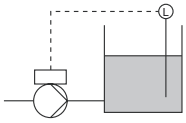
L2: distance in meters between heat exchanger and sensor.

Constant differential temperature	K_p	T_i
	- 0.5	10 + 5L2
		

L2: Distance [m] between heat exchanger and sensor.

Constant flow rate	K_p	T_i
	0.5	0.5

Constant pressure	K_p	T_i
	0.5	0.5
	0.5	0.5

Constant level	K_p	T_i
	- 20	0
	20	0

Note: If the controller is too slow-reacting, increase the gain.

If the controller is hunting or unstable, dampen the system by reducing the gain or increasing the integral time.

Factory setting

See section *29. Factory settings*.

12.7 Operating range

Set the operating range as follows:

- Set the minimum speed within the range of fixed minimum speed to user-set maximum speed.
- Set the maximum speed within the range of user-set minimum speed to fixed maximum speed.

The range between the user-set minimum and maximum speeds is the operating range. See fig. 35.

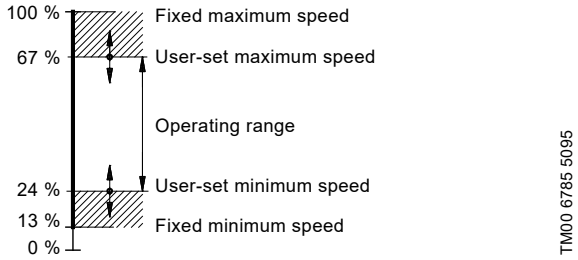


Fig. 35 Example of minimum and maximum settings

Factory setting

See section *29. Factory settings*.

12.8 Limit-exceeded function

This function can monitor a measured parameter or one of the internal values such as speed, motor load or motor current. If a set limit is reached, a selected action can take place. You can set two limit-exceeded functions, meaning that you can monitor two parameters or two limits of the same parameter simultaneously.

The function requires determining the following settings:

"Measured"

This menu/display/function allows you to set the measured parameter for monitoring.

"Limit"

This menu/display/function allows you to set the limit which triggers the function.

"Hysteresis band"

This menu/display/function allows you to set the hysteresis band.

"Limit exceeded when"

This menu/display/function allows you to select whether the function is activated if the selected parameter exceeds or drops below the set limit.

- Above limit.
  The function is activated if the measured parameter exceeds the set limit.
- Below limit.
  The function is activated if the measured parameter drops below the set limit.

Note: The "Limit exceeded" function with the "Below limit" setting is the factory standard for dry-run protection on Hydro Multi-E pump systems.

"Action"

If the value exceeds a limit, you can set an action. You can select the following actions:

- No action
  The pump remains in its current state. Use this setting if you only want to have a relay output when the limit is reached. See section *13.5 Signal relays 1 and 2 ("Relay outputs")*.
- "Warning/alarm"
  A warning is given.
- "Stop"
  The pump stops.
- "Min."
  The pump reduces speed to minimum.
- "Max."
  The pump increases speed to maximum.
- "User-defined speed"
  The pumps runs at a speed set by the user.

Detection delay

You can set a detection delay which ensures that the monitored parameter stays above or below a set limit in a set time before the function is activated.

Resetting delay

The resetting delay is the time elapsed from the measured parameter differing from the set limit, including the set hysteresis band, until the function is reset.

Example:

The function monitors the outlet pressure from a CRE pump. If the pressure is below 72.5 psi (5 bar) for more than 5 seconds, a warning must be given. If the outlet pressure is above 102 psi (7 bar) for more than 8 seconds, reset the limit exceeded warning.

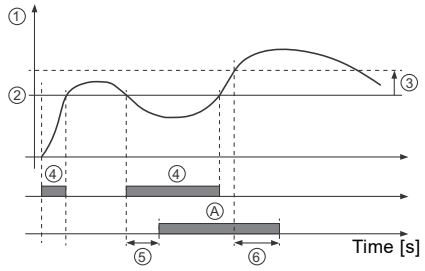


Fig. 36 Limit exceeded (example)

Pos.	Setting parameter	Setting
1	"Measured"	Outlet pressure
2	"Limit"	73 psi (5 bar)
3	"Hysteresis band"	29 psi (2 bar)
4	"Limit exceeded when"	Below limit
5	"Detection delay"	5 seconds
6	"Resetting delay"	8 seconds
A	"Limit exceeded function active"	-
-	"Action"	Warning

Factory setting

See section *29. Factory settings*.

12.9 Proportional pressure

It is possible to control the system in proportional pressure control, see section *12.3 Control mode*. With this function, the system automatically adjusts the setpoint to the actual flow rate to compensate for flow-dependent dynamic losses. This will also gain considerable energy savings and increase the comfort for the users.

To use this function, the system calculates the flow based on the head of the system (outlet-inlet pressure).

The outlet pressure is always known as the system is always fitted with an outlet pressure sensor. The inlet sensor depends on the system design. If not present, it can be retrofitted, see section *15.1.3 Inlet pressure sensor*.

If there is no inlet pressure available or if it is very constant, it is also possible to set a fixed inlet pressure.

Set the flow calculation

Connect Grundfos GO to each pump in the system (one at the time) then select "Setting the proportional pressure" in the settings.

Type in the pump data if not already done by factory (it can be read on the pump nameplate).

- rated flow (Q)
- rated head (H)
- maximum head (H_{max}).

The individual pump will now calculate its own flow, and the system will sum up the system flow.

Set the proportional pressure control

Connect to one of the master pumps with Grundfos GO Remote or via the HMI 300 control interface to set the proportional pressure control:

- Set the System setpoint which will be the maximum pressure setpoint.

Go to "Settings" and select "Setting the proportional pressure":

- Choose the control curve function ("Linear" or "Quadratic"), see fig. 37.
- Set the zero flow head (the minimum setpoint in the system).
- Set the Q_{max} (the flow point where the system reaches the maximum setpoint)
- Activate or deactivate the "Fixed inlet pressure" (depending on inlet pressure measurement)
- Type in the fixed inlet pressure (if activated).

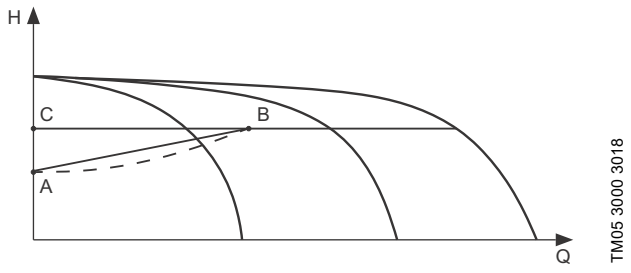


Fig. 37 Proportional pressure

A: The zero head

B: Q_{max} in cascade

C: The maximum pressure (standard setpoint).

Pump in constant-curve control mode

In constant-curve control mode, the pump performance will operate between the maximum and minimum curve of the pump. See fig. 38.

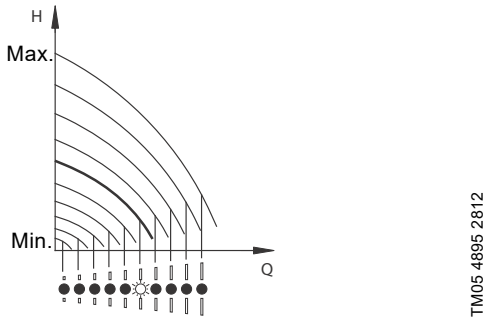


Fig. 38 Pump in constant-curve control mode

12.10 "Pump changeover"

The function ensures that the pumps run for the same number of operating hours. In certain applications, the requirement remains constant for long periods and does not require all pumps to run. In such situations, pump changeover does not take place naturally, thus forced pump changeover may be required. Once every 24 hours, the system will force a changeover to the pump with the lowest operating hours. The interval can be set from 1 to 25 hours and the timer starts when the system is powered on.

12.11 "Undo"

This menu is only available in Grundfos GO Remote.

This display allows you to undo all settings that have been made with Grundfos GO Remote in the current session. Once you undo any setting, you cannot revert to them.

12.12 "Pump name"

This display allows you to name a system which makes it easy to identify it when connecting to Grundfos GO Remote.

12.13 "Unit configuration"

This menu allows you to choose between SI and US units. You can set either unit system as the default for the entire system, or select the preferred unit for each parameter.

Factory setting

See section *29. Factory settings*.

13. Description of functions for pumps

13.1 Analog inputs

Available inputs depend on the functional module fitted in the pump:

Function (terminal)	FM 300* (advanced)
Analog input 1, setup (4)	•
Analog input 2, setup (7)	•
Analog input 3, setup (14)	•

* See section *8. Identification of functional module*.

If you want to set an analog input for other purposes, you can do this manually.

If you make the manual setting via Grundfos GO Remote, you need to enter the menu for the analog input under the "Settings" menu.

Function

The analog inputs can be set to the following functions:

- "Not active"
- "Feedback sensor"
  The sensor is used for the selected control mode.
- "Ext. setpoint infl."
  See section *13.7 External setpoint function*.
- "Other function".

Measured parameter

Select one of the parameters listed below as the parameter to be measured by the sensor connected to the actual analog input. See fig. 39.

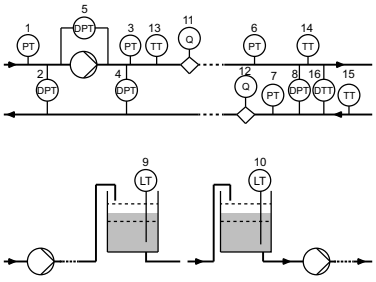


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Fig. 39 Overview of sensor locations

Sensor function/measured parameter	Pos.
"Inlet pressure"	1
"Diff. press., inlet"	2
"Discharge press."	3
"Diff. press.,outlet"	4
"Diff. press, pump"	5
"Press. 1, external"	6
"Press. 2, external"	7
"Diff. press., ext."	8
"Storage tank level"	9
"Feed tank level"	10
"Pump flow"	11
"Flow, external"	12
"Liquid temp."	13
"Temperature 1"	14
"Temperature 2"	15
"Diff. temp., ext."	16
"Ambient temp."	Not shown
"Other parameter"	Not shown

Unit

Parameter	Possible units
Pressure	bar, m, kPa, psi, ft
Level	m, ft, in
Pump flow	m³/h, l/s, yd³/h, gpm
Liquid temperature	°C, °F
Other parameter	%

Electrical signal

Select signal type:

- "0.5-3.5 V"
- "0-5 V"
- "0-10 V"
- "0-20 mA"
- "4-20 mA".

Sensor range, minimum value

Set the minimum value of the connected sensor.

Sensor range, maximum value

Set the maximum value of the connected sensor.

Factory setting

See section *29. Factory settings*.

13.1.1 Setting two sensors for differential measurement

To measure the difference of a parameter between two points, set the corresponding sensors as follows:

Parameter	Analog input for sensor 1	Analog input for sensor 2
Pressure, option 1	Differential pressure, inlet	Differential pressure, outlet
Pressure, option 2	Pressure 1, external	Pressure 2, external
Flow	Pump flow	Flow, external
Temperature	Temperature 1	Temperature 2

If you want to use the control mode "Constant differential pressure", you must choose the function "Feedback sensor" for the analog input of both sensors.

13.2 Pt100/1000 inputs

Function

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

- "Not active"
- "Feedback sensor"
  The sensor is used for the selected control mode.
- "Ext. setpoint infl."
  See section *13.7 External setpoint function*.
- "Other function."

Measured parameter

Select one of the parameters listed below as a parameter to be measured by the PT100/1000 sensor connected to the actual Pt100/1000 input. See fig. 40.

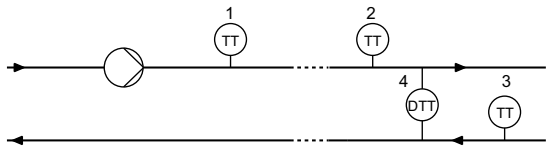

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Fig. 40 Overview of Pt100/1000 sensor locations

Parameter	Pos.
"Liquid temp."	1
"Temperature 1"	2
"Temperature 2"	3
"Ambient temp."	Not shown

Measuring range

- 50 to 204 °C.

Factory setting

See section *29. Factory settings*.

13.3 Digital inputs

Function

Select one of the following functions:

- "Not active"
  When set to "Not active", the input has no function.
- "External stop"
  When the input is deactivated (open circuit), the pump stops.
- "Min." (minimum speed)
  When the input is activated, the pump runs at the set minimum speed.
- "Max." (maximum speed)
  When the input is activated, the pump runs at the set maximum speed.
- "User-defined speed"
  When the input is activated, the motor runs at a speed set by the user.
- "External fault"
  When the input is activated, a timer is started. If the input is activated for more than 5 seconds, the pump stops and indicates a fault. This function depends on input from external equipment.
- "Alarm resetting"
  When the input is activated, a possible fault indication is reset.
- "Dry running"
  When this function is selected, lack of inlet pressure or water shortage can be detected. When detected, the pump stops. The pump cannot restart as long as the input is activated. This requires the use of an accessory, such as one of the following:
  – a pressure switch installed on the inlet side of the pump
  – a float switch installed on the inlet side of the pump.
- "Accumulated flow."
  When this function is selected, the accumulated flow can be registered. This requires the use of a flowmeter which can give a pulse per defined volume of water as a feedback signal.
- "Predefined setpoint digit 1" (applies only to digital input 2).
  When digital inputs are set to predefined setpoint, the pump operates according to a setpoint based on the combination of the activated digital inputs. See section *13.8 Predefined setpoints*.

The priority of the selected functions in relation to each other is presented in section *16. Priority of settings*.

Note: A stop command has always the highest priority.

Activation delay

Select the activation delay (T1) which is the time between the digital signal and the activation of the selected function.

Range: 0 to 6000 seconds.

Duration timer mode

Select the mode. See fig. 41.

- "Not active"
- "Mode A" - active with interrupt
- "Mode B" - active without interrupt
- "Mode C" - active with after-run.

Select the duration time (T2) which is the time that, together with the mode, determines how long the selected function will be active.

Range: 0 to 15,000 seconds.

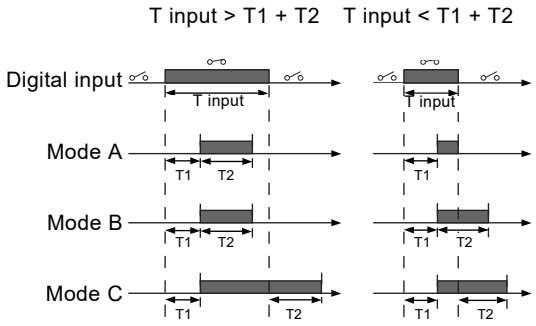

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Fig. 41 Duration timer function of digital inputs

Factory setting

See section *29. Factory settings*.

13.4 Digital inputs/outputs

You can select if the interface is to be used as input or output. The output is an open collector and you can connect it to, for example, an external relay or controller, such as a PLC.

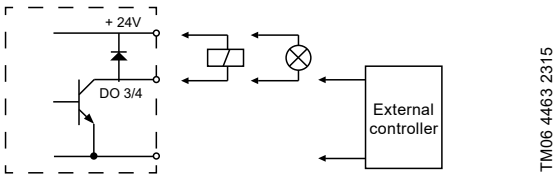

Fig. 42 Example of configurable digital inputs/outputs

To set a digital input/output, make the settings below.

Mode

You can set the digital input/output 3 and 4 to act as digital input or digital output:

- "Digital input"
- "Digital output".

Function

You can set the digital input/output 3 and 4 to the functions stated in the table below.

Note: For "Function if input", see section 19. Digital input, while for "Function if output" see section 13.5 Signal relays 1 and 2 (Relay outputs).

Possible functions, digital input/output 3

"Function if input"	"Function if output"
• Not active"	• "Not active"
• "External stop"	• "Ready"
• "Min."	• "Alarm"
• "Max."	• "Operation"
• "User-defined speed"	• "Pump running"
• "External fault"	• "Warning"
• "Alarm resetting"	• Limit 1 exceeded
• "Dry running"	• Limit 2 exceeded
• "Accumulated flow"	
• Predefined setpoint digit 2"	

Possible functions, digital input/output 4

"Function if input"	"Function if output"
• "Not active"	• "Not active"
• "External stop"	• "Ready"
• "Min."	• "Alarm"
• "Max."	• "Operation"
• "User-defined speed"	• "Pump running"
• "External fault"	• "Warning"
• "Alarm resetting"	• Limit 1 exceeded
• "Dry running"	• Limit 2 exceeded
• "Accumulated flow"	
• Predefined setpoint digit 3"	

Activation delay (only for input)

Select the activation delay (T1) which

is the time between the digital signal and the activation of the selected function.

Range: 0 to 6000 seconds.

Duration timer mode (only for input)

Select the duration timer mode. See fig. 41.

- "Not active"
- "Mode A" - active with interrupt
- "Mode B" - active without interrupt
- "Mode C" - active with after-run.

Select the duration time (T2) which is the time that, together with the mode, determines how long the selected function is active.

Range: 0 to 15,000 seconds.

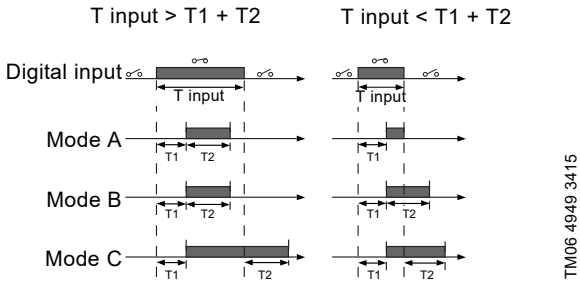

Fig. 43 Duration timer function of digital inputs

Factory setting

See section *29. Factory settings*.

13.5 Signal relays 1 and 2 ("Relay outputs")

The pump incorporates two signal relays for potential-free signalling. For further information, see section *18. Signal relays*.

Function

You can configure the signal relays to be activated by one of the following incidents:

- "Not active"
- "Ready"
  The pump can be running or is ready to run and no alarms are present.
- "Alarm"
  There is an active alarm and the pump is stopped.
- "Operating" ("Operation")
  "Operating" equals "Running" but the pump is still in operation when the pump stops due to low flow. See section *"Low-flow detection"* on page 19.
- "Running" (Pump running)
  The pump is running.
- "Warning"
  There is an active warning.
- "Limit 1 exceeded"
  When this function is activated, the signal relay is activated. See section *12.8 Limit-exceeded function*.
- "Limit 2 exceeded"
  When this function is activated, the signal relay is activated. See section *12.8 Limit-exceeded function*.
- "External fan control" ("Control of external fan")
  When you select "External fan control", the relay is activated if the internal temperature of the motor electronics reaches a preset limit value.

Factory setting

See section *29. Factory settings*.

13.6 "Analog output"

The analog output enables the reading of certain operating data to external control systems.

To set the analog output, make the settings below.

Output signal

- "0-10 V"
- "0-20 mA"
- "4-20 mA".

Function of analog output

- "Actual speed"

Signal range [V, mA]	"Actual speed" [%]		
	0	100	200
"0-10 V"	0 V	5 V	10 V
"0-20 mA"	0 mA	10 mA	20 mA
"4-20 mA"	4 mA	12 mA	20 mA

The reading is a percentage of the rated speed.

- "Actual value"

Signal range [V, mA]	"Actual value"	
	$Sensor_{min}$	$Sensor_{max}$
"0-10 V"	0 V	10 V
"0-20 mA"	0 mA	20 mA
"4-20 mA"	4 mA	20 mA

The reading is a percentage of the range between the minimum and maximum value.

- "Resulting setpoint"

Signal range [V, mA]	"Resulting setpoint" [%]	
	0	100
"0-10 V"	0 V	10 V
"0-20 mA"	0 mA	20 mA
"4-20 mA"	4 mA	20 mA

The reading is a percentage of the external setpoint range.

- "Motor load"

Signal range [V, mA]	"Motor load" [%]	
	0	100
"0-10 V"	0 V	10 V
"0-20 mA"	0 mA	20 mA
"4-20 mA"	4 mA	20 mA

The reading is a percentage of the range between 0 and 200 % of the maximum permissible load at the actual speed.

- "Motor current"

Signal range [V, mA]	"Motor current" [%]		
	0	100	200
"0-10 V"	0 V	5 V	10 V
"0-20 mA"	0 mA	10 mA	20 mA
"4-20 mA"	4 mA	12 mA	20 mA

The reading is a percentage of the range between 0 and 200 % of the rated current.

- "Limit 1 exceeded" and "Limit 2 exceeded"

Signal range [V, mA]	"Limit-exceeded function"	
	Output not active	Output active
"0-10 V"	0 V	10 V
"0-20 mA"	0 mA	20 mA
"4-20 mA"	4 mA	20 mA

This function is typically used for monitoring secondary parameters in the system. If the limit is exceeded, an output, a warning, or an alarm is activated.

- "Flow rate"

Signal range [V, mA]	"Flow rate" [%]		
	0	100	200
"0-10 V"	0 V	5 V	10 V
"0-20 mA"	0 mA	10 mA	20 mA
"4-20 mA"	4 mA	12 mA	20 mA

The reading is a percentage of the range between 0 and 200 % of the nominal flow.

Factory setting

See section *29. Factory settings*.

13.7 External setpoint function

You can influence the setpoint with an external signal:

- one of the analog inputs
- one of the Pt100/1000 inputs if an advanced functional module (FM 300) is fitted.

Before you can enable the function, you must set one of the analog inputs or Pt100/1000 inputs to "*External setpoint function*".

See sections *13.1 Analog inputs* and *13.2 Pt100/1000 inputs*.

Example with constant pressure with linear influence

The actual setpoint is the actual input signal as a percentage multiplied by the minimum sensor value subtracted from the setpoint, plus the minimum sensor value.

For instance, at a minimum sensor value of 0 psi (0 bar), a setpoint of 29 psi (2 bar) and an external setpoint of 60 %, the actual setpoint is:

0.6 x (29 - 0) + 0 = 17.4 psi (1.2 bar)

See fig. 44.

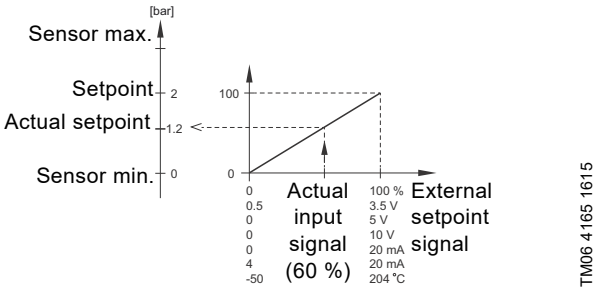

Fig. 44 Example of setpoint influence with sensor feedback

Example with constant curve with linear influence

The actual setpoint (in percentage) is the actual input signal as a percentage multiplied by the user-set minimum speed subtracted from the setpoint, plus the user-set minimum speed.

For instance, at a user-set minimum speed of 25 %, a setpoint of 85 %, and an external setpoint of 60 %, the actual setpoint is:

0.60 x (85 - 25) + 25 = 61 %

See fig. 45.

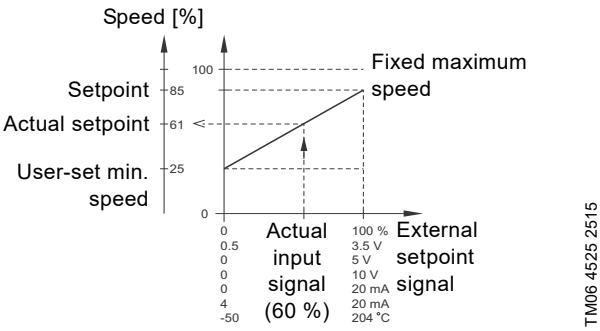

Fig. 45 Example of setpoint influence with constant curve

13.7.1 "Setpoint influence" functions

You can select the following functions:

- "Not active"
  When set to "Not active", the setpoint is not influenced by any external function.
- "Linear function"
  The setpoint is influenced linearly from 0 to 100 %. See fig. 46.

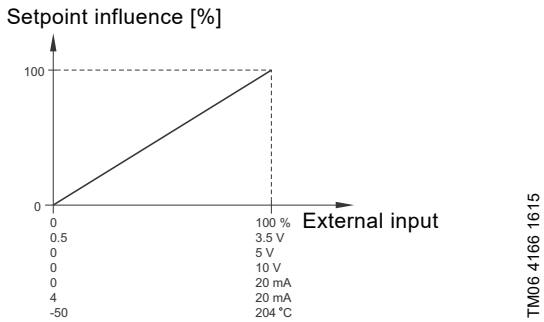

Fig. 46 Linear function

- "Linear with Stop"
  In the input signal range from 20 to 100 %, the setpoint is influenced linearly. If the input signal is below 10 %, the pump changes to operating mode "Stop".If the input signal increases above 15 %, the operating mode is changed back to "Normal". See fig. 47.

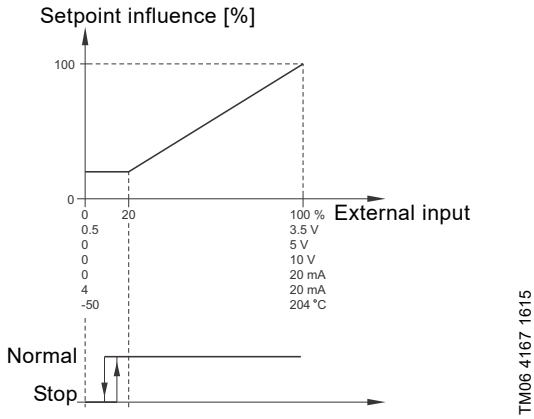

Fig. 47 "Linear with Stop"

- "Influence table".
  The setpoint is influenced by a curve made out of 2 to 8 points. There is a straight line between the points and a horizontal line before the first point and after the last point.

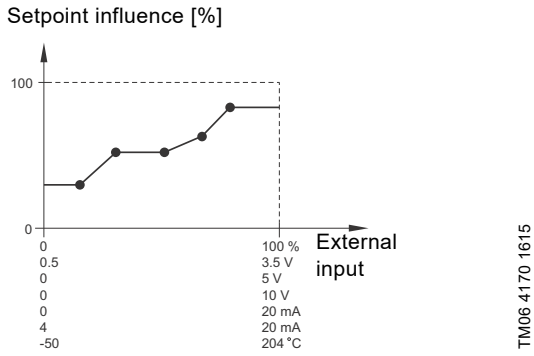

Fig. 48 Influence table (example with five points)

Factory setting

See section *29. Factory settings*.

13.8 Predefined setpoints

You can set and activate seven predefined setpoints by combining the input signals to digital inputs 2, 3 and 4. See the table below.

Set the digital inputs 2, 3 and 4 to "Predefined setpoints" if all seven predefined setpoints are to be used. You can also set one or two of the digital inputs to "Predefined setpoints", but this limits the number of predefined setpoints available.

"Digital inputs"			Setpoint
2	3	4	
0	0	0	Normal setpoint or stop
1	0	0	Predefined setpoint 1
0	1	0	Predefined setpoint 2
1	1	0	Predefined setpoint 3
0	0	1	Predefined setpoint 4
1	0	1	Predefined setpoint 5
0	1	1	Predefined setpoint 6
1	1	1	Predefined setpoint 7

0: Open contact
1: Closed contact

Example

Figure 49 shows how you can use the digital inputs to set seven predefined setpoints. Digital input 2 is open and digital inputs 3 and 4 are closed. If you compare with the table above, you can see that "Predefined setpoint 6" is activated.

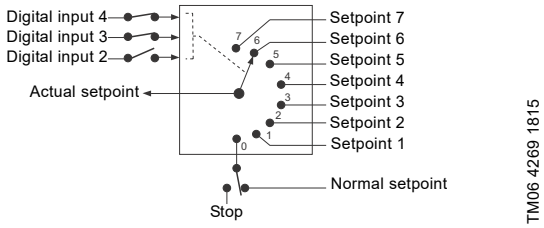

Fig. 49 Principle sketch showing how the predefined setpoints function

If all digital inputs are open, the pump stops or runs at the normal setpoint. Set the desired action with Grundfos GO Remote or with the HMI300.

Factory setting

See section *29. Factory settings*.

13.9 Alarm log

This menu contains a list of logged alarms from the product. The log shows the name of the alarm, when the alarm occurred and when it was reset.

13.10 Warning log

This menu contains a list of logged warnings from the product. The log shows the name of the warning, when the warning occurred and when it was reset.

13.11 "Multi-pump setup"

The multi-pump function enables the control of two pumps connected in parallel without the use of external controllers. The pumps in a multi-pump system communicate with each other via the wireless GENIair connection or the wired GENI connection.

You can set a multi-pump system via the master pumpwhich is the first selected pump.

If two pumps in the system are configured with an outlet-pressure sensor, they can all function as master pumps and take over the master pump function if the other should fail. This provides additional redundancy in the multi-pump system.

13.11.1 Cascade

Cascade operation is possible with two to four pumps of the same size and type connected in parallel. Each pump requires a check valve in series with the pump.

Hydro Multi-E maintains a constant pressure through continuously adjusting the speed of the pumps connected. It adjusts its performance to the demand through cutting in or out the required number of pumps and through parallel control of the pumps in operation.

13.11.2 Setting up a multi-pump system

You can set a multi-pump system in the following ways:

- *Grundfos GO Remote and wireless pump connection*
- *Grundfos GO Remote and wired pump connection*
- *Advanced control and wireless pump connection*
- *Advanced control panel and wired pump connection.*

See step-by-step descriptions below.

Grundfos GO Remote and wireless pump connection

1. Power on both pumps.
2. Establish contact to one of the pumps with Grundfos GO Remote.
3. Set the needed analog and digital inputs via Grundfos GO Remote according to the connected equipment and the required functionality.
4. Assign a pump name to the pump using Grundfos GO Remote.
5. Disconnect Grundfos GO Remote from the pump.
6. Establish contact to the next pump.
7. Set the needed analog and digital inputs via Grundfos GO Remote according to the connected equipment and the required functionality.
8. Complete the previous steps for the rest of the pumps in the system.
9. Assign a pump name to the pump using Grundfos GO Remote.
10. Select the "Assist" menu and choose "Setup of multi-pump system".
11. Select the cascade function.
12. Press [>] to continue.
13. Select cable as the communication method to be used between the two pumps.
14. Press [>] to continue.
15. Press "Select pump 2".
16. Select the pump from the list.
17. Press [>] to continue.

Use the [OK] or button to identify the pump.

18. Complete the previous steps for the rest of the pumps in the system.
19. Confirm the setting by pressing [Send].
20. Press [Finish] in the "Setup complete" dialog box.
21. Wait for the green indicator light in the middle of Grundfos Eye to light up.

14. Setting the product (E products)

14.1 Setting by means of the pumps

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

Setpoint

You can set the desired setpoint in three ways:

- on the pump control panel
- via an input for external setpoint signal
- with Grundfos GO Remote.

Other settings

Make all other settings with Grundfos GO Remote.

You can read important parameters, such as the actual value of the control parameter and power consumption, via Grundfos GO Remote.

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

14.1.1 Radio communication

This product incorporates a radio module for remote control which is a class 1 device and which you can use anywhere in the EU without restrictions.

Some variants of the product and products sold in China and Korea have no radio module.

This product can communicate with Grundfos GO Remote and other products 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.

Radio communication (Enable/disable radio comm.)

You can set the radio communication to either enabled or disabled. You can use this function in areas where radio communication is not allowed.

IR communication remains active.

Factory setting

See section *29. Factory settings*.

14.1.2 Battery

An Li-ion battery is fitted in CRE, CRIE and CRNE. The Li-ion battery complies with the Battery Directive (2006/66/EC). The battery does not contain mercury, lead or cadmium.

14.2 Setting by means of Grundfos GO Remote

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

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

Grundfos GO Remote offers three different mobile interfaces (MI). See fig. 38.

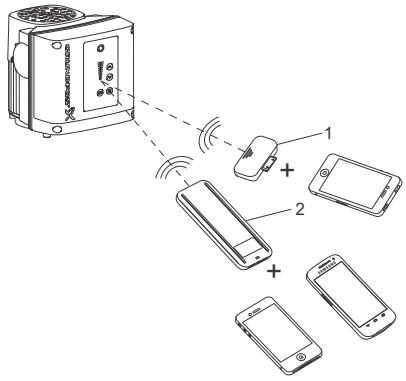

Fig. 50 Grundfos GO Remote communicating with the pump via radio or infrared light

Pos.	Description
1	Grundfos MI 204: Add-on module which can be used in conjunction with an Apple iPhone or iPod touch with Lightning connector, for example a fifth generation iPhone or iPod. (The MI 204 is also available together with an Apple iPod touch and a cover).
2	Grundfos MI 301: Separate module enabling radio or infrared communication. The module can be used in conjunction with an Android or iOS-based smartphone with Bluetooth connection.

14.3 Communication

When Grundfos GO Remote communicates with the pump, the indicator light in the middle of Grundfos Eye will flash green. See section *17. Grundfos Eye*.

Communication must be established using one of these communication types:

- radio communication
- infrared communication.

14.3.1 Radio communication

Radio communication can take place at distances up to 30 meters. Enable communication by pressing or OK on the pump control panel.

14.3.2 Infrared communication

When communicating via infrared light, point Grundfos GO Remote at the pump control panel.

When communication is established, you can communicate with either the pump or the system, depending on the changes set up, see *14.4 Menu overview*.

(Alternative:) When communication is established, the master pump can control itself and the system, while the slave pumps can only control themselves, see *14.4 Menu overview*.

14.4 Menu overview

14.4.1 Main menus

	Menu or function available for system	Menu or function available for pump
Dashboard	●	●
Status	●	●
Settings	●	●
"Setpoint"	●	
"Operating mode"	●	
"Control mode"	●	
"Pipe filling function"	●	
"Buttons on product"		●
"LiqTec"		●
"Stop function"	●	
"Controller"	●	
"Operating range"		●
"Ramps"	●	
"Pump number"		●
"Radio communication"		●
"Analog input 1"		●
"Analog input 2"		●
"Digital input 1"		●
"Digital input 2"		●
"Signal relay 1"		●
"Signal relay 2"		●
"Limit 1 exceeded"		●
"Limit 2 exceeded"		●
"Standstill heating"		●
"Motor bearing monitoring"		●
"Service"		●
"Date and time"		●
"Store settings"		●
"Recall settings"		●
"Undo"		●
"Pump name"		●
"Unit configuration"		●
Alarms and warnings		●
Assist		●
Product information		●

15. Protective functions

It is important that any protective function, for example dry-running protection or external start/stop that is detected via a digital input, is connected to and configured on all the pumps with an outlet-pressure sensor.

If an additional sensor is used, for example the limit-exceeded function or setpoint influence, this sensor must also be connected to all pumps with an outlet-pressure sensor. Alternatively, an additional sensor per pump with an outlet-pressure sensor can be installed.

15.1 Dry-running protection

Hydro Multi-E must be protected against dry running.

Types of dry-running protection:

- A pressure switch or an inlet pressure sensor is factory-fitted to the inlet manifold. See section *15.1.1 Pressure switch* and *15.1.3 Inlet pressure sensor*.
- A level switch is fitted in a water tank (optional). See section *15.1.2 Level switch*.

15.1.1 Pressure switch

The Hydro Multi-E can be fitted with an adjustable pressure switch as dry-running protection. The pressure switch is fitted to the inlet manifold.

If the inlet pressure is below the lower switching point, the system cannot start.

If the pressure switch stops the system during operation due to the inlet pressure being too low, the inlet pressure must increase to a pressure that is higher than the setting of the upper switching point before the system can restart.

If necessary, adjust the lower switching point by turning screw A, and adjust the upper switching point to a value higher than the lower switching point by turning screw B. See fig. 51.

Do not set the lower switching point to a value below the minimum inlet pressure. See section *27.5 Minimum inlet pressure*.

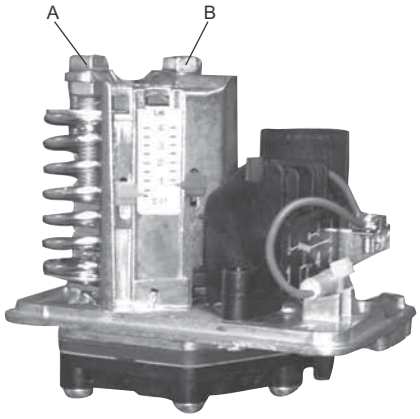

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Fig. 51 Adjustment of switching points

Pos.	Description
A	Low pressure SP
B	High pressure SP

15.1.2 Level switch

If there is no inlet pressure, the system can be optionally fitted with a level switch, either from factory or after delivery. The level switch must be connected to terminal 3 and 10 in all pumps, then it can monitor the water level in a tank connected to the inlet manifold. See section *Advanced functional module (FM 300)*.

Furthermore, the digital input must be configured with Grundfos GO Remote to detect dry running.

The system starts up automatically if it has been stopped due to dry running. It can be changed to manual restart with Grundfos GO Remote.

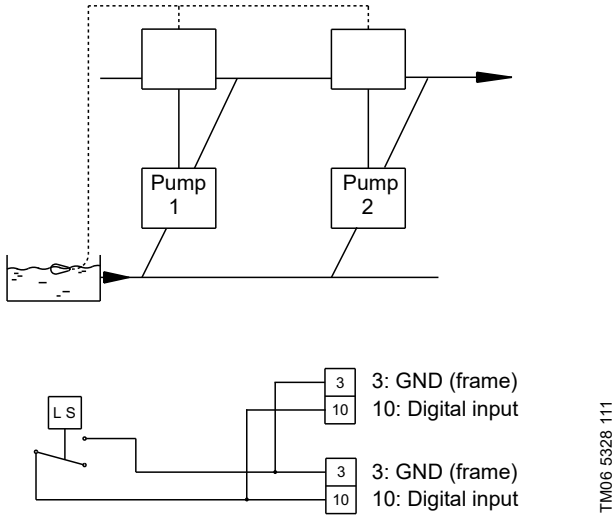

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Fig. 52 Level switch connected to each pump

15.1.3 Inlet pressure sensor

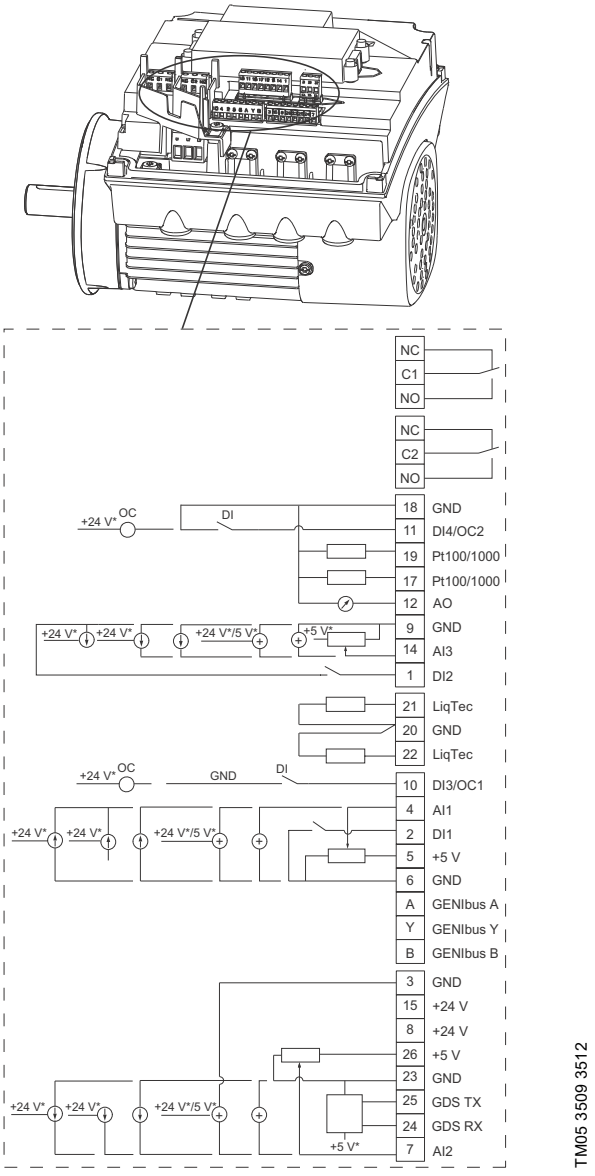
Multi-E systems with inlet sensors have Limit Exceed (Low Limit) configured for dry-running protection

The Hydro Multi-E system can be fitted with one or two inlet pressure sensors, either from factory or after delivery. The sensor can monitor the pressure in the inlet manifold and must be connected to one of the analog inputs. See section *Advanced functional module (FM 300)*.

The analog input is configured with Grundfos GO Remote or via the HMI300 graphical control interface. Configure one of the "Limit exceeded" functions to detect dry-running.

From factory, the system is set to start automatically if it has been stopped due to dry-running. It can be changed to manual restart with Grundfos GO Remote or via the HMI 300 graphical control interface.

Advanced functional module (FM 300)



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

Terminal	Type	Function
NC	Normally closed contact	Signal relay 1 (LIVE or SELV)
C1	Common	
NO	Normally open contact	

Terminal	Type	Function
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: Maximum 24 V resistive or inductive
19	Pt100/1000	Pt100/1000 sensor input 2
17	Pt100/1000	Pt100/1000 sensor input 1
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	LiqTec sensor input 1 (white conductor)
20	GND	Ground (brown and black conductors)
22	LiqTec	LiqTec sensor input 2 (blue conductor)
10	DI3/OC1	Digital input/output, configurable. Open collector: Maximum 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

16. Priority of settings

The system can always be set with Grundfos GO Remote to operate at maximum speed or to stop.

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

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

The priority of the settings is listed in the table below:

Priority	Start/stop button	Control panel on pump or Grundfos GO Remote	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		

* If the bus communication is interrupted, the system will resume its previous operating mode, for example "Stop", selected on the control panel of the pump running as master or with Grundfos GO Remote.

17. Grundfos Eye

The operating condition of Hydro Multi-E is indicated by Grundfos Eye on the pump control panels. See fig. 53, pos. A.

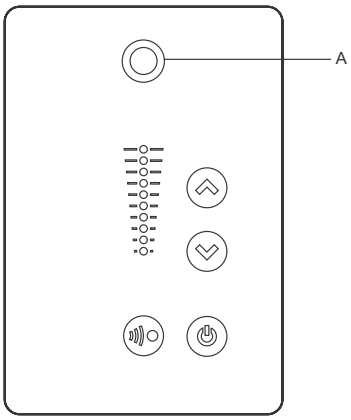


Fig. 53 Grundfos Eye

Grundfos Eye	Indication	Description
	No lights are on.	The power is off. The motor is not running.
	The two opposite green indicator lights are rotating in the direction of rotation of the motor when seen from the non-drive end.	The power is on. The motor is running.
	The two opposite green indicator lights are permanently on.	The power is on. The motor is not running.
	One yellow indicator light is rotating in the direction of rotation of the motor when seen from the non-drive end.	Warning. The motor is running.
	One yellow indicator light is permanently on.	Warning. The motor has stopped.
	Two opposite red indicator lights are flashing simultaneously.	Alarm. The motor has stopped.
	The green indicator light in the middle flashes quickly four times. 	Remote control with Grundfos GO Remote via radio. The motor is trying to communicate with Grundfos GO Remote. The motor 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 you select the motor in the Grundfos GO Remote menu, the green indicator light in the middle flashes continuously. Press on the pump control panel to allow remote control and data exchange via Grundfos GO Remote.
	The green indicator light in the middle is permanently on. 	Remote control with Grundfos GO Remote via radio. The motor is communicating with Grundfos GO Remote via radio connection.
	The green indicator light in the middle flashes quickly while Grundfos GO Remote is exchanging data with the motor. It takes a few seconds. 	Remote control with Grundfos GO Remote via infrared light. The motor is receiving data from Grundfos GO Remote via infrared communication.

18. 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",or "Warning".

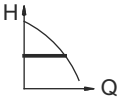
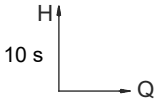
The functions of the two signal relays are presented in the table below:

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

19. Digital input

Hydro Multi-E has a digital input for external faults. The input has been factory-set to external faults and is active in closed condition.

Functional diagram: input for digital function

Digital function (terminals 1 and 9)		
		Normal duty
		External fault

If the digital input is active for more than 10 seconds (s), Hydro Multi-E stops due to an external fault.

The digital input is used for the dry-running protection.

20. Data communication

It is possible to connect the system to an external network. The connection can be made via a GENIbus-based network or a network based on another fieldbus protocol.

The system can communicate via CIM modules. This enables the system to communicate with different types of network solutions.

A CIM module is an add-on communication interface module. The CIM module enables data transmission between the pump and an external system, for example a BMS or SCADA system.

For further information on CIM modules, see Grundfos Product Center at www.grundfos.com, or contact Grundfos.

21. Maintenance

DANGER

Contaminated drinking water

Death or serious personal injury

- Flush the system before starting it or after a standstill period.

WARNING

Electric shock

Death or serious personal injury

- Switch off the power supply and wait at least five minutes before you start any work on the product. Make sure that the power supply cannot be accidentally switched on.

WARNING

Crushing of feet

Death or serious personal injury

- Wear appropriate protective gear, and use appropriate lifting equipment during maintenance.

WARNING

Harm of body

Death or serious personal injury

- Use hard hat.

21.1 Pumps

Pump bearings and shaft seals are maintenance-free.

If CRE or CRIE pumps are to be drained after a long period of inactivity, remove one of the coupling guards to inject a few drops of silicone oil on the shaft between the pump head and the coupling. This will prevent the shaft seal faces from sticking.

21.2 Motors

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

Motors above 10.0 Hp (7.5 kW) must be lubricated according to the recommended intervals and with the type of bearing grease stated on the motor.

21.3 Breaker cabinet

The breaker cabinet is maintenance-free. Keep it clean and dry.

21.4 Service kits

See Grundfos Product Center at www.grundfos.com for service manuals.

22. Taking the product out of operation

DANGER

Contaminated drinking water

Death or serious personal injury

- Flush the system before starting it or after a standstill period.

WARNING

Crushing of feet

Death or serious personal injury

- Wear appropriate protective gear, and use appropriate lifting equipment when dismantling the product.

DANGER

Electric shock

Death or serious personal injury

- Do not touch the conductors in front of the main switch as they are still energized.

If the system is taken out of operation for a period of time, complete the following steps:

1. Shut down the system with the main switch in the breaker cabinet.
2. To shut down a pump, switch off the circuit breaker of the pump.

22.1 Frost protection

If pumps are not used during periods of frost, they must be drained to avoid damage.

Drain the pump by loosening the vent screw in the pump head, then removing the drain plug from the base.

Do not tighten the vent screw or refit the drain plug until the system is to be used again.

23. Startup the product after standstill

DANGER

Contaminated drinking water

Death or serious personal injury

- Flush the system before starting it or after a standstill period.

See section *9. Startup* for further instructions.

24. Fault finding

WARNING

Electric shock

Death or serious personal injury

- Switch off the power supply and wait at least five minutes before you start any work on the product. Make sure that the power supply cannot be accidentally switched on.

WARNING

Crushing of feet

Death or serious personal injury

- Wear appropriate protective gear, and use appropriate lifting equipment during maintenance.

Fault	Cause	Remedy
1. Hydro Multi-E does not run when started.	a) The actual pressure is higher than or equal to the setpoint determined.	Wait until the pressure drops, or lower the pressure on the outlet side of Hydro Multi-E, and check that the pump system starts.
	b) The power supply is disconnected.	Connect the power supply.
	c) The circuit breakers have cut out.	Correct the fault and cut in the circuit breakers.
	d) The internal motor protection is activated.	Contact Grundfos.
	e) The circuit breaker is defective.	Replace the circuit breaker.
	f) The motor is defective.	Repair or replace the motor.
	g) Outlet-pressure sensor fault.	
	– The outlet-pressure sensor is defective.	Replace the outlet-pressure sensor.
	– The cable is broken or short-circuited.	Repair or replace the cable.
2. Hydro Multi-E starts, but stops immediately afterwards. The operating pressure is not reached.	a) Dry running or no inlet pressure.	Check the supply of water to Hydro Multi-E. When the inlet pressure has been re-established, the pumps will restart after 15 seconds.
3. Hydro Multi-E is stopped and cannot restart.	a) Outlet-pressure sensor fault.	
	– The outlet-pressure sensor is defective.	Replace the outlet-pressure sensor. Outlet-pressure sensors with 0-20 mA or 4-20 mA output signals are monitored by Hydro Multi-E.
	– The cable is broken or short-circuited.	Repair or replace the cable.
	b) Terminal box unit fault.	
	– The power supply is disconnected on pump 1.	Connect the power supply.
	– The terminal box is defective.	Replace the terminal box of pump 1. Contact Grundfos.
4. Unstable water supply from Hydro Multi-E (only applies to very low consumption).	a) The inlet pressure is too low.	Check the inlet pipe and possible inlet strainer.
	b) The inlet pipe or pumps are partly blocked by debris.	Clean the inlet pipe or pumps.
	c) The pumps suck air.	Check the inlet pipe for leakages.
	d) The outlet-pressure sensor is defective.	Replace the outlet-pressure sensor.
5. Pumps are running, but deliver no water.	a) The inlet pipe or pumps are blocked by debris.	Clean the inlet pipe or pumps.
	b) The check valve is blocked in the closed position.	Clean the check valve. The check valve must move freely.
	c) The inlet pipe is leaky.	Check the inlet pipe for leakages.
	d) Air in inlet pipe or pumps.	Vent the pumps. Check the inlet pipe for leakages.
6. Hydro Multi-E is unable to reach the setpoint.	a) The cable is broken or short-circuited (GENIbus communication between pump 1 and pump 2 or 3).	Repair or replace the cable.
	b) Pump 2 or 3 is out of operation.	Connect the power supply to the pump and check the pump condition.

7.	Leakage from a shaft seal.	a)	The shaft seal is defective.	Replace the shaft seal.
		b)	CRE and CRIE pumps: The height adjustment of the pump shaft is inaccurate.	Re-adjust the shaft height.
8.	There is noise when the pumps are operating.	a)	The pumps are cavitating.	Clean the inlet pipe or pumps and possibly the inlet strainer.
		b)	CRE and CRIE pumps: The pumps do not rotate freely (frictional resistance) due to inaccurate height adjustment of the pump shaft.	Re-adjust the shaft height. See the CR, CRI, CRN installation and operating instructions supplied with Hydro Multi-E.
9.	Very frequent starts and stops.	a)	The diaphragm tank precharge pressure is wrong.	Check the precharge pressure.
		b)	The difference between start and stop pressures is too small. **Note:** This situation will only arise if emergency operation is installed.	Increase the differential pressure setting on each pressure switch.

25. Technical data, Hydro Multi-E with single-phase pumps

25.1 Supply voltage

1 x 200-240 V ± 10 %, 50/60 Hz, PE.

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

Maximum feeder overcurrent protective device rating

Motor size [Hp (kW)]	Max. [A]	
	2 pumps	3 pumps
1.0 (0.75)	15	25
1.5 (1.1)	25	35
2.0 (1.5)	25	40

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

25.2 Leakage current

Motor size [Hp (kW)]	Number of pumps in pump system	Leakage current [mA]
1.0 - 2.0 (0.75 - 1.5)	2	< 7
	3	< 10.5
	4	< 14

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

25.3 Torques

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

26. Technical data, Hydro Multi-E with three-phase pumps

26.1 Supply voltage

3 × 200-240 V ± 10 %, 50/60 Hz, PE.

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

Maximum feeder overcurrent protective device rating

Motor size [Hp (kW)]	Max. [A]	
	2 pumps	3 pumps
1.5 (1.1)	15	20
2.0 (1.5)	15	25
3.0 (2.2)	25	35
5.0 (4)	40	50
7.5 (5.5)	50	80

3 × 380-480 V ± 10 %, 50/60 Hz, PE.

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

Maximum feeder overcurrent protective device rating

Motor size [Hp (kW)]	Max. [A]	
	2 pumps	3 pumps
1.0 (0.75)	15	15
1.5 (1.1)		
2.0 (1.5)		
3.0 (2.2)		
5.0 (4)	20	30
7.5 (5.5)	30	40
10.0 (7.5)	35	50
15.0 (11)	50	70

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

26.2 Leakage current

Motor size [Hp (kW)]	Number of pumps in pump system	Leakage current [mA]
0.40 - 14.75 (0.3 - 11) (supply voltage below 400 V)	2	< 7
	3	< 10.5
	4	< 14
0.49 - 14.75 (0.37 - 11) (supply voltage over 400 V)	2	< 10
	3	< 15
	4	< 20

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

26.3 Torques

See section *25.3 Torques*.

27. Operating conditions

27.1 Temperatures

27.1.1 Ambient temperature during storage and transportation

Minimum: -22 °F (-30 °C).

Maximum: 140 °F (60 °C).

27.1.2 Ambient temperature during operation

Minimum: -4 °F (-20 °C).

Maximum: 122 °F (50 °C).

The motors can operate with the rated output power (P2) at 122 °F (50 °C), but continuous operation at higher temperatures will reduce the expected product life. If the motors are to operate at ambient temperatures between 122 and 140 °F (50 and 60 °C), oversized motors must be selected. Contact Grundfos for further information.

27.1.3 Liquid temperature

System type:	Liquid temperature (water):
Systems with CR, CRE 3 and CR, CRE 5	32-140 °F (0-60 °C)
Systems with CRE 10 and larger	32-180 °F (0-82 °C)

27.2 Installation altitude

Installation altitude is the height above sea level of the installation site. Motors installed up to 3281 ft (1000 m) above sea level can be loaded 100 %. The motors can be installed up to 11483 ft (3500 m) above sea level.

Motors installed over 3281 ft (1000 m) above sea level must not be fully loaded due to the low density and consequent low cooling effect of the air.

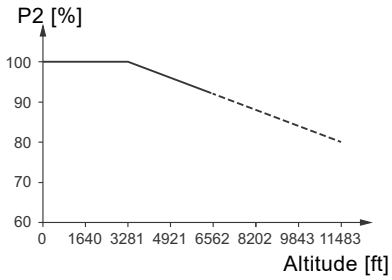


Fig. 54 Motor output power in relation to altitude

In order to maintain the galvanic isolation and ensure correct clearance according to IEC 60664-1:2007, you must adapt the supply voltage to the altitude:

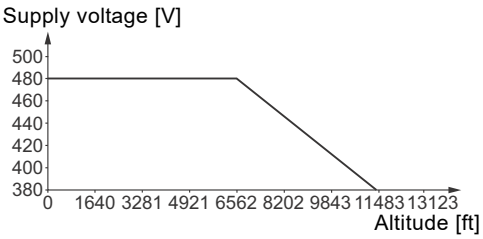
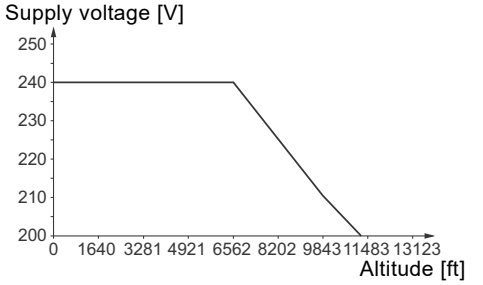


Fig. 55 Supply voltage for three-phase motor in relation to altitude



Supply voltage for single-phase motor in relation to altitude

27.3 Humidity

Maximum 95 %.

27.4 Maximum operating pressure

See *5.1 Nameplate*.

27.5 Minimum inlet pressure

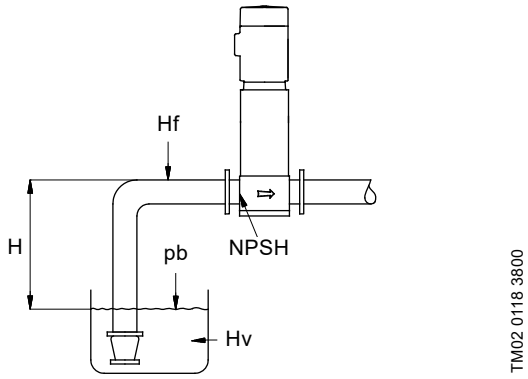


Fig. 56 Parameters for the calculation of minimum inlet pressure

The minimum inlet pressure "H" in feet of head required to avoid cavitation in the pumps can be calculated as follows:

H = pb x 2.31 - NPSH - Hf - Hv - Hs

pb = Barometric pressure in psi. Barometric pressure can be set to 14.5 psi.

In closed systems, p_b indicates the system pressure in psi.

NPSH = Net Positive Suction Head in feet of head

The NPSH value can be read from the NPSH curve at the highest flow which the individual pump will be delivering.

Hf = Friction loss in inlet manifold in feet of head at the highest flow the individual pump will be delivering.

Note: If a check valve is installed on the inlet side of the pump, the friction loss in the valve must be added. See the manufacturer's data.

Hv = Vapor pressure in ft

Hs = Safety margin of minimum 2 feet of head.

In some regions, the pump system is available with a low inlet manifold which makes it more suitable for suction lift operation. Contact Grundfos for further information.

Example

pb	= 14.5 (1 bar).
Pump type	= CRE 15, 50 Hz.
Flow rate	= 15 m^3/h
NPSH	= 1.7 psi (1.2 meters head).
(from Grundfos Product Center)	
Hf	= 4.26 psi (3.0 meters head).
Liquid temperature	= 180 °F (82 °C).
Hv	= 3 psi (2.1 meters head).
H	= pb x 10.2 - NPSH - Hf - Hv - Hs [14.50 psi (meters head)].
H	= 1 x 10.2 - 1.2 - 3.0 - 2.1 - 0.5 equal to 3.9 psi (2.8 meters head).

This means that each pump can operate at a suction lift of maximum 3.9 psi (2.8 meters head).

Pressure calculated in psi (bar): 2.8 x 0.0981 = 0.27

Pressure calculated in kPa: 2.8 x 9.81 = 27.4

27.6 Maximum inlet pressure

The maximum inlet pressure must not exceed 116 psi (8 bar). However, the actual inlet pressure plus the pressure when the pump is operating against a closed valve must always be lower than the maximum operating pressure.

27.7 Minimum flow rate

Due to the risk of overheating, the pumps must not be used at flow rates below 10 % of the rated flow rate of one pump.

The pumps must not run against a closed outlet valve.

27.8 Maximum starts and stops

The system must not be started and stopped via the power supply more than four times per hour.

When the system is switched on via the power supply, it will start after approximately 5 seconds.

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

When started via an external on/off switch, the system starts immediately.

27.9 Diaphragm tank

The diaphragm tank precharge pressure must be set to 70 % of the setpoint.

If the setpoint is changed, the diaphragm tank precharge pressure must be changed accordingly to ensure optimal operation.

Measure the precharge pressure while the system is pressureless.

We recommend that you use nitrogen gas for precharging.

28. Inputs and 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 less than 25 mADC.

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

Digital inputs (DI)

The internal pull-up current is above 10 mA when the initial voltage (Vi) is equal to 0 VDC.

The internal pull-up current is zero when the initial voltage (Vi) is greater than 5 VDC.

Certain logical low: Vi below 1.5 VDC.

Certain logical high: Vi over 3.0 VDC.

Hysteresis: No.

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

Maximum cable length: 1640 ft (500 m).

Open-collector digital outputs (OC)

Current sinking capability: 75 mADC, no current sourcing.

Load types: Resistive and/or 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: 28-16 AWG (0.5 - 1.5 mm^2).

Maximum cable length: 1640 ft (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: Ri is greater than 100 kΩ at 77 °F (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: Ri is equal to 292 Ω.

Current overload protection: Yes. Change to voltage signal.

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

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

Maximum cable length: 500 m (exclusive of potentiometer).

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

Use maximum 10 kΩ.

Maximum cable length: 328 ft (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: 28-16 AWG (0.5 - 1.5 mm^2).

Maximum cable length: 1640 ft (500 m).

Pt100/1000 inputs (PT)

Temperature range:

- Minimum -22 °F (-30 °C) (88/882 Ω).
- Maximum 356 °F (180 °C) (168/1685 Ω).

Measurement tolerance: ± 34.7 °F (1.5 °C).

Measurement resolution: Less than 32.54 °F (0.3 °C).

Automatic range detection (Pt100 or Pt1000): Yes.

Sensor fault alarm: Yes.

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

Use Pt100 for short wires.

Use Pt1000 for long wires.

LiqTec sensor inputs

Use Grundfos LiqTec sensor only.

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

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 %.
- 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: 28-12 AWG (0.5 - 2.5 mm^2).

Maximum cable length: 1640 ft (500 m).

Bus input

Grundfos GENIbus protocol, RS-485.

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

Maximum cable length: 1640 ft (500 m).

29. Factory settings

●	Function is enabled.
❍	Function is disabled.
-	Function is not available.

Settings	CRE
"Setpoint"	30 % of sensor range
"Operating mode"	"Normal"
"Control mode"	"Constant pressure"
"Pipe filling function"	"Not active"
"Buttons on product"	"Active"
"Stop function" (Low-flow stop function)	"Active"
"Controller" (Controller settings):	●
"Ti"	0.5
"Kp"	0.5
"Operating range"	25-100 %
Ramps	
Ramp-up	1 second
Ramp-down	3 seconds
"Number" ("Pump number")	-
"Radio communication"	"Active"
"Analog input 1"	"4-20 mA"
"Analog input 2"	"Not active"
"Analog input 3"	"Not active"[2)]
"Pt100/1000 input 1"	"Not active"
"Pt100/1000 input 2"	"Not active"
"Digital input 1"	"External stop"
"Digital input 2"	"Not active"
"Digital in/output 3"	Dry running[3)]
"Digital in/output 4"	"Not active"
"Pulse flowmeter"	"Not active"
Predefined setpoints	"Not active"
"Analog output"	"Not active"
"External setpoint function"	"Not active"
"Signal relay 1"	"Ready"
"Signal relay 2"	"Running"
"Limit 1 exceeded"	"Not active"
"Limit 2 exceeded"	"Not active"
"LiqTec"	"Not active"
Standstill heating	"Not active"
"Motor bearing monitoring"	"Active"
"Pump name"	Hydro Multi-E

1) Only available if an advanced functional module, type FM 300, is fitted.

2) Active if inlet sensor is fitted from factory.

3) Not active if inlet sensor is fitted from factory.

30. Other technical data

EMC (electromagnetic compatibility)

The EMC is according to IEC 61000-6-2:2005 and 61000-6-3:2007.

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).

Insulation class

F (IEC 85).

Ambient temperature

- During operation: 32 to 104 °F (0 to 40 °C).
- During storage or transport: -40 to 140 °F (-40 to +60 °C).

31. Sound pressure level

31.1 Hydro Multi-E with single-phase pumps

Motor size [Hp (kW)]	Number of pumps in pump system		Sound pressure level [dB(A)]
	2	3	
0.49 - 1.4 (0.37 - 1.1)	•		60
		•	63
2.0 (1.5)	•		67
		•	69

31.2 Hydro Multi-E with three-phase pumps

Motor size [Hp (kW)]	Number of pumps in pump system		Sound pressure level [dB(A)]
	2	3	
2.0 (1.5)	•		67
		•	69
3.0 (2.2)	•		67
		•	69
4.0 (3.0)	•		71
		•	73
5.3 (4.0)	•		71
		•	73
7.3 (5.5)	•		71
		•	73
10.0 (7.5)	•		77
		•	79
14.7 (11)	•		77
		•	79

32. Disposal

WARNING

Overhead load

Death or serious personal injury
- Restrict access to the area.
- Use protective equipment when dismantling the base frame.
- Removal of the system must be carried out by trained personnel.

CAUTION

Crushing of feet

Minor or moderate personal injury
- Use protective equipment when removing the tank.

CAUTION

Sharp edges

Minor or moderate personal injury
- Wear safety gloves.

CAUTION

Hot surface

Minor or moderate personal injury
- Make sure the system is cooled down.

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

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

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