

Hydro Multi-B

Pressure boosting and tank fill applications

Installation and operating instructions



HURLEY ENGINEERING
MANUFACTURERS REPRESENTATIVES

The Pacific Northwest's premier Grundfos CBS Manufacturer's Representative for all Grundfos Booster systems. Hurley Engineering offers complete start up, selection & installation assistance, and has a full staff of service technicians available for preventive maintenance programs. Hurley Engineering is also the Pacific Northwest's only Grundfos CBS Authorized Service Partner.



GRUNDFOS 

**AUTHORIZED
SERVICE PARTNER**



WATER QUALITY

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



be
think
innovate

English (US) Installation and operating instructions

Original installation and operating instructions

These installation and operating instructions describe the Grundfos Hydro Multi-B booster system.

Sections 1-5 give the information necessary to be able to unpack, install and start up the product in a safe way.

Sections 6-17 give important information about the product, as well as information on service, fault finding and disposal of the product.

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



This appliance can be used by children aged from 8 years and above and persons with reduced physical, sensory or mental capabilities or lack of experience and knowledge if they have been given supervision or instruction concerning use of the appliance in a safe way and understand the hazards involved.

Children shall not play with the appliance. Cleaning and user maintenance shall not be made by children without supervision.

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.



CAUTION

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



SIGNAL WORD

Description of hazard

Consequence of ignoring the warning.
- Action to avoid the hazard.

2.2 Other important notes



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



Tips and advice that make the work easier.



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.

3. Receiving the product

3.1 Transporting the product

The booster system is delivered in a recyclable packaging, specially designed for transport by forklift truck or a similar vehicle.

The forks of the forklift truck must be at least 6.6 ft (2 m) long.

4. Installing the product

Before installing the product, check the following:

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

4.1 Location

Install the booster system in a well-ventilated room to ensure sufficient cooling of the control cabinet and pumps.



The booster system is designed for indoor installation. Do not expose the product to direct sunlight.

Place the booster system with a 3.3 ft (1 m) clearance on all sides for inspection and removal.

4.2 Mechanical installation

4.2.1 Pipes



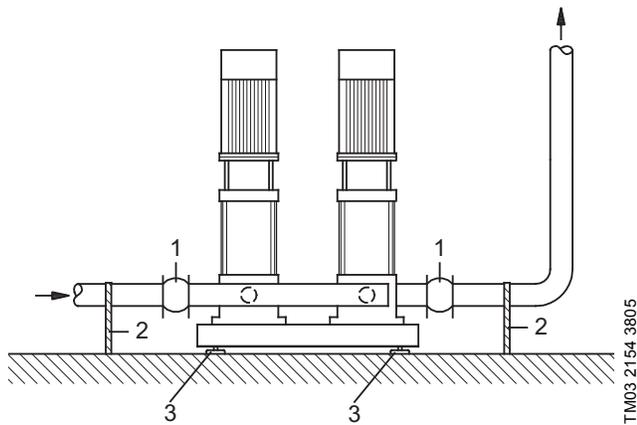
The pipes connected to the booster system must be of adequate size.

Connect the pipes to the manifolds of the booster system. Either end can be used. Apply sealing compound to the unused end of the manifold, and fit the screw cap. For manifolds with flanges, fit a blanking flange with gasket.

We recommend that you install pipe supports for the inlet and outlet pipes. See figs 1 and 2.

Noise and vibration are generated by the rotations in the motor and pump and by the flow in pipes and fittings. The effect on the environment is subjective and depends on correct installation and the state of the other parts of the system.

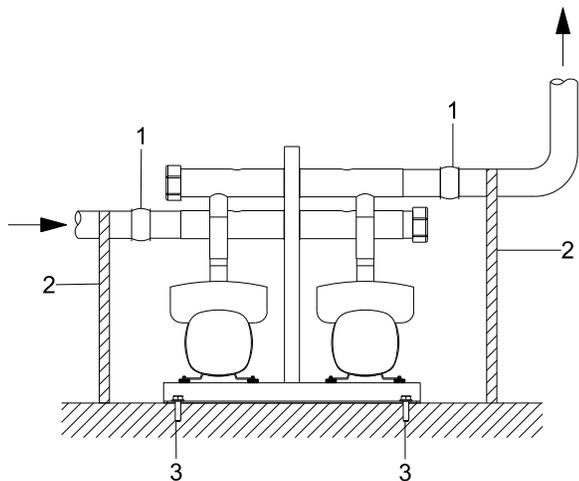
If booster systems are installed in blocks of flats or the first consumer on the line is close to the booster system, we recommend that you fit expansion joints on the inlet and outlet pipes to prevent that vibrations are transmitted through the pipes.



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Fig. 1 Example showing the position of expansion joints, pipe supports and machine shoes

Pos.	Description
1	Expansion joint (and good location for isolating valves)
2	Pipe support
3	Machine shoe



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Fig. 2 Example showing the position of expansion joints, pipe supports and mounting bolts

Pos.	Description
1	Expansion joint (and good location for isolating valves)
2	Pipe support
3	Mounting bolt



Expansion joints, pipe supports as well as machine shoes or mounting bolts shown in figs 1 and 2 respectively are not included in a standard booster system.

Tighten all nuts before startup.

Fasten the pipes to parts of the building to ensure that they cannot move or be twisted.

4.2.2 Foundation

Position the booster system on an even and solid surface, for instance a concrete floor or foundation. The booster system must be bolted to the floor or foundation.



The weight of a concrete foundation must be 1.5 times the weight of the booster system.

4.2.3 Vibration dampers

To prevent the transmission of vibrations to buildings, it may be necessary to isolate the booster system foundation from building parts by means of vibration dampers.

The right damper varies from installation to installation, and a wrong damper may increase the vibration level. Vibration dampers must therefore be sized by the supplier. If the booster system is installed on a base frame with vibration dampers, always fit expansion joints on the manifolds. This is important to prevent the booster system from "hanging" in the pipes.

4.2.4 Expansion joints

Fit expansion joints for these reasons:

- to absorb expansions or contractions in the pipes caused by changing liquid temperature
- to reduce mechanical strains in connection with pressure surges in the pipes
- to isolate mechanical structure-borne noise in the pipes (only rubber bellows expansion joints).



Do not install expansion joints to compensate for inaccuracies in the pipes such as center displacement of flanges.

Fit expansion joints at a distance of minimum 1 to 1 1/2 times the nominal flange diameter from the manifold on the inlet as well as on the outlet side. This prevents the development of turbulence in the expansion joints, resulting in better inlet conditions and a minimum pressure loss on the outlet side.



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Fig. 3 Examples of rubber bellows expansion joints without and with limiting rods

Expansion joints with limiting rods can be used to minimise the forces caused by the expansion joints. We always recommend that you use expansion joints with limiting rods for flanges larger than ANSI 4" (DN 100).

Anchor the pipes so that they do not stress the expansion joints and the pump. Follow the supplier's instructions and pass them on to advisers or pipe installers.

4.2.5 Prefilling of diaphragm tank, if applicable

If a diaphragm tank is connected to the system, prefill the tank with nitrogen to a pressure of 0.7 times the setpoint.



Use nitrogen to avoid corrosion.

4.3 Electrical installation

CAUTION

Electric shock



Minor or moderate personal injury

- The electrical installation must be carried out by an approved person in accordance with local regulations and the relevant wiring diagram.
- Switch off the power supply and lock the main switch with a padlock to ensure that the power supply cannot be accidentally switched on.

- The electrical installation of the booster system must comply with enclosure class UL type 3R.
- Check that the power supply and frequency correspond to the values stated on the nameplate.
- Make sure that the conductor cross-section meets the specifications in the wiring diagram.



See the wiring diagram supplied with the booster system. Tighten all wire terminals in the panel before switching on power to the panel.



If the system cannot be installed with the supply disconnecting device located minimum 2 ft (0.6 m) above service level according to EN 60204-1 paragraph 5.3.4, install the system with an external "supply disconnecting device" made according to EN 60204-1, paragraph 5.3.2. The system must be provided with a means permitting it to be locked in the OFF (isolated) position.

5. Starting up the product



A positive inlet pressure is required before startup and during operation.

Do not start the pumps until they have been fully primed.

Set the precharge pressure on the diaphragm tank with zero pressure on the tank.

After having carried out the mechanical, electrical and hydraulic installation described in sections [4.2 Mechanical installation](#), [4.3 Electrical installation](#), proceed as follows:

5.1 Positive inlet pressure startup procedure

1. Check that the precharge pressure in the diaphragm tank is 0.7 times the required outlet pressure (setpoint).



Measure the precharge pressure in the diaphragm tank while the system is not pressurized.

2. Close all pump outlet isolation valves on the Multi B system.
3. Open the outlet valve on one pump and turn the tap on the outlet side of the system allowing water to pass through the pump. Once complete, close the isolation valve.
4. Repeat step 3 for all remaining pumps in the system. Once complete, open the outlet isolation valve on all pumps after all pumps have been vented.
5. Switch on the main switch.
6. Turn the system on by pressing [On/Off] and adjust the setpoint to the desired setpoint value by pressing arrow up or arrow down on the controller.

5.2 Flooded suction and suction lift startup procedures

1. Check that the precharge pressure in the diaphragm tank is 0.7 times the required outlet pressure (setpoint).
Note: Set the precharge pressure with zero pressure on the tank.



Measure the precharge pressure in the diaphragm tank while the system is not pressurized.

2. Switch off the main switch on the cabinet front.
3. Switch off the circuit breakers of all pumps. The circuit breakers are located inside the cabinet.
4. Set the "Emergency/Normal" switch for all pumps to "Emergency". The switch is located on the front of the control cabinet.
5. Close all pump outlet valves and prime all pumps. Prime the pumps by opening the cap on the port of the check valve positioned closest to the pump and filling water into the port. Prime the pump when water no longer is able to fill into the pump. Reinstall the cap on the check valve port and repeat the procedure for all pumps.
6. Switch on the relevant circuit breaker of the pump to be started.
7. Switch on the main switch; this will start the pump with the relevant circuit breaker on.
8. Vent the pump by slowly opening the outlet valve. This will also allow gradual filling of the outlet pipes.
9. Set the "Emergency/Normal" switch for the relevant pump to "Normal".
10. Switch off the main switch.
11. Repeat steps 6, 7, 8, 9 and 10 for the other pumps in the system.
12. Switch on the main switch.
13. Adjust the required setpoint via the CU 323 by pressing arrow up or arrow down.
14. Set the system to "On" by pressing [On/Off].
15. Increase the setpoint to the desired setpoint value.



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

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

The initial setpoint pressure value for the system is 0 psi, and the maximum pressure is 22 psi above the setpoint value.



This may cause a "Maximum pressure exceeded" alarm condition after startup is complete. Increase the setpoint pressure value to the desired pressure and, if necessary, bleed off the pressure on the outlet to clear the "Maximum pressure exceeded" fault.

5.3 Handling the product

Lift the booster systems with CM and CME pumps as shown in fig. 4.

During handling, the lifting point must always be above the center of gravity of the booster system.

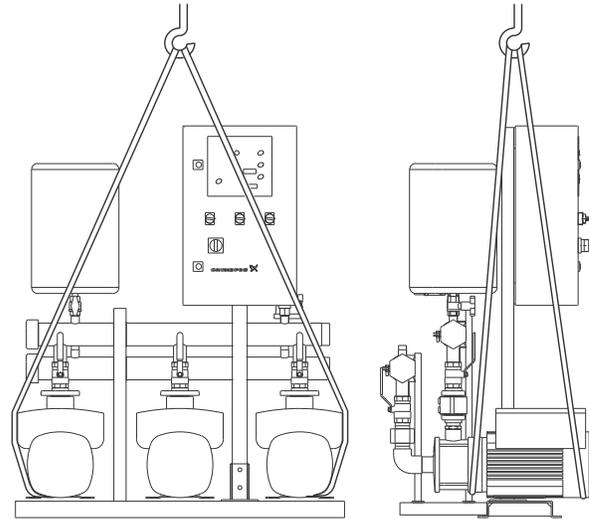


Fig. 4 Correct lifting of Hydro Multi-B with CM and CME pumps

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CAUTION

Overhead load

- Minor or moderate personal injury
- When lifting the booster system, do not use the eyebolts of the motors.
 - Do not lift the booster system by the manifolds.
 - Do not stand on the manifolds.



CAUTION

Crushing of feet

- Minor or moderate personal injury
- When lifting the booster system, do not use the eyebolts of the motors.
 - Do not lift the booster system by the manifolds.
 - Do not stand on the manifolds.



When lifting the booster system, only use suitable lifting equipment that is in good condition and approved for the weight. The weight is stated on the nameplate of the booster system.

6. Product introduction

6.1 Product description

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

As standard, the booster systems consist of two and three pumps connected in parallel and mounted on a common base frame with a control cabinet and all necessary fittings.

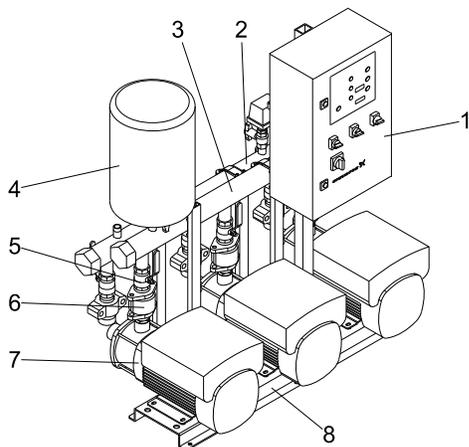


Fig. 5 Front view of Hydro Multi-B booster system with three CM(E) pumps

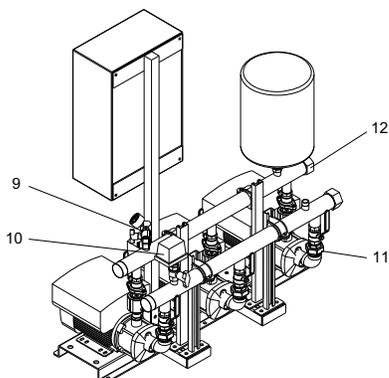


Fig. 6 Rear view of Hydro Multi-B booster system with three CM(E) pumps

Pos.	Description	Quantity
1	Control cabinet	1
2	Inlet manifold	1
3	Outlet manifold	1
4	Diaphragm tank (not included)	1
5	Isolating valve	2 per pump
6	Non-return valve	1 per pump
7	Pump	2-4
8	Base frame	1
9	Pressure transmitter and pressure gauge	1
10	Pressure switch or inlet pressure sensor	1
11	Oval flange (CME 3-10)	2 per pump
	Intermediate adapter (CME 15-25)	1 per pump
12	Screw cap or blanking flange	2

6.2 Applications

The booster systems are suitable for the following application types:

- constant-pressure boosting
- tank filling.

6.2.1 Booster system for constant-pressure applications

The booster system for constant-pressure applications is designed to maintain a constant pressure on the outlet side of the pumps. The booster systems for constant-pressure applications adjust the performance according to the demand and keep a constant pressure in the following ways:

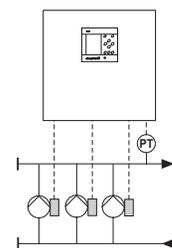
- by cutting the required number of pumps in and out
- through continuous adjustment of the speed of the running pumps.

Operating principle

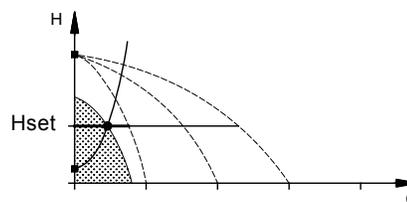
The user enters the required pressure of the system (setpoint) via the user interface of the CU 323 control unit. CU 323 adjusts the system performance according to the feedback received from the pressure transmitter installed in the outlet manifold.

Control variant E

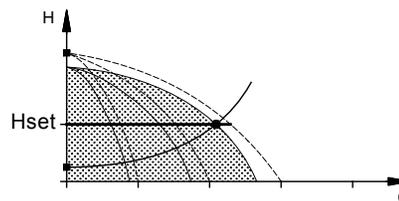
Two to three electronically speed-controlled pumps



One speed-controlled pump in operation.



Three speed-controlled pumps in operation.



- Control variant E for constant-pressure applications maintains a constant pressure through continuous adjustment of the speed of the pumps.
- The system performance is adjusted to the demand by cutting the required number of pumps in and out and through parallel control of the pumps in operation.

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6.2.2 Booster system for tank-filling applications

The booster system for tank-filling applications is designed to fill a tank such as a roof tank or a break tank in a controlled manner. The booster system controls the filling either via level switches, a level sensor, or a ball cock valve.

- Operating principle
The system has three methods of operation, one based on level switches, one based on a level sensor and the other based on a ball cock valve.
- Operation with level switches
The user adjusts the switches in the tank to the desired stop and start levels.
- Operation with level sensor
The user adjusts the setpoint so it corresponds to the real tank height, measured from the bottom of the tank to the top, via the user interface of the CU 323 control unit.



The CU323 will display the tank level graphically. For assistance contact Grundfos.

- Operation with ball cock valve
The user adjusts the ball cock valve in the tank to the desired start and stop levels.
- Factory setting
Start level: 15 % of setpoint
Stop level: 85 % of setpoint
High-level alarm: 95 % of setpoint.



The PC tool is required to adjust the start and stop level setting. For assistance contact Grundfos.

The Multi-B systems configured for tank filling applications work as described below.

Control variant E

E: Two to three electronically speed-controlled pumps

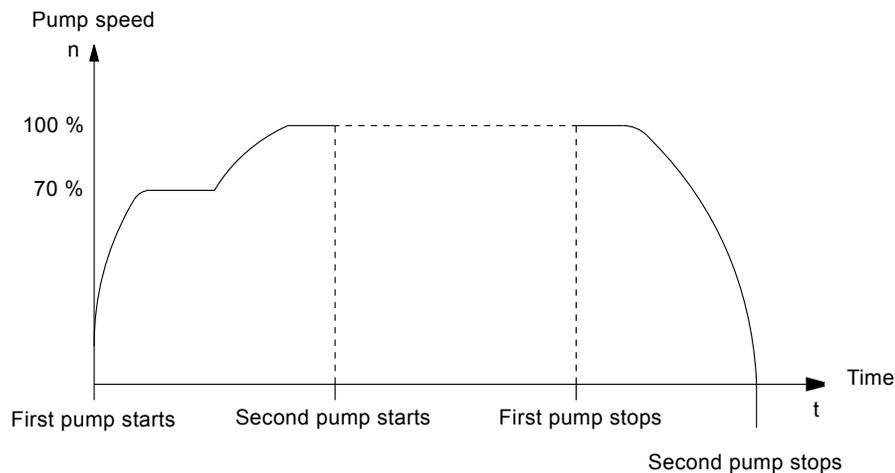


Fig. 7 Example of tank filling

- In tank-filling applications, the booster system fills the tank with focus on protecting the piping and preventing water hammer. When low level in the tank is reached, a speed-controlled pump starts by running approximately 70 % of maximum speed to slowly and safely fill the pipes. After a while, it increases the speed to 100 %, and the next pump is started. When the tank is full, the pumps stop.
 - Systems with more than two pumps will as default set one pump as standby pump.
 - Changeover among the mains-operated pumps is automatic and depends on load, time and fault.
-

6.3 Identification

6.3.1 Nameplate

The nameplate of the booster system is fitted on the base frame.

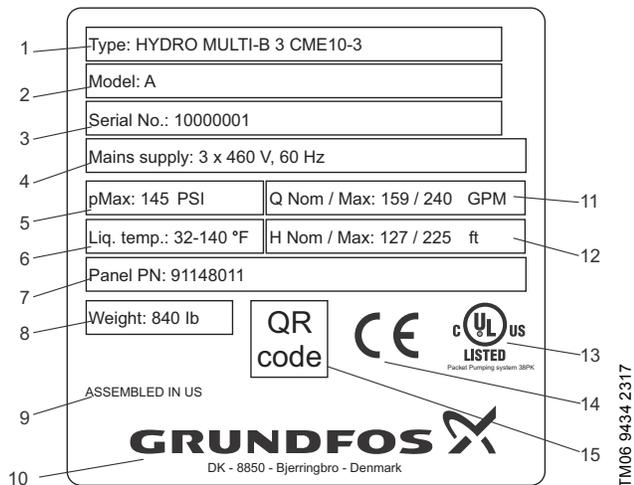


Fig. 8 Nameplate

Pos.	Description
1	Type designation
2	Model
3	Serial number
4	Supply voltage
5	Maximum operating pressure in psi
6	Liquid temperature
7	Panel part number
8	Weight in lb
9	Country of origin
10	Company logo
11	Maximum flow rate in GPM
12	Nominal head in ft
13	Approval mark, cULus (Category QCZJ)
14	Approval mark
15	QR code

6.3.2 Type key

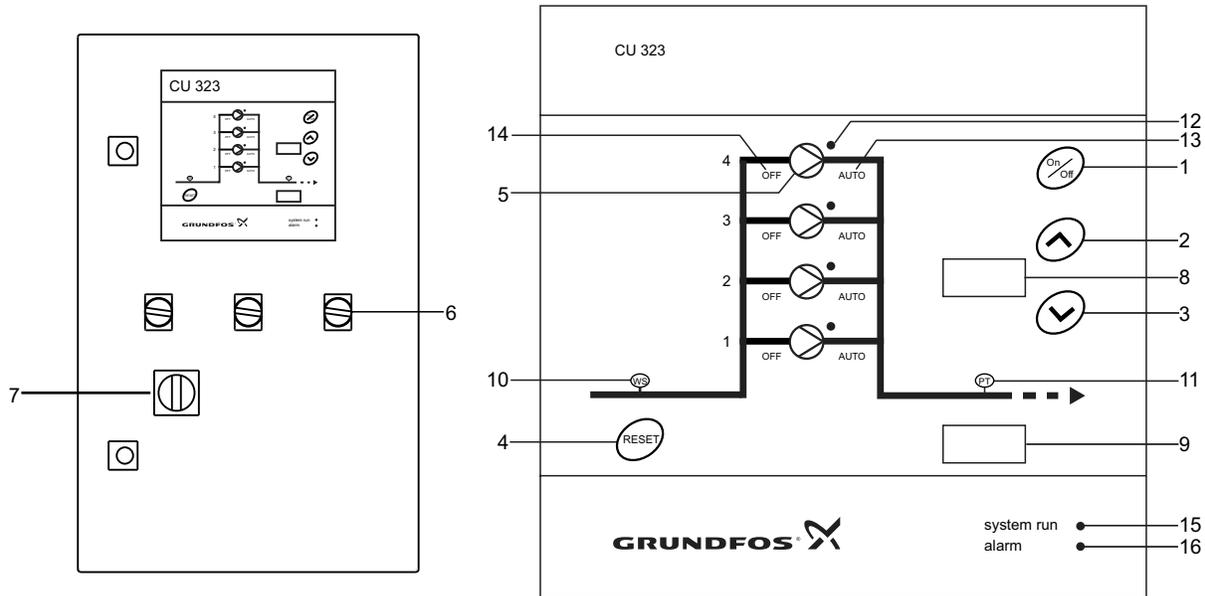
Code	Example	Hydro Multi-B	-E	3 CME 10-3	A	3 x 460 V, 60 Hz
	Type range					
	System type					
E	All pumps, E-motor or CUE					
	Number of pumps with integrated frequency drive and pump type					
	Pump material					
A	Cast iron (EN-GJL-200)					
	Supply voltage, frequency					

* The control cabinet can be placed up to 6.6 ft (2 m) from the pumps.

7. Control unit

The booster system incorporates a CU 323 control unit which enables manual setting and monitoring of the system.

Figure 9 shows the user interface for a system with four pumps.



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Fig. 9 User interface of control cabinet and CU 323

Pos.	Buttons	Description
1		[On/Off]: Changes the system operating mode between "Normal" and "Stop".
2		[Up]: Increases the setpoint value.
3		[Down]: Decreases the setpoint value.
4		[RESET]: Resets all alarms.
5		[>]: Changes the operating mode of the individual pumps between "AUTO" and "OFF". Each pump in the system has an Auto/Off button.
6		Enables "Emergency/Normal" operation. Note: If a pump is set to "Emergency" operation, it will run at 100 % speed, and the power supply to CU 323 will be switched off. There is a delay of 30 seconds before the pumps are set to "Emergency" operation.
7		Switches the power supply to the control cabinet on or off.
	"Setpoint"	Shows the setpoint. After unlocking CU 323, the setpoint will flash.
	<i>PPP</i>	Proportional-pressure control. "PPP" flashes for one second followed by the current setpoint for four seconds. This function is only available for E-pump systems.
	<i>l...l</i>	The tank symbol appears in tank-filling mode with float switches.
	<i>l...l</i> or "Setpoint"	Alternates between the tank symbol and the setpoint in tank-filling mode with analog input.
8	<i>E.St</i>	External stop: Indicates that the system has been stopped externally via a digital input.
	<i>OFF</i>	Indicates that the system has been set to "OFF".
	<i>On</i>	Indicates that the system has been set from "OFF" to "On". "On" is only shown for 3 seconds after which the setpoint is shown.
	<i>0-7</i>	Indicates that the buttons on CU 323 have been locked automatically. To unlock the buttons, press [RESET] and arrow up or [RESET] and arrow down simultaneously.
	<i>bus</i>	Indicates that the system is remotely controlled.
	<i>LOC</i>	Local: Appears if attempts to change local settings are made while the system is remotely controlled.

Pos.	Buttons	Description
	"Measured value"	Shows the actual, measured value on the outlet side.
9	<i>PPS</i>	Proportional setpoint at zero flow, PPS [psi]. "PPS" is visible if you press [RESET] for four seconds. After [RESET] has been released, you can adjust "PPS" by means of the arrow up or arrow down buttons. If the buttons are not activated for four seconds, the system returns to normal operation. This function is only available for E-pump systems.
	---	Appears in tank-filling mode with float switches.
	<i>Err</i>	Appears in case of a primary sensor fault.
	<i>H.L</i> or "Measured value"	Alternates between the actual, measured value on the outlet side and "H.L." when a maximum outlet pressure or a level limit has been exceeded.

Pos.	Indicator lights	Status	Description
10		Off	Normal state.
		Red	Water shortage fault.
11		Off	Normal state.
		Red	Primary and/or redundant sensor fault. Maximum discharge pressure or level limit has been exceeded.
12	 (pump LED)	Off	The pump has stopped due to cascade operation. The system is in "OFF" state. The power supply has been switched off.
		Red	A pump fault has occurred.
		Green	The pump is running.
		Flashing green	The pump is in standby mode or has been stopped by pressing [>] or via remote control.
13	AUTO	Yellow	The pump is controlled by the CU 323.
14	OFF	Yellow	The pump has been stopped by pressing [>] or via remote control.

Pos.	Indicator lights	Status		Description
		Pos. 15: system run (green)	Pos. 16: alarm (red)	
15 and 16	 (system LEDs)	Off	Off	The power supply has been switched off.
		On	Off	The system is in normal operation.*
		Flashing	Off	The system has been set to stop.
		Off	On	The system has been stopped due to an alarm.
		On	On	The system is in normal operation, but there is a warning.*
		Flashing	On	The system has been set to stop, and there is a warning.

* The last pump in operation might have been stopped temporarily by the low-flow stop function

Optional Tank level indicator lights

Pos.	Indicator lights	Status	Description
Not shown	 (High level)	On	Tank level is high.
		Off	Tank level is normal.
Not shown	 (Low level)	On	Tank level is low
		Off	Tank level is normal

Indicator lights correspond to the float switch position

8. Operating modes

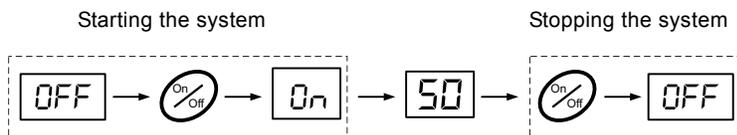
User operation depends on the system mode. The system modes are described in the following sections.

8.1 Local mode, external stop not activated

In this mode, the system is locally controlled, and the external stop via digital input is not activated.

The flow charts below show examples of how settings can be made.

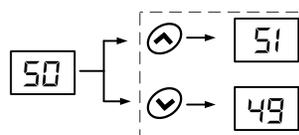
Starting and stopping the system



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Changing the setpoint while the system is running

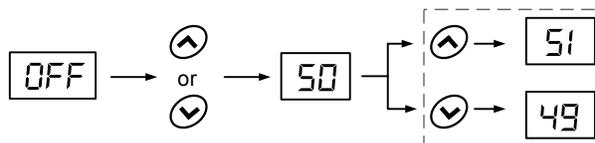
Changing the setpoint



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Changing the setpoint while the system is in "OFF" mode

Changing the setpoint



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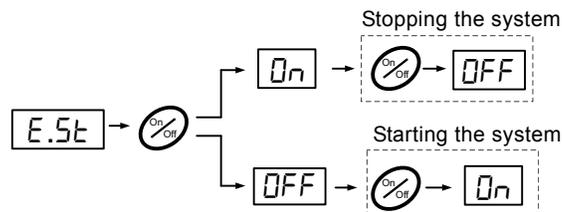
Local mode, external stop activated

In this mode, the system is locally controlled, and the external stop via digital input is activated.

External stop via digital input has higher priority than local control. This means that settings can be changed locally, but they will not be effective until external stop has been deactivated.

The flow charts below show examples of how settings can be made

Starting and stopping the system



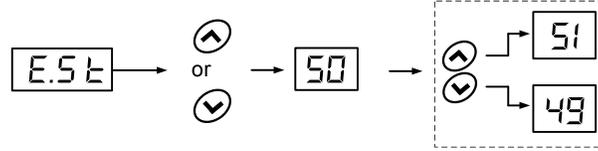
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If you do not touch the buttons for 3 seconds, CU 323 reverts to the initial display.

Changing the setpoint

Changing the setpoint



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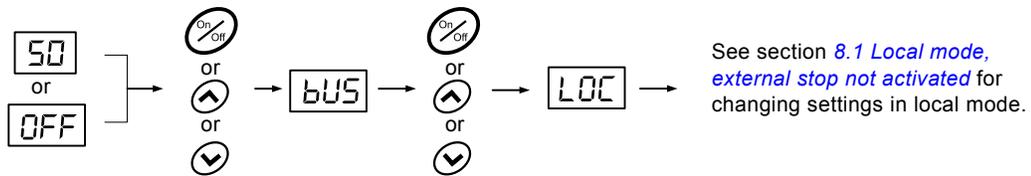


If you do not touch the buttons for 3 seconds, CU 323 reverts to the initial display.

8.2 Remote-controlled, external stop not activated

In this mode, the system is remote-controlled, and the external stop via digital input is not activated. If you want to change the local settings, follow the flow chart examples below.

Keep the buttons pressed for 3 seconds.



TM04 9582 4610

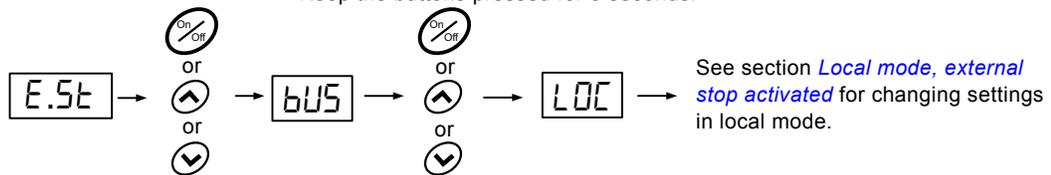


If you do not touch the buttons for 3 seconds, CU 323 reverts to the initial display.

8.3 Remote-controlled, external stop activated

In this mode, the system is remote-controlled, and the external stop via digital input is activated. If you want to change the local settings, follow the flow chart examples below.

Keep the buttons pressed for 3 seconds.



TM04 9583 4610



If you do not touch the buttons for 3 seconds, CU 323 reverts to the initial display.

8.4 Adjusting the proportional-pressure setpoint

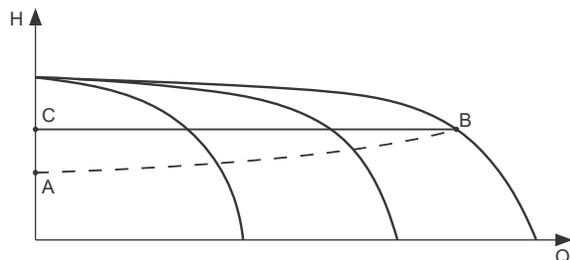
Description

You can only enable this function in pressure-controlled systems. The function automatically adapts the setpoint to the actual flow rate to compensate for flow-dependent dynamic losses.

The adaptation can only be square. See fig. 10.



A filter factor can be set to prevent fluctuation.



TM06 2845 4714

Fig. 10 Proportional pressure

Pos.	Description
	Pressure at zero flow.
A	Starting point of proportional-pressure control. Influence at zero flow is equal to x % of the setpoint.
B	Qnom
C	Setpoint

The function has these purposes:

- compensate for pressure losses
- reduce the energy consumption
- increase the comfort for the user.

Activating the function through PC Tool E-products

Settings > Primary controller.

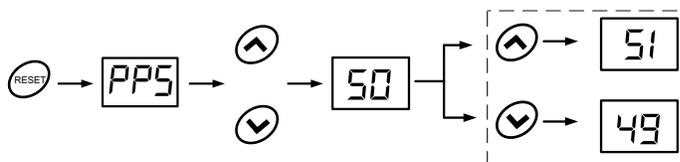
1. Select: Enabled proportional pressure.
2. Set: Influence at zero flow.
3. Set: Filter factor.
4. Select: Hmax / Enter value. Based on pump data.
5. Select: Qnom / Enter value. Based on pump data.
6. Select: Hnom / Enter value. Based on pump data.

Activating the function via the operating panel

This is only applicable when the function is enabled in PC Tool E-products.

1. Press [RESET] for 4 seconds. Let go of the button when the text "PPS" appears in the display.
2. Adjust the "PPS" value with the arrow up and arrow down buttons.

Keep the buttons pressed for 4 seconds.



See section [Local mode](#), [external stop activated](#) for changing settings in local mode.

TM06 5417 4515



The "PPS" value is defined in psi at zero flow.

9. Functions

The booster systems include application-optimized software.

9.1 General functions

9.1.1 Dry-running protection (optional)



When a pump is running in manual mode, it is not protected against dry running.

To protect the pumps against damage from dry running, the booster system incorporates a water shortage function. This function is based on the monitoring of the inlet pressure or the level in a possible tank on the inlet side.

The pressure or level can be monitored by one of the following devices:

- pressure switch
- float switch
- level switch
- external electrode relay
- analog sensor.

Dry-running protection with pressure switch, float switch, level switch or external electrode relay

Set the monitoring device to the desired limit.

If a water shortage is detected for more than 5 seconds, the system will stop, and the "WS" water shortage indicator light is on.

When the water supply has been reestablished, the dry-running fault is automatically reset.

Dry-running protection with analog sensor

The limit for the minimum inlet pressure in the inlet manifold is a factory-set value which can only be changed by a Grundfos service engineer.

If the sensor output is below the limit for minimum inlet pressure for more than 5 seconds, the system will stop, and the "WS" water shortage indicator light is on.

When the water supply has been reestablished, the dry-running fault is automatically reset.

9.1.2 Automatic pump changeover

The automatic pump changeover function ensures an equal number of operating hours of the pumps, but it also ensures that, in case of an alarm on one pump, another pump is automatically started.

There are three types of automatic pump changeover:

- operation-dependent pump changeover
- alarm-dependent pump changeover
- time-dependent pump changeover.

Alarm-dependent pump changeover

If a pump stops due to an alarm, CU 323 will send a stop command to the pump to prevent auto-restarting and start another pump which is ready to start and which has the lowest number of operating hours.



If the speed-controlled pump in an ES system is stopped due to an alarm, the system will function as an S-system.

See section [9.2.5 S-system mode \(start/stop band\)](#).

Time-dependent pump changeover

In certain applications, the demand remains constant for long periods and does not require all pumps to run. In such situations, pump changeover does not take place naturally, and forced pump changeover may thus be required.

Once every 24 hours, CU 323 checks if any of the running pumps has a higher number of operating hours than the pumps that are stopped. If this is the case, the pump will be stopped, and a pump with a lower number of operating hours will start.

9.1.3 Minimum time between start and stop

This function ensures a delay between the start/stop of one pump and the start/stop of another pump. The purpose is to prevent hunting when pumps start and stop continuously.



If the system is stopped due to an alarm, the minimum time between start and stop will be ignored, and the pumps will be stopped immediately.

9.2 Functions for constant-pressure systems

9.2.1 Pump cascade control

The cascade function ensures that only the required number of pumps is running. This means that the number of running pumps always corresponds to the required flow at the entered setpoint. The first pump is started if the pressure at the outlet manifold is below the setpoint.

If the first pump is not able to keep the outlet pressure at the setpoint, and the minimum time between start/stop has passed, another pump is started.

During the start and stop of a pump, the speed of the speed-controlled pump is controlled in such a way that the pressure disturbance is kept as low as possible.

At decreasing demand, pumps will be stopped if the pressure rises above the setpoint. Pumps will not be stopped until the minimum time between start/stop has passed.

The last pump in operation

If only one pump is operating, this pump can be operated in energy-saving on/off mode. See section [9.2.4 Low-flow operation](#).

The number of possible starts/stops per hour for all pumps is limited by the maximum number of starts per hour.

9.2.2 Standby pumps

This function is optional and available on request. The function makes it possible to limit the maximum performance of the booster system by selecting one or more pumps as standby pumps.

If a three-pump system has one standby pump, maximum two pumps are allowed to operate at a time.

If one of the two pumps in operation has a fault and is stopped, the standby pump will be started. The performance of the booster system is thus not reduced.

The status as standby pump alternates between all pumps. Contact Grundfos for further information.

9.2.3 Maximum pressure exceeded

This function protects the piping on the outlet side of the booster system against damaging high pressures. The pressure is monitored, and if the pressure is higher than 22 psi (1.5 bar) above the setpoint for more than 5 seconds, the pumps are stopped, the indicator light "PT" is on, and the display indicates high limit "H.L".

When the pressure falls below the setpoint, the system will automatically restart.

9.2.4 Low-flow operation

When only one pump is operating due to cascade, the booster system regularly checks for low flow by decreasing the pump speed.

When low flow is detected, the booster system will change its mode of operation to "low-flow operation" and run in on/off mode as described below.

In on/off mode, the system has two phases:

- Off phase
Water is drawn from the diaphragm tank until the pressure of the system reaches the lower limit of the on/off band ($P_{set} - 0.5 \times \text{on/off band}$).
- Boosting phase
The pump runs at 100 % speed until the pressure reaches the upper limit of the on/off band ($P_{set} + 0.5 \times \text{on/off band}$).

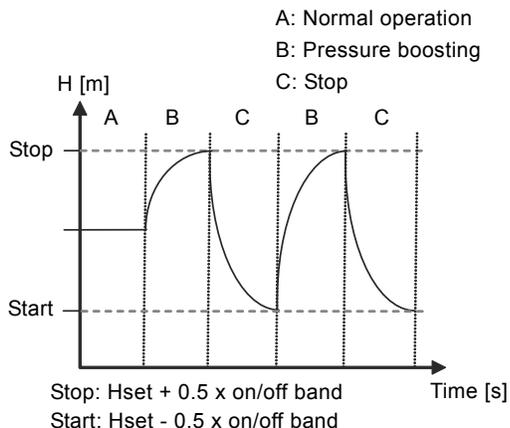


Fig. 11 On/off operation

TM03 9292 4807

9.2.5 S-system mode (start/stop band)

S-system mode is only auto-enabled in an ES system if the CME pump is out of operation due to a fault.

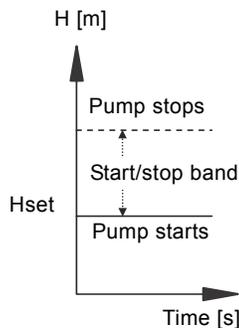


Fig. 12 Start/stop band

TM03 9205 3607

9.2.6 Proportional-pressure control mode

The proportional-pressure control mode is only available for E-pump systems.

Description

You can only enable this function in pressure-controlled systems. The function automatically adapts the setpoint to the actual flow rate to compensate for flow-dependent dynamic losses.

The adaptation can only be square. See fig. 13.



A filter factor can be set to prevent fluctuation.

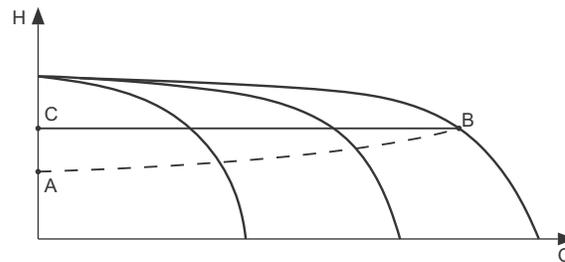


Fig. 13 Proportional pressure

TM06 2845 4714

Pos.	Description
	Pressure at zero flow.
A	Starting point of proportional-pressure control. Influence at zero flow is equal to x % of the setpoint.
B	Q_{nom}
C	Setpoint

The function has these purposes:

- compensate for pressure losses
- reduce the energy consumption
- increase the comfort for the user.

Activating the function through PC tool E-products

Settings > Primary controller.

1. Select: Enabled proportional pressure.
2. Set: Influence at zero flow.
3. Set: Filter factor.
4. Select: Hmax / Enter value. Based on pump data.
5. Select: Qnom / Enter value. Based on pump data.
6. Select: Hnom / Enter value. Based on pump data.

Activating the function via the operating panel

This is only applicable when the function is enabled in PC Tool E-products.

1. Press [RESET] for 4 seconds. Let go of the button when the text "PPS" appears in the display.
2. Adjust the "PPS" value with the arrow up and arrow down buttons.



The "PPS" value is defined in psi at zero flow.

9.3 Functions for tank-filling systems

9.3.1 Cascade control

The cascade control function for tank-filling systems is designed to fill the tank with focus on protecting the piping and preventing water hammer. The cascade is time-dependent and starts and stops the pumps in a pre-defined sequence. See fig. 7 on page 8.

9.3.2 Standby pumps

Systems with more than two pumps will as default set one pump as standby pump.

The status as standby pump alternates to ensure that all pumps have equal numbers of operating hours.

9.3.3 Maximum level exceeded

This function protects against the risk of overfilling the tank. The level is monitored and if the level is higher than 95 % of the height of the tank, the pumps are stopped; the display indicates high limit "H.L", and the "PT" indicator light is on.

9.3.4 Optional tank fill application panels

Optional panels include indicator lights controlled by float switches that indicate if the high or low level is exceeded with 80 dB alarm.

10. Data communication

CU 323 must have a CIM module (Communication Interface Module) fitted to be able to transfer data to the SCADA system or to a mobile phone.

Various CIM modules are available, depending on the type of network. See the Hydro Multi-B data booklet or contact Grundfos for further information regarding CIM modules.

11. Servicing the product

WARNING

Electric shock



- Death or serious personal injury
- Switch off the power supply before you start any work on the product.
 - Lock the main switch with a padlock to ensure that the power supply cannot be accidentally switched on.

11.1 Maintaining the product

11.1.1 Pumps

The internal pump parts are maintenance-free. It is important to keep the motor clean in order to ensure adequate cooling of the motor. If the pump is installed in dusty environments, clean and check it regularly. Take the enclosure class of the motor into account when cleaning.

The motor has maintenance-free, greased-for-life bearings.

11.1.2 CU 323

CU 323 is maintenance-free. It must be kept clean and dry. Protect it against direct sunlight. Furthermore, CU 323 must not be outside the ambient temperature range. See section 15. [Technical data](#).

12. Protecting the product against frost

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

Follow these instructions:

1. Close the isolating valves before and after the pump.
2. Remove the filling and drain plugs.
3. Open the isolating valves and refit the plugs before the pump is put into operation again.

WARNING

Electric shock



- Death or serious personal injury
- Make sure that the escaping hot or cold liquid does not cause injury to persons or damage to the equipment.
 - In hot-water installations, pay special attention to the risk of injury caused by scalding hot water.

Do not fit the filling and drain plugs until the pump is to be used again.

13. Taking the product out of operation

Switch off the main switch to take the booster system out of operation.

WARNING

Electric shock



- Death or serious personal injury
- Do not touch the conductors in front of the main switch as they are still energized.
 - Lock the main switch with a padlock to ensure that the power supply cannot be accidentally switched on.

Take individual pumps out of operation by switching off the corresponding motor-protective circuit breaker, automatic circuit breaker or fuse.

14. Fault finding

WARNING



Electric shock

Death or serious personal injury

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

Fault	Possible cause	Remedy
1. The pumps are not running.	a) The actual pressure is higher than or equal to the setpoint.	Wait until the pressure has dropped, or lower the pressure on the outlet side of the booster system. Check that the pumps start.
	b) The power supply has been switched off.	Connect the power supply.
	c) The main switch has cut out.	Cut in the main switch.
	d) The main switch is defective.	Replace the main switch.
	e) The motor protection has been activated.	Contact Grundfos.
	f) The motor is defective.	Repair or replace the motor.
	g) The pressure transmitter is defective.	Replace the pressure transmitter. 0-145 psi (0-10 bar) transmitters with 0-10 V, 0-20 mA or 4-20 mA output signals are monitored by the booster system.
	h) The cable is broken or short-circuited.	Repair or replace the cable.
2. The pumps start, but stop immediately. The operating pressure is not reached.	a) Water shortage or no inlet pressure.	Re-establish the supply of water to the booster system. When the inlet pressure has been re-established, press [RESET] to restart the system.
3. The booster system has stopped and cannot restart.	a) The pressure transmitter is defective.	Replace the pressure transmitter. 0-145 psi (0-10 bar) transmitters with 0-10 V, 0-20 mA or 4-20 mA output signals are monitored by the booster system.
	b) The cable is broken or short-circuited.	Repair or replace the cable.
	c) The power supply to CU 323 has been switched off.	Connect the power supply.
	d) CU 323 is defective.	Contact Grundfos.
4. Unstable water supply from the booster system.	a) The inlet pressure is too low.	Check the inlet pipe and the inlet strainer, if any.
	b) The inlet pipe, strainer or pumps are partly blocked by impurities.	Clean the inlet pipe, strainer or pumps.
	c) The pumps suck air.	Check the inlet pipe for leakages.
	d) The pressure transmitter is defective.	Replace the transmitter.
5. The pumps are running, but deliver no water.	a) The valves are closed.	Open the valves.
	b) The inlet pipe or pumps are blocked by impurities.	Clean the inlet pipe or pumps.
	c) The non-return valve is blocked in the closed position.	Clean the non-return valve. Check that the non-return valve moves freely.
	d) The inlet pipe is leaky.	Check the inlet pipe for leakages.
	e) There is air in the inlet pipe or pumps.	Vent and prime the pumps. Check the inlet pipe for leakages.
6. The booster system is unable to reach the setpoint.	a) The consumption is too high.	<ul style="list-style-type: none"> • Reduce the consumption, if possible. • Install a bigger booster system.
	b) Too many standby pumps have been selected.	Reduce the number of standby pumps.
	c) There is a pipe fracture or a leakage in the system.	Check the system, and repair the damaged parts, if necessary.
7. Leakage from the shaft seal.	a) The shaft seal is defective.	Replace the shaft seal.
8. Noise.	a) The pumps are cavitating.	Clean the inlet pipe or pumps and possibly the inlet strainer.
9. Very frequent starts and stops.	a) The diaphragm tank precharge pressure is not correct.	Set the correct precharge pressure.

15. Technical data

15.1 Pressure

Inlet pressure



A positive inlet pressure is required before startup and during operation.

We recommend that you calculate the inlet pressure in these cases:

- Water is drawn through long pipes.
- Inlet conditions are poor.



In this document, the term "inlet pressure" is defined as the pressure or vacuum which can be measured immediately before the booster system.

To avoid cavitation, make sure that there is a minimum inlet pressure on the inlet side of the booster system. The minimum inlet pressure in psi can be calculated as follows:

$$H = P_b - \text{NPSH} - H_f - H_v - H_s$$

Barometric pressure in feet (33.9 feet at sea level).

$$P_b =$$

In closed systems, P_b indicates system pressure in feet.

$$H_f =$$

Friction loss in suction piping in feet. (At the highest flow the pump will be delivering.)

$$H_v =$$

Vapor pressure in feet.

$$\text{NPSH} =$$

Net Positive Suction Head in feet.

NPSH can be read from the NPSH curve at the maximum capacity at which the pump will run.

See Grundfos CM, CME Data booklet 98435269 / L-CM-PG-001.

$$H_s = \text{Safety margin} = \text{minimum 2 feet}$$



If "H" is calculated as positive, the pump can operate at a suction of maximum "H" feet. If "H" is calculated as negative, an inlet pressure (psia) of minimum "H" feet is required.

$$P \text{ (psi)} = H/2.31$$

Maximum inlet pressure

The actual inlet pressure plus the pressure when the pump is operating against a closed valve must always be lower than the maximum system pressure.

Operating pressure

As standard, the maximum operating pressure is 232 psi (16 bar).

15.2 Temperature

Liquid temperature: 0 to 140 °F (0 to 60 °C).

Ambient temperature: 0 to 104 °F (0 to 40 °C).

15.3 Relative humidity

Maximum 95 %.

15.4 Sound pressure level

See the installation and operating instructions for the CM pumps.

The sound pressure level for a number of pumps can be calculated as follows:

$$L_{\text{max}} = L_{\text{pump}} + (n - 1) \times 3$$

$$L_{\text{max}} = \text{Maximum sound pressure level}$$

$$L_{\text{pump}} = \text{Sound pressure level for one pump}$$

$$n = \text{Number of pumps}$$



Considering the flow in pipes, vibrations, etc., the actual sound pressure level of the booster system will be lower than 90 dB(A).

15.5 Electrical data

Supply voltage

See the nameplate.

Digital inputs

Open-circuit voltage	24 VDC
Closed-circuit current	5 mA, DC
Frequency range	0-4 Hz



All digital inputs are supplied with PELV voltage (Protective Extra-Low Voltage).

Analog inputs

	0-20 mA
Input current and voltage	4-20 mA 0-10 V
Tolerance	± 3.3 % of full scale
Repetitive accuracy	± 1 % of full scale
Input resistance, current	< 250 Ω
Input resistance, voltage	10 kΩ ± 10 %
Supply to sensor	24 V, maximum 50 mA per sensor, short-circuit-protected



All digital inputs are supplied with PELV voltage (Protective Extra-Low Voltage).

Digital outputs (relay outputs)

Normally open contacts (DO1, DO2 and DO3)	C, NO
Normally closed contacts (DO4 and DO5)	C, NC, NO
Optional tank fill panel auxiliary contacts	
High level, (DO6)	C, NO
Low Level, (DO7)	C, NC
Maximum contact load	240 VAC, 2 A
Minimum contact load	5 VDC, 10 mA

All digital outputs are potential-free relay contacts.



Some outputs have a common C terminal. For further information, see the wiring diagram supplied with the booster system.

Inputs for PTC sensor or thermal switch

For PTC sensors to DIN 44082. Thermal switches can also be connected.

Open-circuit voltage	8 VDC \pm 15 %
Closed-circuit current	1.7 mA, DC



Inputs for PTC sensors are electrically separated from the other inputs and outputs of the booster system.

16. Related documents

You find further product information about the booster systems in the following documents.

All documents are available in Grundfos Product Center:
www.grundfos.com > International website > Grundfos Product Center.

Title	Frequency [Hz]	Publication number
Data booklets		
Grundfos Hydro Multi-B	60	98607787
Installation and operating instructions		
CM	60	L-CM-TL-001
CRE, CRIE, CRNE, CRKE, SPKE, MTRE, CME*	60	98566351
CU 323	50/60	97775216
Diaphragm tank	-	98817081
Service documentation		
Service instructions	60	97921460
Service kit catalogue	50/60	96488862
Other documentation		
**	-	-

* The instructions are only relevant for Hydro Multi-B booster systems.

** A wiring diagram is supplied with the booster system.

16.1 Service documentation

Service documentation is available in Grundfos Product Center under the specific product.

If you have any questions, please contact the nearest Grundfos company or service workshop.

17. Disposing of the product

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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