BoosterpaQ - Hydro MPC

US **Installation and operating instructions**

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CONTENTS

Warning

Prior to installation, read these installation and operating instructions. Installation and operation must comply with local regulations and accepted codes of good practice.

1. Symbols used in this document

Warning

If these safety instructions are not observed, it may result in personal injury!

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

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

2. Scope of these instructions

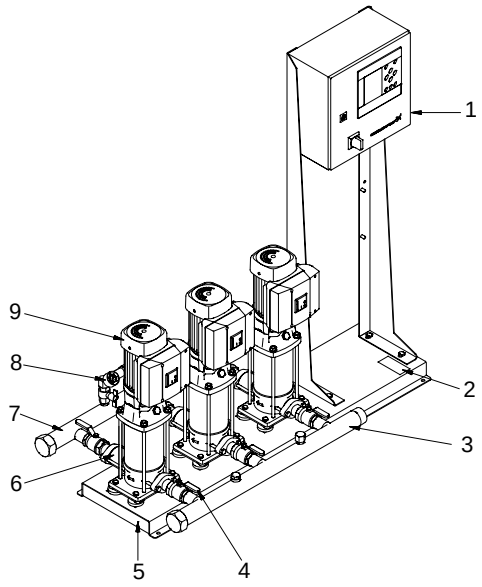
These installation and operating instructions apply to Grundfos Hydro MPC booster sets.

Hydro MPC is a range of factory-assembled booster sets, ready for installation and operation.

3. Product description

As standard, Hydro MPC booster sets consist of two to six pumps coupled in parallel and mounted on a common base frame with all the necessary fittings and a control cabinet.

Note ***A diaphragm tank must be included in most installations.***



TM03 1171 1205

Fig. 1 Hydro MPC booster set

Pos.	Description	Quantity
1	Control cabinet	1
2	Nameplate	1
3	Suction manifold (stainless steel)	1
4	Isolating valve	2 per pump
5	Base frame (stainless steel)	1
6	Non-return valve	1 per pump
7	Discharge manifold (stainless steel)	1
8	Pressure transmitter/pressure gauge on suction and discharge manifolds	2
9	Pump	2 - 6

Hydro MPC booster sets are divided into seven groups based on control type:

Control variant	Description
-E	2 to 6 CRE pumps
-ED	2 CRE pumps and up to 4 mains-operated CR pumps
-ES	1 CRE pump and up to 5 mains-operated CR pumps
-EF	2 to 6 CR pumps connected to external frequency converters
-EDF	2 CR pumps connected to external frequency converters and up to 4 mains-operated CR pumps
-F	Up to 6 CR pumps connected to an external frequency converter. The speed controlled operation alternates between the pumps.
-S	2 or 6 mains-operated CR pumps

See also *6.1 Examples of control variants*.

Hydro MPC booster sets always includes application-optimised software for setting the booster set to the application in question.

4. Nameplate

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

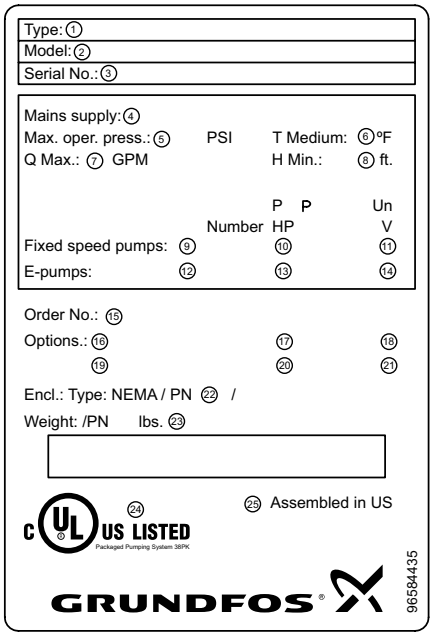


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Fig. 2 Nameplate

Pos.	Description
1	Type designation
2	Model
3	Serial number
4	Supply voltage
5	Maximum operating pressure in psi
6	Liquid temperature in °F
7	Maximum flow rate in GPM
8	Minimum head in ft.
9	Number of fixed speed pumps
10	Motor power in HP
11	Nominal voltage in volts
12	Number of E pumps
13	Motor powr in HP
14	Nominal voltage in volts
15	Order number
16	Options
17	Options
18	Options
19	Options
20	Options
21	Options
22	Enclosure class & panel P/N
23	Weight in lb
24	Approval marks
25	Production location & date code

5. Software label

The software label is placed on the back of the CU 351 located inside the panel door.

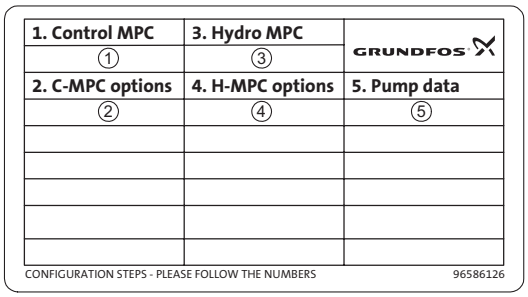


Fig. 3 Software label

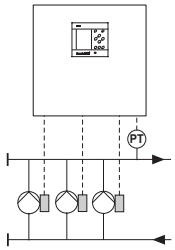
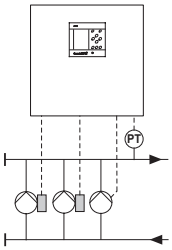
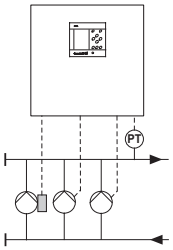
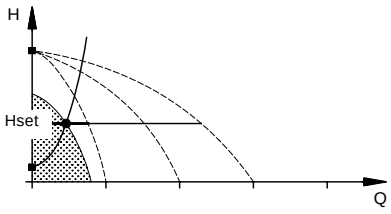
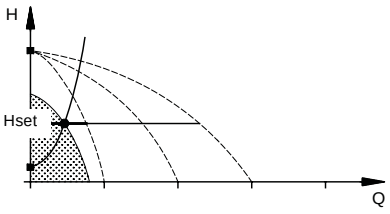
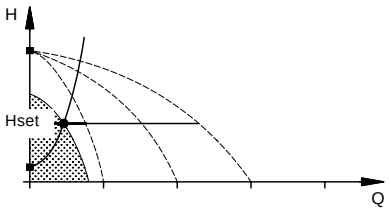
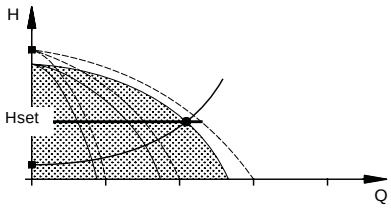
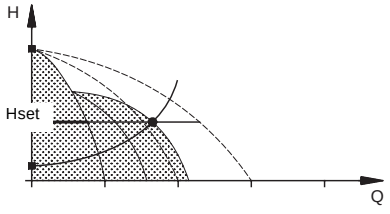
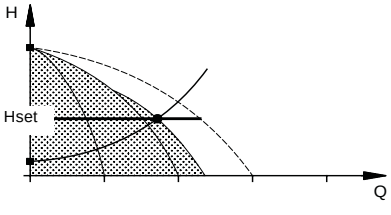
Pos.	Description
1	Control MPC - GSC file number
2	Control MPC options - GSC file numbers
3	Hydro MPC - GSC file number
4	Hydro MPC options - GSC file numbers
5	Pump data - GSC file numbers

Note ***A .gsc (Grundfos Standard Configuration) file is a configuration data file.***

6. Type key

Example	Hydro MPC	-ED	2 CRE 5-10	1 CR 5-10	3 x 460 V, 60 Hz
Type range					
Subgroups: Pumps with integrated frequency converter: -E, -ED, -ES Pumps with external frequency converter: -EF, -EDF, -F Mains-operated pumps (start/stop): -S					
Number of pumps with integrated frequency converter and pump type					
Number of mains-operated pumps and pump type					
Supply voltage, frequency					

6.1 Examples of control variants

Booster sets with motors that include an integrated frequency converter		
Hydro MPC-E	**Hydro MPC-ED**	**Hydro MPC-ES**
Hydro MPC booster set with three CRE pumps.	Hydro MPC booster set with two CRE pumps and one mains-operated CR pump.	Hydro MPC booster set with one CRE pump and two mains-operated CR pumps.
 TM03 0993 0905	 TM03 0994 0905	 TM03 0996 0905
One CRE pump in operation.	One CRE pump in operation.	One CRE pump in operation.
 TM00 7995 2296	 TM00 7995 2296	 TM00 7995 2296
Three CRE pumps in operation.	Two CRE pumps and one mains-operated CR pump in operation.	One CRE pump and two mains-operated CR pumps in operation.
 TM00 7996 2296	 TM03 0814 0505	 TM00 7998 2296
• Hydro MPC-E maintains a constant pressure through continuous adjustment of the speed of the pumps. • The system performance is adjusted to the demand through cutting in/out the required number of pumps and through parallel control of the pumps in operation. • Pump changeover is automatic and depends on load, time and fault. • All pumps in operation will run at equal speed.	• Hydro MPC-ED maintains a constant pressure through continuous adjustment of the speed of two CRE pumps, while the CR pump is mains-operated. • One CRE pump always starts first. If the pressure cannot be maintained by the pump, the second CRE pump will be cut in. If the two CRE pumps cannot maintain the pressure, the CR pump will be cut in. • Pump changeover is automatic and depends on load, time and fault.	• Hydro MPC-ES maintains a constant pressure through continuous adjustment of the speed of the CRE pump. The other pumps are cut in/out according to demand and to achieve a performance corresponding to the consumption. • The CRE pump always starts first. If the pressure cannot be maintained by the pump, one or both CR pumps will be cut in. • Changeover among the pumps on mains operation is automatic and depends on load, time and fault.

Note:

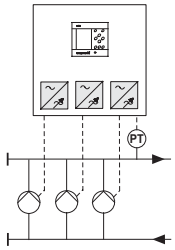
1.) CRE refers to CR pump with motor/integrated frequency drive.

2.) CR refers to CR pump with constant speed motor (mains-operated or DOL)

Booster sets with motors connected to external frequency converters

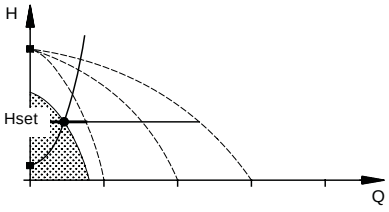
Hydro MPC-EF

Hydro MPC booster set with three CR pumps each connected to an external frequency converter in the control cabinet.



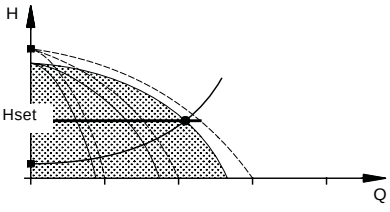
TM03 0995 0905

One CR pump in operation.



TM00 7995 2296

Three CR pumps in operation.

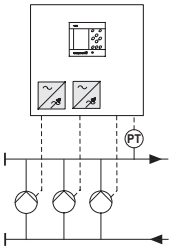


TM00 7996 2296

- Hydro MPC-EF maintains a constant pressure through continuous adjustment of the speed of the pumps connected.
- The system performance is adjusted to the demand through cutting in/out the required number of pumps and through parallel control of the pumps in operation.
- Pump changeover is automatic and depends on load, time and fault.
- All pumps in operation will run at equal speed.

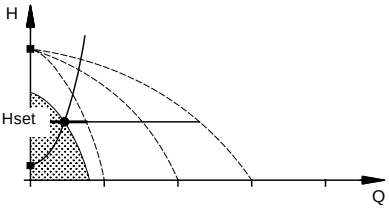
Hydro MPC-EDF

Hydro MPC booster set with two CR pumps connected to external frequency converters in the control cabinet and one mains-operated CR pump.



TM03 0997 0905

One CR pump connected to an external frequency converter in operation.



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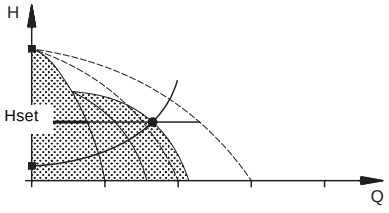
Two CR pumps connected to external frequency converters and one mains-operated CR pump in operation.



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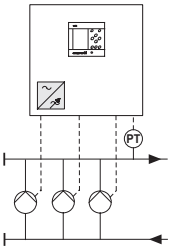
- Hydro MPC-EDF maintains a constant pressure through continuous adjustment of the speed of two CR pumps connected to external frequency converters, while the third CR pump is mains-operated.
- One CR pump connected to an external frequency converter always starts first. If the pressure cannot be maintained by the pump, the second CR pump connected to an external frequency converter will be cut in. If the pressure cannot be maintained by the two pumps, a mains-operated CR pump will be cut in.
- Pump changeover is automatic and depends on load, time and fault.

Hydro MPC-F

Hydro MPC booster set with three CR pumps connected to an external frequency converter in the control cabinet. The speed-controlled operation alternates between the pumps.



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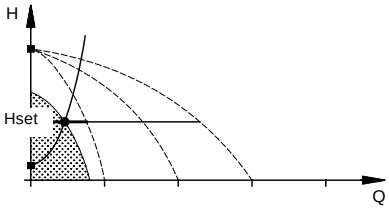
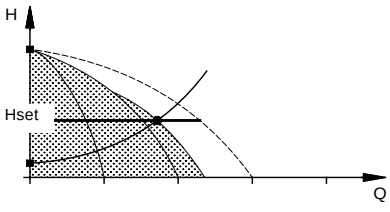
One CR pump connected to an external frequency converter in operation.



TM00 7995 2296

One CR pump connected to an external frequency converter and two mains-operated CR pumps in operation.



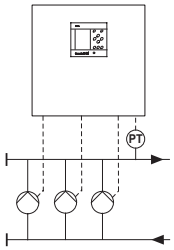
TM00 7998 2296

- Hydro MPC-F maintains a constant pressure through continuous adjustment of the speed of the CR pump connected to an external frequency converter. The speed controlled operation alternates between the pumps.
- One CR pump connected to the external frequency converter always starts first. If the pressure cannot be maintained by the pump, one or two mains-operated CR pumps will be cut in.
- Pump changeover is automatic and depends on load, time and fault.

Booster set with mains-operated pumps also called DOL (on/off)

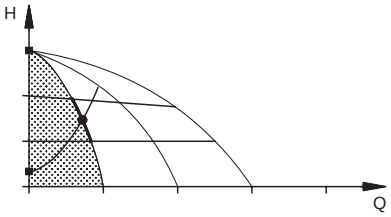
Hydro MPC-S

Hydro MPC booster set with three mains-operated CR(I) pumps.



TM03 0999 0905

One mains-operated CR pump in operation.



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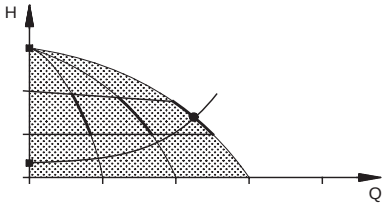
Three mains-operated CR pumps in operation.



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- Hydro MPC-S maintains pressure range through cutting in/out the required number of pumps.
- The operating range of the pumps will lie between H_{set} and H_{stop} (cut-out pressure). The cut-out pressure cannot be set but is calculated automatically.
- Pump changeover is automatic and depends on load, time and fault.

7. Installation

Warning

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

Before installation check that

- the booster set corresponds to the one ordered
- no visible parts have been damaged.

7.1 Mechanical installation

7.1.1 Location

The booster set must be installed in a well ventilated room to ensure sufficient cooling of the pumps and control cabinet.

Note ***Hydro MPC is not designed for outdoor installation and must not be exposed to direct sunlight.***

The booster set must have a 3 feet clearance in front and on the two sides for inspection and dismantling.

7.1.2 Pipework

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

The pipework connected to the booster set must be of adequate size. Either end of the manifold can be used to connect the piping, however, it is not recommended or allowed by accepted codes to have piping under the control panel. 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.

To achieve optimum operation and minimize noise and vibration, it may be necessary to consider vibration dampening of the booster set.

Noise and vibration are generated by the rotations in the motor and pump and by the flow in pipework 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 sets are installed where the first consumer on the line is close to the booster set, it is advisable to fit expansion joints on the suction and discharge pipes to prevent vibration being transmitted through the pipework.

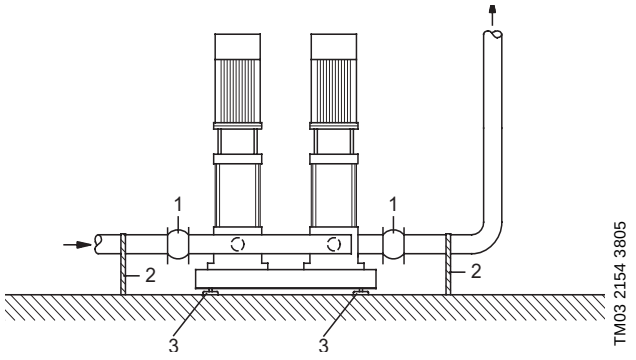


Fig. 4 Sketch showing the position of expansion joints, pipe supports and machine shoes

Pos.	Description
1	Expansion joint
2	Pipe support
3	Machine shoe

Note ***Expansion joints, pipe supports and machine shoes shown in the figure above are not supplied with a standard booster set.***

All nuts should be checked and re-tightened if necessary prior to start-up.

The pipes must be fastened to parts of the building to ensure that they cannot move or be twisted.

7.1.3 Foundation

The booster set should be positioned on an even and solid surface, for instance a concrete floor or foundation. If the booster set is not fitted with machine shoes, it must be bolted to the floor or foundation.

Note ***As a rule unless protected, the weight of a concrete foundation should be 1.5 x the weight of the booster set.***

7.1.4 Vibration dampers

To prevent the transmission of vibrations to buildings, it may be necessary to isolate the booster set 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 should therefore be sized by the supplier of vibration dampers.

If the booster set is installed on a base frame with vibration dampers, expansion joints should always be fitted on the manifolds. This is important to prevent the booster set from "hanging" in the pipework.

7.1.5 Expansion joints

Expansion joints are installed to

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

Note ***Expansion joints must not be installed to compensate for inaccuracies in the pipework such as center displacement of flanges.***

Fit expansion joints at a distance of minimum 1 to 1½ times the nominal flange diameter from the manifold on the suction as well as on the discharge side. This prevents the development of turbulence in the expansion joints, resulting in better suction conditions and a minimum pressure loss on the pressure side. At high water velocities (> 10 ft/sec) it is advisable to install larger expansion joints corresponding to the pipework.

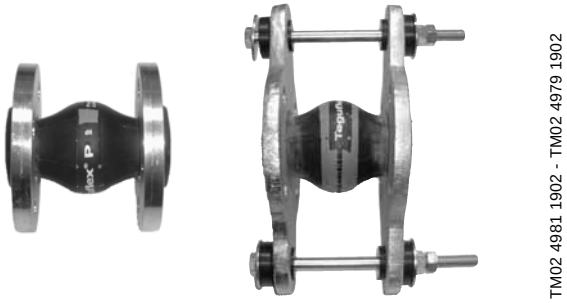


Fig. 5 Examples of rubber bellows expansion joints without and with limit rods

Expansion joints with limit rods can be used to minimize the forces caused by the expansion joints. Expansion joints with limit rods are always recommended for flanges larger than 6 inches.

The pipework should be anchored so that it does not stress the expansion joints and the pump. Follow the supplier's instructions and pass them on to advisers or pipe installers.

7.2 Electrical installation

The electrical installation should be carried out by an authorized person in accordance with local regulations and the relevant wiring diagram.

- The electrical installation of the booster set must comply with enclosure class, IP 54.
- Make sure that the booster set is suitable for the electricity supply to which it is connected.
- Make sure that the wire cross-section corresponds to the specifications in the wiring diagram.

Note ***The pump mains connection must be carried out as shown in the wiring diagram.***

The connection of the electrical supply, transmitters and external monitoring equipment must be carried out by an authorized electrician in accordance with the NEC, local regulations and the BoosterpaQ wiring diagram.

Ensure that the Hydro MPC controls and the pumps are suitable for the electricity supply on which they will be used (see Technical Data). Please read the wiring diagram carefully. According to the NEC, if the motors cannot be seen from the control panel, they must be fitted with a disconnected switch.

Any BoosterpaQ that utilizes a variable frequency drive (E, ED, ES, EF, EDF, F) should be connected to an electrical supply that all phase lines are electrically symmetrical with respect to ground. A "four wire wye" electrical supply with line impedance between 0.5% - 3% is recommended. If a variable frequency drive is connected to a delta transformer or if line impedance is not within the recommended 0.5% - 3%, the drive may not operate correctly and may not provide optimum performance (excessive faults, erratic behavior, or complete failure). Ask your power company or electrician to determine what type of electrical supply is present. Generator supplied power must meet public utility power quality standards.

8. Start-up

1. Have a qualified person check for proper power supply and plumbing connections. Make sure the main power is off.
2. Check that the air pre-charge in the diaphragm tank is 0.7 times the required discharge pressure set-point (0.9 times for MPC-S systems). System pressure must not be applied to the tank connection during the tank precharge process. If water is supplied to the tank from the system, close the tank valve during the pressurizing process.

Prime the system as follows

3. **Suction pressure system** (pumps are flooded at least as high as the highest part of the pumps)
   – close all discharge manifold pump isolation valves and open all inlet manifold pump isolation valves
   – open the vent plug on top of each pump. It is a small hex head screw in a large vent plug. Air and water will escape from the pump through a small hole in the large vent plug. When the air is out and water is flowing steadily, tighten the small hex head screw on the vent plug to stop the flow.

Note ***If you are filling an empty piping system, do not allow the pumps to run with the discharge valves wide open as cavitation may occur.***

4. **Suction lift system** (the water source is below the pumps or does not flood the pumps to the highest point on the pumps).
   – close all discharge manifold pump isolation valves and open all inlet manifold pump isolation valves
   – for suction lift applications, a foot valve must be placed on the inlet piping at the water source (tank, etc). If there is a fill point above the highest point of the pumps, you may fill the system from this point. If there is no fill point above the highest point of the pumps, remove the large vent plug on each pump. Fill each pump until the water is up to the vent plug, then replace the vent plugs.
5. Ensure all circuit breakers are in the "on" position.
6. Make sure the discharge manifold pump isolatin valves are closed. Switch on main power.

Caution ***The pumps may start at this time.***

7. At this time "Start-up wizard" may now be ran. Steps 8 and 10 can be skipped upon completion of "Start-up wizard". If "Start-up wizard" could not be ran or already ran proceed to step 8.
8. Turn the MPC controller to Max. by performing the following: Move top line display to "Operation", next move down to "System operating mode" and press OK. Next use the Up or Down button and select the "Max". setting and press OK.
9. Vent the system by opening the vent plug on each pump (as in Step 3). Venting with the pumps running ensures all air is removed from the suction piping. Do not run the system with the discharge manifold pump isolation valves closed more than five minutes to prevent over-heating of the pump liquid.
10. Turn the MPC controller to Stop by performing Step 8. again and select "Stop" instead of "Max". As pumps stop, check pump rotation. Repeat as necessary. If the area is dark, a flashlight may be required, or remove a coupling guard on each pump for better visibility. Disconnect the main power when removing coupling guards.

Warning

Do not touch the couplings while the pumps are turning as injury may result. Replace all coupling guards after the rotation check. Disconnect main power when removing and replacing coupling guards (or open service disconnect switches if this option was supplied).

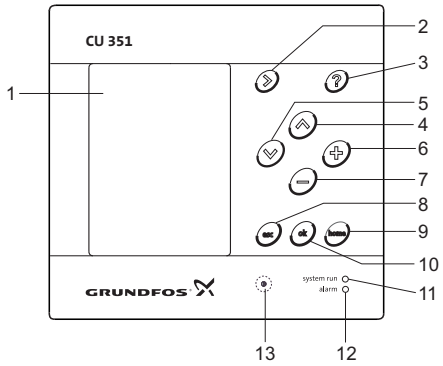
If the rotation is incorrect on any 3 phase pumps, switch any 2 of the 3 power main wires supplied to the control panel (L1, L2, L3). If that doesn't correct the rotation, call your Grundfos representative.

Note ***If you are filling an empty piping system, do not allow the pumps to run with the discharge valves wide open as cavitation may occur.***

11. Upon completion of venting pumps and checking for correct rotation you are now ready to bring BoosterpaQ online. With the discharge manifold isolation valves still closed, turn the MPC controller to "Max". (See Step 8 above). Partially open each pump discharge isolation valve to allow water to enter into discharge piping of BoosterpaQ. Continue the process of filling the discharge piping until discharge piping pressure is approximately desired Setpoint pressure of BoosterpaQ.
12. Turn MPC controller to "Normal" by performing Step 8 again and select "Normal" instead of "Max". Open the discharge manifold isolation valves for each pump completely. System is now on line.
13. It may be necessary to clear alarms in fault log. Follow steps in paragraph sections *10.6.2* to clear alarms.

9. Control panel

The control panel in the front cover of the control cabinet features a display, a number of buttons and two indicator lights. The control panel enables manual setting and change of setpoint.



TM03 1304 1705

Fig. 6 Hydro MPC control panel

Key:

Pos.	Description
1	Display
2	Arrow to the right
3	Help
4	Up
5	Down
6	Plus
7	Minus
8	Esc
9	Home
10	Ok
11	Indicator light, operation (green)
12	Indicator light, fault (red)
13	Contrast

9.1 Display (pos. 1)

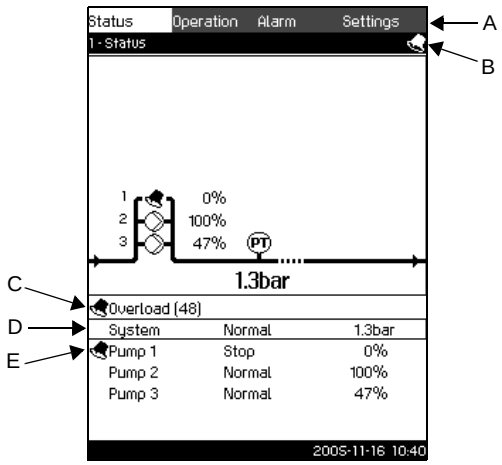


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Fig. 7 Display design

9.1.1 Menu line

The menu line (A) is illustrated in fig. 7.

The display has four main menus:

Status:	Indication of system status
Operation:	Change of operating parameters such as setpoint (password option)
Alarm:	Alarm log for fault finding
Settings:	Change of settings (password option)

9.1.2 Top line

The top line (B) is illustrated in fig. 7.

The top line shows

- the display number and title (left side)
- the selected menu (left side)
- the symbol in case of alarm (right side)
- the symbol if the service language has been selected (right side).

9.1.3 Graphical illustration

The graphical illustration may show a status, an indication or other elements, depending on the position in the menu structure.

The illustration may show the entire system or part of it as well as various settings.

When the graphical illustration is shown, a list will appear (see *9.1.4*). The list shows

- the status of alarms (see C in fig. 7)
- the system (see D in fig. 7) and
- the pumps (see E in fig. 7).

9.1.4 List

The list includes one or more lines with information grouped to the left and to the right.

The left side shows texts, and the right side shows values.

Headlines and empty lines cannot be selected.

9.1.5 Scroll bar

If the list of illustration elements exceeds the display, the symbols and will appear in the scroll bar to the right. Use the and buttons to move up and down in the list.

9.1.6 Bottom line

The bottom line shows the date and time.

9.2 Buttons and indicator lights

The buttons (pos. 2 to 10) are active when they are illuminated.

9.2.1 Arrow to the right (pos. 2)

Press the button to move to the next menu in the menu structure. If you press when the **Settings** menu is highlighted, you go to the **Status** menu.

9.2.2 Help (pos. 3)

When the button is illuminated, a help text applying to the current display will appear if the button is pressed.

Close the text by pressing the esc button.

9.2.3 Up and down (pos. 4 and 5)

Press the and buttons to move up and down in lists.

A text can be selected when it is in a box.

If a text is marked and the button is pressed, the text above will be marked instead. If the button is pressed, the text below will be marked.

If the button is pressed in the last line in the list, the first line will be marked.

If the button is pressed in the first line in the list, the last line will be marked.

9.2.4 Plus and minus (pos. 6 and 7)

Use the and buttons to increase and reduce values.
A value is activated when the ok button is pressed.

9.2.5 Esc (pos. 8)

Use the esc button to go one display back in the menu.

If a value has been changed and the esc button is pressed, the new value will not be saved. For further information, see *9.2.7 Ok (pos. 10)*.

If the ok button is pressed before the esc button, the new value will be saved. For further information, see *9.2.7 Ok (pos. 10)*.

9.2.6 Home (pos. 9)

Press the home button to return to the Status menu.

9.2.7 Ok (pos. 10)

Use the ok button as an enter button.

The ok button is also used to start the setting process for a value.

If a value has been changed and the ok button is pressed, the new value will be activated.

9.2.8 Indicator lights (pos. 11 and 12)

The Hydro MPC control panel incorporates a green and red indicator light.

The green indicator light is on when the Hydro MPC is in operation.
The green indicator light is flashing if the Hydro MPC has been set to stop.

The red indicator light is on if there is an alarm or a warning.
The fault can be identified from the alarm list.

9.2.9 Contrast (pos. 13)

The contrast in the display can be changed by means of the button:

1. Press the button.
2. Adjust the contrast with and .

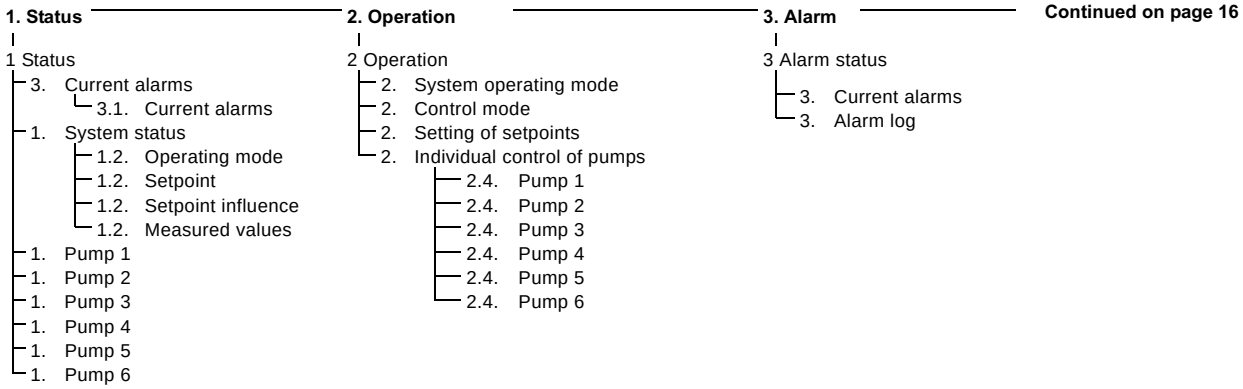
9.2.10 Back light

If no button is touched for 15 minutes, the back light of the panel will be dimmed. The indicator lights are still active.

Press the home button to re-activate the control panel and the back light.

10. Functions

10.1 Tree of functions



Key to the four main menus, Status, Operation, Alarm and Settings

Status
The **Status** menu shows alarms and the status of system and pumps. **Note:** No settings can be made in this menu.
Operation
In the **Operation** menu the most basic parameters can be set, such as setpoint, operating mode, control mode and forced control.
Alarm
The **Alarm** menu gives an overview of alarms and warnings. Alarms and warnings can be reset in this menu.
Settings
In the **Settings** menu it is possible to set various functions: • Primary controller Setting of setpoint, setpoint influence, primary sensor and redundant primary sensor. • Pump cascade control Setting of min. time between start/stop, number of starts/hour, number of standby pumps, forced pump changeover and test run. • Secondary functions Setting of stop function, digital and analog inputs, min., max. and user-defined duty, pump curve data and control source. • Monitoring functions Setting of dry-running protection, min. and max. pressure and external fault. • Functions, CU 351 Selection of service language, main language and units. Setting of time and date, passwords, Ethernet connection and GENIbus number.

10.2 Overview

Continued from page 15

- **4. Settings**
  - 4. Primary controller
    - 4.1.1 PI controller
    - 4.1.2 Alternative setpoints
      - 4.1.2.1...4.1.2. Alternative setpoints 2...7
    - 4.1.3 Setpoint influence
      - 4.1.3.1 External setpoint influence
        - 4.1.3.1 Influence function
    - 4.1.4 Primary sensor
    - 4.1.5 Redundant primary sensor
  - 4. Pump cascade control
    - 4.2.1 Min. time between start/stop
      Max. number of starts/hour
    - 4.2.3 Standby pumps
    - 4.2.4 Forced pump changeover
    - 4.2.5 Test run
  - 4. Secondary functions
    - 4.3.1 Low flow estimation/stop function
    - 4.3.7 Overview of digital inputs
      - 4.3.7.1...4.3.7. Function, DI1..DI3 (CU 351), [10, 12, 14]
      - 4.3.7.4...4.3.7. Function, DI1..DI9 (IO 351-41), [10...46]
    - 4.3.8 Overview of analog inputs
      - 4.3.8.1 Setting, analog input AI1 (CU 351), [51]
        - 4.3.8.1. Function, AI1 (CU 351), [51]
      - 4.3.8.2 Setting, AI2 (CU 351), [54]
        - 4.3.8.2. Function, AI2 (CU 351), [54]
      - 4.3.8.3 Setting, AI3 (CU 351), [57]
        - 4.3.8.3. Function, AI3 (CU 351), [57]
      - 4.3.8.4 Setting, AI1 (IO 351-41), [57]
        - 4.3.8.4. Function, AI1 (IO 351-41), [57]
      - 4.3.8.5 Setting, AI2 (IO 351-41), [60]
        - 4.3.8.5. Function, AI2 (IO 351-41), [60]
      - 4.3.8.6 Setting, AI1 (IO 351-42), [57]
        - 4.3.8.6. Function, AI1 (IO 351-42), [57]
      - 4.3.8.7 Setting, AI2 (IO 351-42), [60]
        - 4.3.8.7. Function, AI2 (IO 351-42), [60]
    - 4.3.9 Overview of digital outputs
      - 4.3.9.1...4.3.9. Function, DO1 and DO2 (CU 351), [72, 75]
      - 4.3.9.3...4.3.9. Function, DO1...DO7 (IO 351-41), [77...88]
      - 4.3.9.10..4.3.9 Function, DO1...DO7 (IO 351-42), [77...88]
    - 4.3.1 Min., max. and user-defined duty
      - 4.3.14.1 Min. duty
      - 4.3.14.2 Max. duty
      - 4.3.14.3 User-defined duty
    - 4.3.1 Pump curve data
      - 4.3.19.1 Data, main pumps
    - 4.3.2 Control source
  - 4. Monitoring functions
    - 4.4.1 Dry-running protection
      - 4.4.1.1 Pressure/level switch
      - 4.4.1.2 Measurement, inlet pressure
      - 4.4.1.3 Measurement, tank level
    - 4.4.2 Min. pressure
    - 4.4.3 Max. pressure
    - 4.4.4 External fault
  - 4. Functions, CU 351
    Change to service language (GB)
    Run wizard again
    - 4.5.1 Display language
    - 4.5.2 Display units
      - 4.5.2.1 Units for pressure
      - 4.5.2.2 Units for differential pressure
      - 4.5.2.3 Units for head
      - 4.5.2.4 Units for level
      - 4.5.2.5 Units for flow rate
      - 4.5.2.6 Units for volume
      - 4.5.2.7 Units for specific energy
      - 4.5.2.8 Units for temperature
      - 4.5.2.9 Units for power
      - 4.5.2.1 Units for energy
    - 4.5.3 Date and time
    - 4.5.4 Password
    - 4.5.5 Ethernet
    - 4.5.6 GENIbus number
    - 4.5.9 Software status

10.3 Description of functions

The description of functions is based on the four main menus of the CU 351 control unit: **Status**, **Operation**, **Alarm** and **Settings**.

The functions apply to all control variants unless otherwise stated.

10.4 Status

The first status display is shown below. This display is shown when the Hydro MPC is switched on, and it appears when the buttons of the control panel have not been touched for 15 minutes.

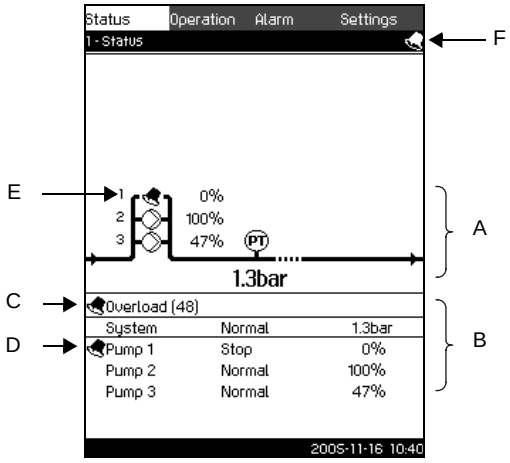


Fig. 8 Status menu

Description

No settings can be made in this menu.

The upper half of the display (A) shows a graphic illustration of the Hydro MPC booster set and part of the system. The selected measuring parameters are shown with sensor symbol and current value.

The current value of the control parameter, usually the discharge pressure, is shown in large print.

The lower display half (B) shows

- the latest current alarm, if any, and the fault cause together with the fault code in brackets
- system status with current operating mode and current value of the control parameter
- pump status with current operating mode and speed as percentage (%).

Note ***If a fault has occurred, the symbol will be shown in the alarm line (C) together with the cause and alarm code, for instance overload (48).***

If the fault is related to one of the pumps, the symbol will also be shown in front of the status line (D) of the pump in question. At the same time the symbol will be flashing instead of the pump symbol (E). The symbol will be shown to the right in the top line of the display (F). As long as a fault is present, this symbol will be shown in the top line of all displays.

To open a menu line, mark the line with ⌄ or ⌃ and press ok.

The display makes it possible to open status displays showing

- current alarms
- system status
- status of each pump.

10.4.1 Current alarms (3.1)

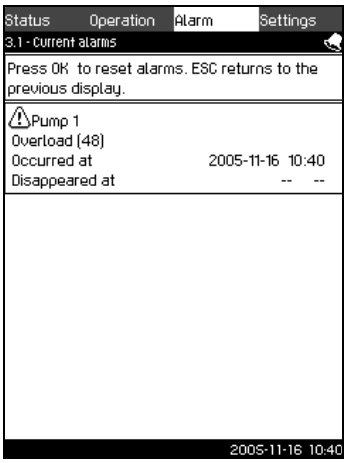


Fig. 9 Current alarms

Description

In this display, current unreset alarms are shown.

For further information, see *10.6.2 Current alarms (3.1)* and *10.6.3 Alarm log (3.2)*.

10.4.2 System status (1.2)

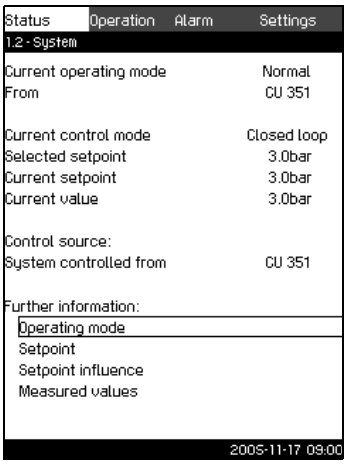


Fig. 10 System status

Description

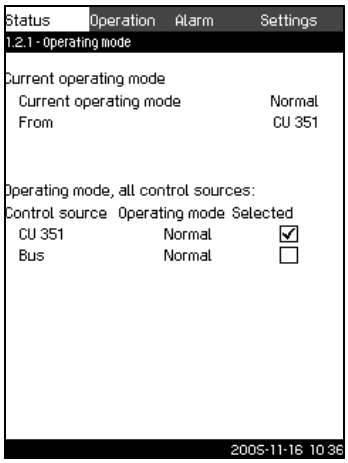
This display shows the current operational state of the Hydro MPC booster set. It is possible to go to subdisplays showing details.

The display makes it possible to open specific displays about

- operating mode
- setpoint
- setpoint influence
- measuring values.

To open a menu line, mark the line with ⌄ or ⌃ and press ok.

10.4.3 Operating mode (1.2.1)



TM03 2273 4005

Fig. 11 Operating mode

Description

Here the operating mode of the Hydro MPC booster set is shown as well as from where the Hydro MPC is controlled.

Operating modes

Hydro MPC has five operating modes:

1. *Normal*
   The booster set adapts its performance to the requirement.
2. *Max.*
   The booster set has a constant high performance. Normally all pumps run at maximum speed.
3. *User-defined*
   The booster set has a constant performance set by the user. Usually it is a performance between *Max.* and *Min*.
4. *Min.*
   The booster set has a constant low performance. Normally one pump is running at a speed of 70%.
5. *Stop*
   All pumps have been stopped.

The performance required in the operating modes *Max., Min.* and *User-defined* can be set in the **Settings** menu, see *10.7.25 Min., max. and user-defined duty (4.3.14)*.

The current operating mode can be controlled from four different sources: *Fault*, *External signal*, *CU 351* and *Bus*.

The priority of the sources is shown in the following table. *Fault* has the highest, and *Bus* the lowest priority.

Furthermore, the table shows five operating modes: *Stop*, *Max.*, *User-defined*, *Min.* and *Normal*. These operating modes are prioritised.

The command from the source or operating mode with the highest priority will always be in force.

Finally, it is possible to relate a source to an operating mode, for instance *External signal* to *Max.*
As several digital inputs can be set to external operation at the same time, the CU 351 has an order of priority of the external commands.

Example

Source	Priority	Operating modes				
		Stop	Max.	User-defined	Min.	Normal
Fault	1	x	x	x	x	x
External signal	2	1.	2.	3.	4.	5.
CU 351	3	x	x	x	x	x
Bus	4	x	x	x	x	x

The source *Fault* may for instance relate to the function dry-running protection. In case of water shortage, the operating mode will be *Stop*, as this mode has first priority. Other sources can result in other operating modes, depending on priority.

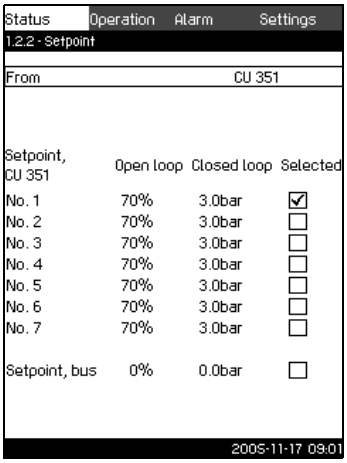
Control source

Hydro MPC can be set to remote control via an external bus (option). In this case, a setpoint and an operating mode must be set via the bus.

In the **Settings** menu it is possible to select whether the CU 351 or the external bus is to be the control source.

The status of this setting is shown in the display **Operating mode**.

10.4.4 Setpoint (1.2.2)



TM03 2272 4005

Fig. 12 Setpoint

Description

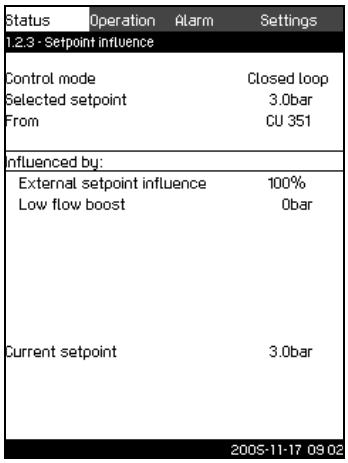
This display shows the selected setpoint and whether it comes from the CU 351 or an external bus.

The display also shows all seven possible setpoints from CU 351 (for closed- and open-loop control). At the same time, the selected setpoint is shown.

As it is a status display, no settings can be made.

Setpoints can be changed in the **Operation** menu.

10.4.5 Setpoint influence (1.2.3)



TM03 2271 4005

Fig. 13 Setpoint influence

Description

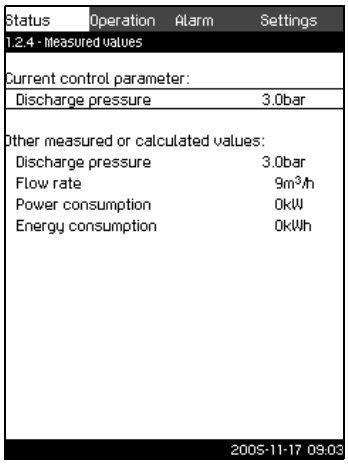
The selected setpoint can be influenced by parameters. The parameters, shown as percentage from 0 to 100%, can only reduce the setpoint, as the influence is multiplied with the selected setpoint:

$$Setpoint_{Current} = Setpoint_{Select.} \times Influence(1) \times Influence(2) \times \ldots$$

The display shows the parameters influencing the selected setpoint and the percentage of influence.

Finally the resulting current setpoint is shown.

10.4.6 Measured values (1.2.4)



TM03 2270 4005

Fig. 14 Measured values

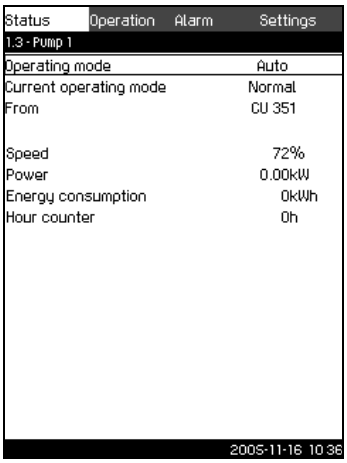
Description

This display gives a general status of all measured and calculated parameters.

Note

The lines Power consumption and Energy consumption are only shown in Hydro MPC-E booster sets.

10.4.7 Pump status (1.3 to 1.8)



TM03 2268 4005

Fig. 15 Pump status

Description

This display shows the operational state of the individual pumps.

The pumps may have different operating modes:

- *Auto*
  Together with the other pumps in automatic operation the pump is controlled by the PI controller which ensures that the booster set delivers the required performance (pressure).
- *Manual*
  The pump is not controlled by the PI controller. In manual operation, the pump has one of the following operating modes:
  - *Max.*
    The pump runs at a set maximum speed.
  - *Normal*
    The pump runs at a set speed. (This operating mode can only be selected for variable-speed pumps.)
  - *Min.*
    The pump runs at a set minimum speed. (This operating mode can only be selected for variable-speed pumps.)
  - *Stop*
    The pump has been forced to stop.

Besides information about the operating mode, it is possible to read various parameters in the status display, such as:

- speed (only 0 or 100% are shown for mains-operated pumps)
- power consumption (only CR(I)E pumps)
- energy consumption (only CR(I)E pumps)
- operating hours.

10.5 Operation

In this menu, the most basic parameters can be set, such as setpoint, operating mode, control mode and forced control of pumps.

10.5.1 Operation (2)

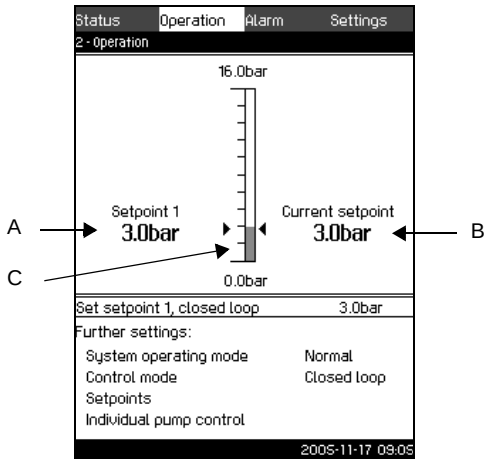


Fig. 16 Operation

Description

The column shows the setting range. In closed-loop control it corresponds to the range of the primary sensor, here 0-16 bar. In open-loop control the setting range is 0-100%.

At the left hand of the column the primary setpoint 1 (A) is shown, i.e. the value set in the display. At the right hand of the column the current setpoint (B) is shown, i.e. the setpoint acting as reference for the PI controller. If no kind of setpoint influence has been selected, the two values are identical. The current measured value (discharge pressure) is shown as the grey part of the column (C). See *10.4.5 Setpoint influence (1.2.3)*, *10.7.5 Setpoint influence (4.1.3)* and *10.7.6 External setpoint influence (4.1.3.1)*.

Below the top part is a menu line for setting of setpoint 1.

The bottom half of the display makes it possible to go to displays where operating and control modes as well as forced control of individual pumps can be selected.

Setting range

Setpoint:

Closed-loop control:	Measuring range of the primary sensor
Open-loop control:	0-100%

Setting via control panel

Setpoint:

1. Mark the **Operation** menu with ▷.
2. Mark **Set setpoint 1** with ▽ or △. Set the value with ⊕ or ⊖.
3. Save with ok.

System operating mode, control mode as well as forced control of individual pumps:

1. Mark the **Operation** menu with ▷.
2. Mark the setting, for instance **System operating mode**, with ▽ or △.
3. Go to a new display with ok.

Factory setting

The setpoint is a value suitable for the Hydro MPC booster set in question. Typically 50% of the maximum head of the pumps.

The factory setting may have been changed in the start-up menu.

10.5.2 System operating mode (2.1)

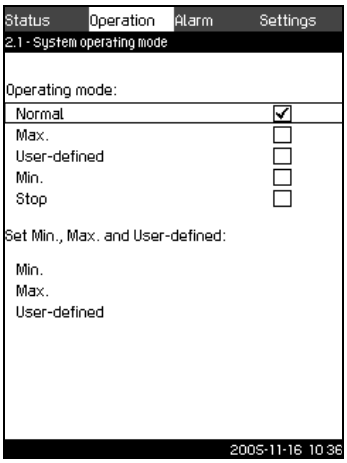


Fig. 17 System operating mode

Description

Hydro MPC can be set to five different operating modes. *Normal* is the typical setting. See *10.4.3 Operating mode (1.2.1)*.

The performance of the operating modes *Max.*, *Min.* and *User-defined* can be set in the **Settings** menu.

In the display shown, it is possible to go directly to the **Settings** menu in order to set the pump performance.

Setting range

It is possible to select the operating modes *Normal*, *Max.*, *Min.* and *User-defined* as well as *Stop*.

Setting via control panel

1. Mark the **Operation** menu with ▷.
2. Mark **System operating mode** with ▽ or △ and press ok.
3. Select the desired operating mode by marking one of the lines with check boxes with ▽ or △ and press ok.
4. In order to set the performance in min., max. or user-defined duty, mark the desired line at the bottom of the display and press ok.
   See *10.7.25 Min., max. and user-defined duty (4.3.14)*.

Factory setting

Normal.

10.5.3 Control mode (2.2)

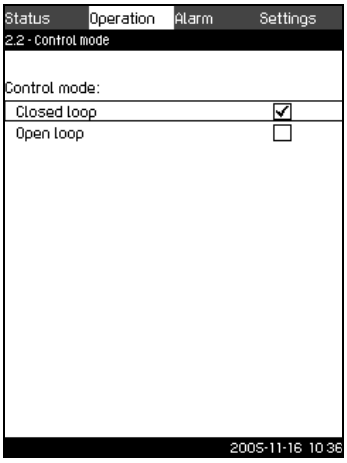


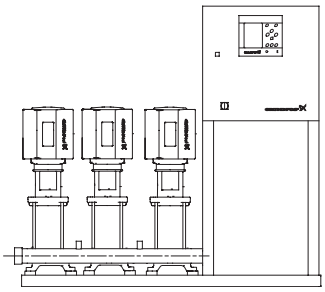
Fig. 18 Control mode

Description

There are two control modes, namely closed and open loop. The typical control mode is closed loop where the built-in PI controller ensures that the booster set delivers the discharge pressure required (setpoint). In open-loop control, the pumps run at a fixed speed. **Examples:**

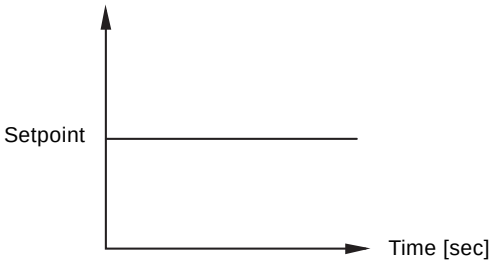
1. The performance is based on the setpoint set in CU 351, see example 1.
2. The performance is controlled by a building management system connected to the Hydro MPC, see example 2.
   Open-loop control is used when the booster set is controlled by an external controller which controls the performance of the Hydro MPC booster set via an external signal. In such cases the Hydro MPC is like an actuator.
3. The speed of the pumps is determined by the signal from a transmitter monitoring the level in a tank, see example 3.

Example 1



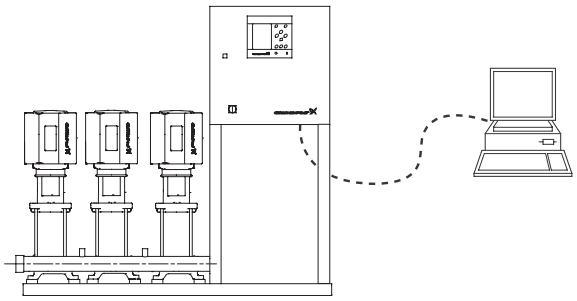
TM03 2231 3905

Speed [%]



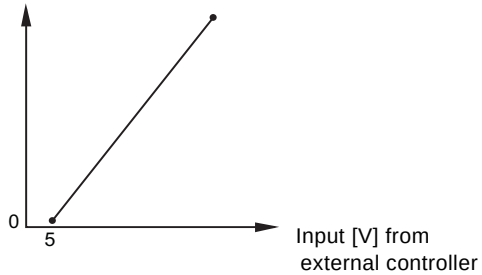
TM03 2390 4105

Example 2



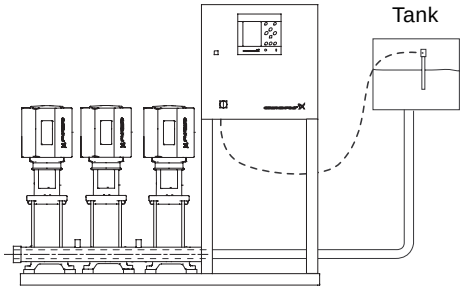
TM03 2232 3905

Speed [%]



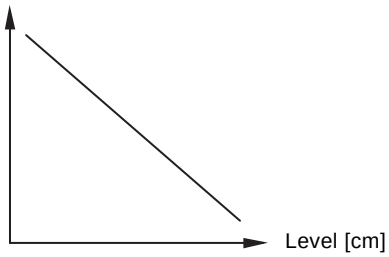
TM03 2391 4105

Example 3



TM03 2233 3905

Speed [%]



TM03 2256 3905

Setting range

There are two control modes:

Closed and open loop.

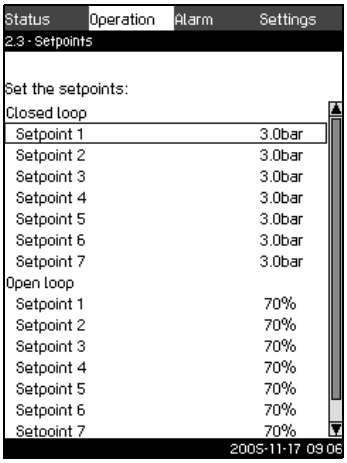
Setting via control panel

1. Mark the **Operation** menu with ⊙.
2. Mark **Control mode** with ⊙ or ⊙ and press ⊙.
3. Select the desired control mode with ⊙ or ⊙ and press ⊙.

Factory setting

Closed-loop control.

10.5.4 Setting of setpoints (2.3)



TM03 2282 4005

Fig. 19 Setting of setpoints

Description

In addition to the primary setpoint 1 (shown in display 2), six other setpoints can be set for closed-loop control. It is furthermore possible to set seven setpoints for open-loop control.

As described in *10.7.3 Selection of alternative setpoints (4.1.2)* and *10.7.4 Setting of alternative setpoints 2 to 7 (4.1.2.1 to 4.1.2.7)*, it is possible to activate one of the alternative setpoints by means of external contacts.

Setting range

The setting range of setpoints for closed-loop control depends on the range of the primary sensor, see *10.7.8 Primary sensor (4.1.4)*.

Open-loop control: 0-100%.

Setting via control panel

1. Mark the **Operation** menu with ⊙.
2. Mark **Setpoints** with ⊙ or ⊙ and press ⊙.
3. Select the setpoint with ⊙ or ⊙.
4. Set the setpoint with ⊙ or ⊙ and press ⊙.

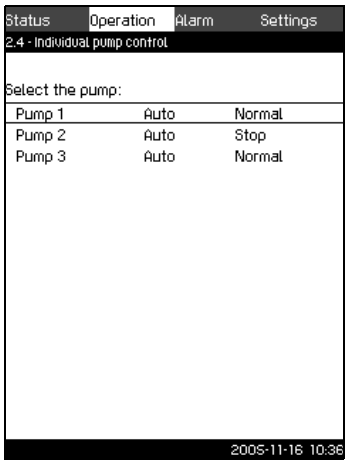
Factory setting

Setpoint 1 for closed-loop control is a value suitable for the Hydro MPC in question.

The other setpoints for closed-loop control are 3 bar.

All setpoints for open-loop control are 70%.

10.5.5 Forced control (2.4) + (2.4.1 to 2.4.6)



TM03 2275 4005

Fig. 20 Forced control

Description

It is possible to change the operating mode from automatic operation to one of the manual operating modes.

Auto

The pumps are controlled by the PI controller, ensuring that the booster set delivers the required performance (pressure).

Manual

The pump is not controlled by the PI controller, but set to one of the following manual operating modes:

- *Max.*
  The pump runs at a set maximum speed.
- *Normal*
  The pump runs at a set speed. (This operating mode can only be selected for variable-speed pumps.)
- *Min.*
  The pump runs at a set minimum speed. (This operating mode can only be selected for variable-speed pumps.)
- *Stop*
  The pump has been forced to stop.

Pumps in manual operation are not part of the normal pump cascade and speed control. The manual pumps are a "disturbance" of the normal control of Hydro MPC.

If one or more pumps are in manual operation, Hydro MPC may not be able to deliver the set performance.

There are two displays for the function. In the first display the pump to be set is selected, and in the next display the operating mode is selected.

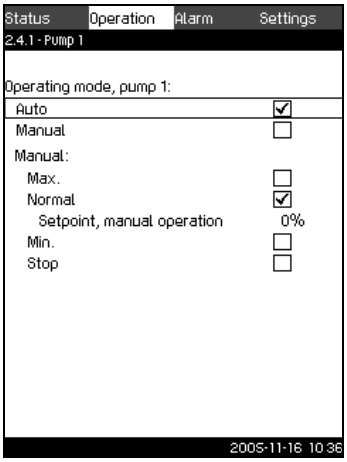
Setting range

All pumps can be selected.

Setting via control panel

1. Mark the **Operation** menu with ⊙.
2. Mark **Individual pump control** with ⊙ or ⊙ and press ⊙.
3. Select the pump with ⊙ or ⊙ and press ⊙.

10.5.6 Setting of individual operating mode (2.4.1 to 2.4.6)



TM03 2281 4005

Fig. 21 Setting of individual operating mode

Description

This display is shown for the individual pumps and makes it possible to set an operating mode.

Setting range

It is possible to select *Auto* or *Manual* as well as the operating mode of the pump for manual operation - *Normal*, *Max.*, *Min.* or *Stop*. For mains-operated pumps only *Max.* or *Stop* can be selected.

Setting via control panel

1. Mark the **Operation** menu with ⊙.
2. Mark **Individual pump control** with ⊙ or ⊙ and press ⊙.
3. Select the pump with ⊙ or ⊙ and press ⊙.
4. Mark **Auto** or **Manual** with ⊙ or ⊙ and press ⊙.
5. *Manual:* Select the operating mode with ⊙ or ⊙ and press ⊙.
6. *Normal:* Mark **Setpoint** with ⊙ or ⊙.
   Set the speed of the variable-speed pump with ⊙ or ⊙ and press ⊙.

Factory setting

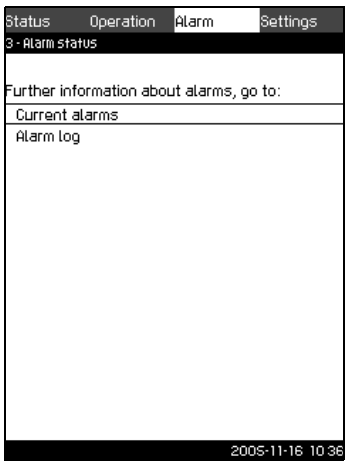
Auto.

10.6 Alarm

The **Alarm** menu gives an overview of current alarms and warnings.

In this menu it is possible to reset alarms and to see the alarm log.

10.6.1 Alarm (3)



TM03 2291 4005

Fig. 22 Alarm

Description

A fault in the Hydro MPC booster set or one of the components monitored can cause an alarm ⊗ or a warning ⚠. Besides the fault signal via the fault signal relay and the red indicator light on CU 351, an alarm can also cause a change of operating mode, for instance from *Normal* to *Stop*. A warning only causes a fault indication.

The table shows the possible causes of fault together with an alarm code number, and whether they result in an alarm or a warning. It also shows to what operating mode the booster set changes in case of alarm, and whether restart of the booster set and reset of the alarm is manual or automatic.

The table also shows that the reaction to some of the fault causes mentioned can be set in the **Settings** menu. See *10.7.32 Monitoring functions (4.4)* to *10.7.39 External fault (4.4.4)*.

Fault	Warning(⚠)/alarm(⊗)	Change of operating mode to	Reset of alarm Restart	Set in the Settings menu	Alarm code
Water shortage, level 1*	⚠		Auto		206
Water shortage, level 2*	⊗	Stop	Man/auto	X	214
Max. pressure	⊗	Stop	Auto		210
Min. pressure	⚠		Auto	X	211
	⊗	Stop	Man		
Alarm, all pumps	⊗	Stop		Auto	203
External fault	⚠		Auto	X	3
	⊗	Stop	Man		
Dissimilar sensor signals	⚠		Auto		204
Primary sensor (without redundant primary sensor)	⊗	Stop	Auto		89
Fault, sensor	⚠		Auto		88
Communication fault	⚠		Auto		10
Phase failure	⚠		Auto		2
Undervoltage, pump	⚠		Auto		7,40, 42,73
Overvoltage, pump	⚠		Auto		32
Overload, pump	⚠		Auto		48,50, 51,54
Overtemperature, pump	⚠		Auto		65,67
Other fault, pump	⚠		Auto		76,83
Internal fault, CU 351	⚠		Auto		72,83, 157
Internal fault, IO 351	⊗	Stop	Auto		72,83, 157
VFD, not ready	⚠		Auto		213
Fault, Ethernet	⚠		Auto		231, 232, 233

* Level 1 is the tank level where a warning ⚠ is indicated in case of water shortage. Level 2 is the tank level where an alarm ⊗ is indicated and the pumps stop in case of water shortage. For further information, see *10.7.34 Dry-running protection with pressure/level switch (4.4.1.1)* and *10.7.36 Dry-running protection with level transmitter (4.4.1.3)*.

Alarm (3) continued

MPC alarm indication "Protocol description"	Alarm code	Associated device and device no.	Description/cause	Remedy	Reset type[1]	Alarm/warning Action type[2]
1. Water shortage, level 1 *Water shortage, level 1	206	System	a) The pre-pressure (or the level in the feed tank) is below its programmable warning limit.	1. Check the actual and the corresponding settings. 2. Check the sensor/switch, wiring and input according to the wiring diagram. 3. Check the sensor/switch.	Auto	Warning Unchanged
2. Water shortage, level 2 *Water shortage, level 2	214		a) The pre-pressure (or the level in the feed tank) is below its programmable warning limit.		Auto/ Manual	Alarm Stop
			b) The pre-pressure switch detect water shortage.			Warning Unchanged
3. Discharge pressure high *Pressure above max. pressure	210		a) The system pressure is above the programmable high-pressure alarm limit.		Auto/ Manual	Alarm Fast stop (over rule min. seq. time)
4. Discharge pressure low *Pressure below min. pressure	211		a) The system pressure is below the programmable low-pressure alarm limit.		Auto/ Manual	Alarm/Warning Stop/ Unchanged
5. All pumps in alarm *All pumps in alarm	203		a) All pumps, set to Auto, is stopped on account of pump alarm	Troubleshoot according to the alarm message/code: 1. System 2. Pumps installed Use fault fault finding for the pump.	Auto	Alarm Stop
			b) Pumps are not indicating alarm	Check the Genibus wires eg. connection, polarisation.		
6. External fault signal *External fault signal	003		a) External fault digital input activated.	1. Check the external signal source. 2. Check the digital input according to the wiring diagram	Auto/ Manual	Alarm/Warning Stop/ Unchanged
7. Inconsistency between sensors *Inconsistency between sensors	204	Primary sensor and/or redundant sensor	a) Primary feedback sensor value (pressure) is inconsistent with redundant feedback sensor value.	1. Check the wiring and input according to the wiring diagram. 2. Check the sensor output according to the measured value.	Auto	Warning Unchanged
8. Primary sensor *Closed loop feedback sensor signal fault	089	Primary sensor	a) A fault in the sensor assigned to the feed back control is detected.	1. Check the wiring and input according to the wiring diagram. 2. Check the sensor output according to the measured value.	Auto	Alarm Stop
			b) Error in the settings of the sensor which is assigned to the regulator.	Check the primary sensor settings		
9. Sensor fault *General (measurement) sensor signal fault	088	CU 351 IO 351 as IO module	a) The signal (ex. 4-20 mA) from one of the analog sensors is outside the selected signal range.	1. Check the wiring and input according to the wiring diagram. 2. Check the sensor output according to the measured value		Warning Unchanged

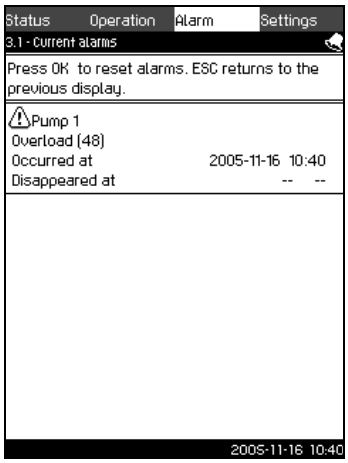
MPC alarm indication "Protocol description"	Alarm code	Associated device and device no.	Description/cause	Remedy	Reset type[1]	Alarm/warning Action type[2]
10. CU 351 internal fault *Real time clock out of order	157	CU 351	a) The real-time clock in CU 351 is out of order.	Replace the CU 351	Auto	Warning Unchanged
11. Ethernet fault *Ethernet: No address from DHCP server	231		a) No address from DHCP server	1. Communication error. 2. Please contact the system integrator.		
12. Ethernet fault *Ethernet: Auto disabled due to misuse	232		a) Auto-disabled due to misuse			
13. FLASH parameter verification error *FLASH parameter verification error	083		a) Verification error in CU 351 FLASH memory	Replace the CU 351		
14. IO 351 internal fault *Hardware fault type 2	080	IO 351	a) IO 351 pump module hardware fault b) IO 351 I/O module hardware fault	See current alarms and identify the faulty IO 351 module from the alarm message and replace the module.		
15. VFD not ready *VFD not ready	213	Pump 1-6 CU 351	a) The VFD signal relay do not release the VFD for operation	1. Check for VFD alarm 2. Check the wiring and input according to the wiring diagram.		
16. Communication fault *Pump communication fault	010	Pump 1-6 IO 351	a) No GeniBus communication with a device connected to CU 351	See actual alarms and identify the faulty device from the alarm message. 1. Check power supply 2. Check GeniBus cable connection 3. Check, with R100, that the device GeniBus no. is correct.		
17. Device alarms	From device	Pump 1-6	a) The device is in alarm	See actual alarms and identify the faulty device from the alarm message. 1. Fault find according to the service instruction for the device.		

1) Reset type is either fixed as "Auto acknowledge" (Auto) or can be programmed to be Auto or manual ackknowledge (Auto/Man)*.

2) Programmable action types:

- Go to operating mode "Stop" (no delay (<0.5 s) between pump disconnections).
- Go to operating mode "Min".
- Go to operating mode "User-defined".
- Go to operating mode "Max".
- Set pumps in source mode "Local". - No action (warning only)

10.6.2 Current alarms (3.1)



TM03 2293 4005

Fig. 23 Current alarms

Description

This submenu shows

- warnings ⚠ caused by faults that still exist.
- alarms ⊗ caused by faults that still exist.
- alarms ⊗ caused by faults that have disappeared, but the alarm requires manual reset.

All warnings and alarms with automatic reset are automatically removed from the menu and transferred to the alarm log when the fault has disappeared.

Alarms requiring manual reset are reset in this display by pressing ok. They are then transferred to the alarm log. An alarm cannot be reset until the fault has disappeared.

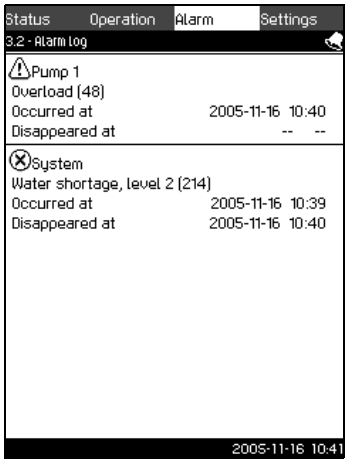
For every warning or alarm the following is shown:

- Whether it is a warning ⚠ or an alarm ⊗.
- Where the fault occurred: System, Pump 1, Pump 2, etc.
- In case of input-related faults the input is shown.
- What the cause of the fault is, and the alarm code in brackets: Water shortage, level 1 (206), max. pressure (210), etc.
- When the fault occurred: Date and time.
- When the fault disappeared: Date and time. If the fault still exists, date and time are shown as --...--.

The latest warning/alarm is shown at the top of the display.

10.6.3 Alarm log (3.2)

The alarm log can store up to 24 warnings and alarms.



TM03 2292 4005

Fig. 24 Alarm log

Description

Here warnings and alarms are shown.

For every warning or alarm the following is shown:

- Whether it is a warning ⚠ or an alarm ⊗.
- Where the fault occurred. System, Pump 1, Pump 2, etc.
- In case of input-related faults the input is shown.
- What the cause of the fault is, and the alarm code in brackets: Water shortage, level 1 (206), max. pressure (210), etc.
- When the fault occurred: Date and time.
- When the fault disappeared: Date and time. If the fault still exists, date and time are shown as --...--.

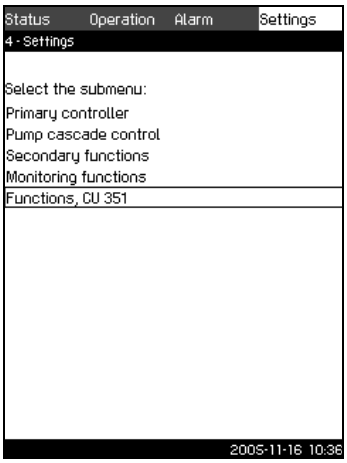
The latest warning/alarm is shown at the top of the display.

Setting via control panel

To open the alarm log, proceed as follows:

1. Mark the **Alarm** menu with ›.
2. Mark **Alarm log** with ⌄ or ⌃ and press ok.
3. Scroll up and down in the list with ⌄ or ⌃ if it takes up more than one page.

10.7 Settings



TM03 2294 4005

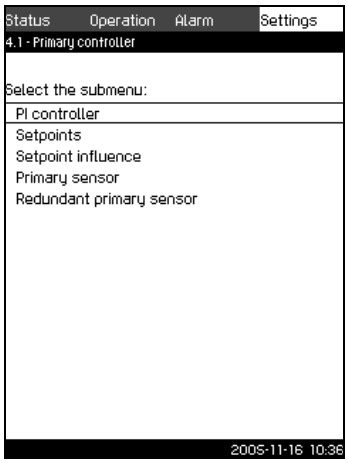
Fig. 25 Settings

In the **Settings** menu it is possible to set the following functions:

- Primary controller
  Setting of setpoint, setpoint influence, primary sensor and redundant primary sensor.
- Pump cascade control
  Setting of min. time between start/stop, number of starts/hour, number of standby pumps, forced pump changeover and test run.
- Secondary control
  Setting of stop function, digital and analog inputs, min., max. and user-defined duty, pump curve data and control source.
- Monitoring
  Setting of dry-running protection, min. and max. pressure and external fault.
- CU 351
  Selection of service language, display language, units and date and time, setting of passwords, Ethernet connection and GENIbus number.

Usually, all these functions are set correctly when the Hydro MPC is switched on.
It is only necessary to make settings in this menu if the functionality is to be expanded with for instance alternative setpoints, setpoint influence or redundant primary sensor, or if the controller settings are to be adjusted.

10.7.1 Primary controller (4.1)



TM03 2368 4005

Fig. 26 Primary controller

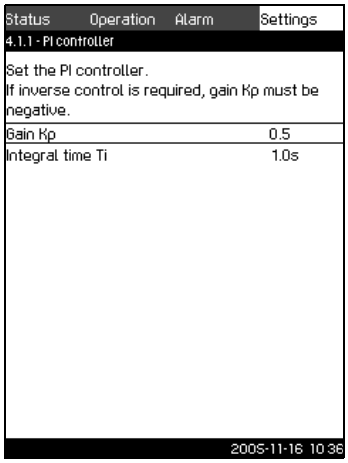
Description

In this menu section it is possible to set the functions related to the primary controller.
It is only necessary to make setting in this menu if the functionality is to be expanded with for instance alternative setpoints, setpoint influence or redundant primary sensor.

The following menus can be selected:

- PI controller
- Setpoints
- Setpoint influence
- Primary sensor
- Redundant primary sensor.

10.7.2 PI controller (4.1.1)



TM03 2387 4005

Fig. 27 PI controller

Description

Hydro MPC includes a standard PI controller which ensures that the pressure is stable and corresponds to the setpoint.

It is possible to adjust the PI controller if a faster or slower reaction to changes of consumption is required.

A faster reaction is obtained if K_p is increased and T_i is reduced.

A slower reaction is obtained if K_p is reduced and T_i is increased.

Setting range

- Gain K_p: –20 to 20.
  Note: For inverse control, set Kp to a negative value.
- Integral time T_i: 0.1 to 3600 seconds.

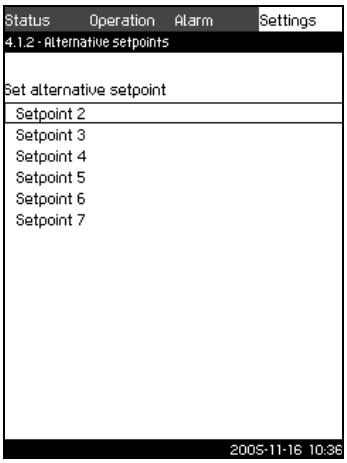
Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Primary controller** with ⊙ or ⊙ and press ⊙.
3. Mark **PI controller** with ⊙ or ⊙ and press ⊙.
4. Select the gain (K_p) with ⊙ or ⊙. Set the value with ⊙ or ⊙ and save with ⊙.
   Note: Usually it is not necessary to adjust K_p.
5. Select the integral time (T_i) with ⊙ or ⊙. Set the time with ⊙ or ⊙ and press ⊙.

Factory setting

- K_p: 0.5
- T_i: 1 second

10.7.3 Selection of alternative setpoints (4.1.2)



TM03 2383 4005

Fig. 28 Selection of alternative setpoints

Description

This function makes it possible to select up to six setpoints (no. 2 to 7) as alternatives to the primary setpoint (no. 1). The primary setpoint (no. 1) is set in display 2 in the **Operation** menu.
Every alternative setpoint can be addressed manually to a separate digital input (DI). When the contact of the input is closed, the alternative setpoint applies.

If more than one alternative setpoint has been selected, and they are activated at the same time, the CU 351 selects the setpoint with the lowest number.

Setting range

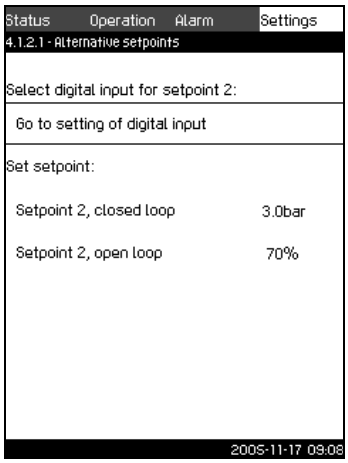
- Six setpoints, no. 2 to 7.

Factory setting

No alternative setpoints have been selected.

10.7.4 Setting of alternative setpoints 2 to 7 (4.1.2.1 to

4.1.2.7)



TM03 2384 4005

Fig. 29 Setting of alternative setpoints 2 to 7

For each alternative setpoint, select the digital input to activate the setpoint.

It is possible to set a setpoint for closed loop and for open loop.

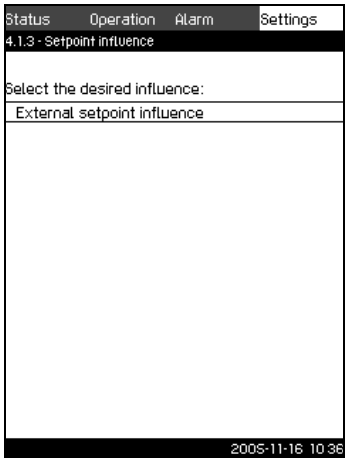
Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Primary controller** with ⊙ or ⊙ and press ⊙.
3. Mark **Alternative setpoint** with ⊙ or ⊙ and press ⊙.
4. Select the alternative setpoint with ⊙ or ⊙ and press ⊙.
5. Mark Go to setting of digital input with ⊙ or ⊙ and press ⊙.
   Now the display *Overview of digital inputs (4.3.7)* appears. Set the input and return with ⊙.
6. Mark the menu line of the setpoint (closed or open loop) with ⊙ or ⊙.
7. Set the required setpoint with ⊙ or ⊙ and save with ⊙. Set both setpoints if Hydro MPC is to be controlled both in open and closed loop.

Factory setting

No alternative setpoints have been set.

10.7.5 Setpoint influence (4.1.3)



TM03 2377 4005

Fig. 30 Setpoint influence

Description

The setpoint may be influenced by several factors so that the current setpoint is adapted to parameters which are to influence for instance the discharge pressure of the booster set.

The parameters which influence the performance of the booster set are shown as a percentage from 0 to 100%. They can only reduce the setpoint, as the influence is multiplied with the setpoint:

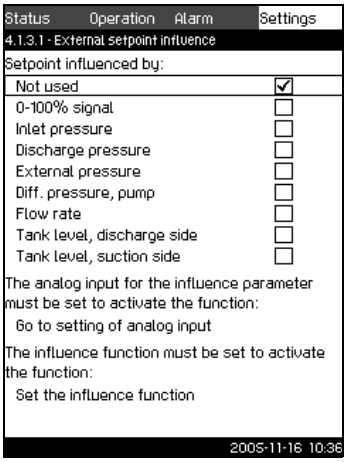
$$\text{Setpoint}_{\text{Current}} = \text{Setpoint}_{\text{Select.}} \times \text{Influence}(1) \times \text{Influence}(2)$$

The influence values can be set individually.

Factory setting

Setpoint influence is not activated.

10.7.6 External setpoint influence (4.1.3.1)



TM03 2379 4005

Fig. 31 External setpoint influence

Description

This function makes it possible to make an external analog signal influence the setpoint. The analog signal may be a 0-100% signal from another control unit, a signal transmitter such as a flow sensor, or a parameter in the system.

The function is linked to a selected analog input (AI), and the relation between the measuring parameter and the desired influence in percentage is described in a table with maximum eight points.

Setting range

The following parameters can be selected:

- Not used
- 0-100% signal
- Inlet pressure
- Discharge pressure
- External pressure
- Differential pressure of pump
- Flow rate
- Tank level, discharge side
- Tank level, suction side.

Setting via control panel

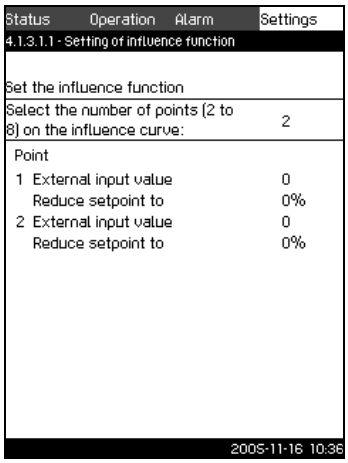
1. Mark the **Settings** menu with ⊙.
2. Mark **Primary controller** with ⊙ or ⊙ and press ⊙.
3. Mark **Setpoint influence** with ⊙ or ⊙ and press ⊙.
4. Mark **External setpoint influence** with ⊙ or ⊙ and press ⊙.
5. Mark the parameter which is to influence the setpoint with ⊙ or ⊙ and press ⊙.
6. Mark **Go to setting of analog input** with ⊙ or ⊙ and press ⊙.
   Now the display *Overview of analog inputs (4.3.8)* appears. Select the analog input (AI) and set the measuring parameter.

7. Mark **Setting of influence function** with ⌄ or ⌃ and press ok.

Factory setting

External setpoint influence is not activated.

10.7.7 Influence function (4.1.3.1.1)



TM03 2389 4005

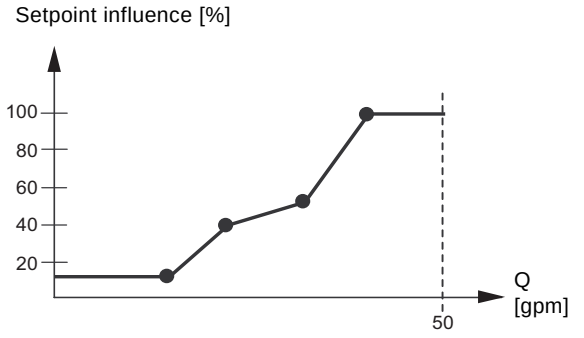
Fig. 32 Setting of influence function

Description

In this menu you select the relation between the measuring parameter which is to influence the setpoint and the desired influence as a percentage.

The relation is set by entering values in a table with maximum eight points by means of the control panel.

Example with four points:



TM03 1691 2705

Fig. 33 Relation between setpoint influence and flow rate

The control unit of the Hydro MPC draws straight lines between the points. A horizontal line is drawn from the minimum value of the relevant sensor (0 gpm in the example) to the first point. This is also the case from the last point to the sensor's maximum value (example 50 gpm).

Setting range

Two to eight points can be selected. Each point contains the relation between the value of the parameter which is to influence the setpoint and the influence of the value.

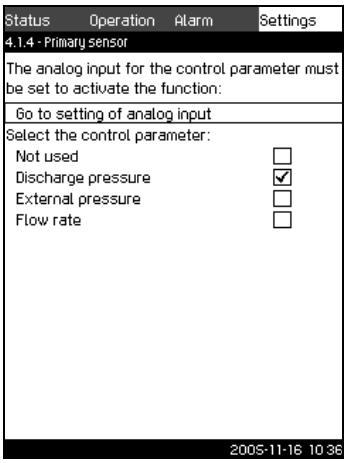
Setting via control panel

1. Mark the **Settings** menu with ⌄.
2. Mark **Primary controller** with ⌄ or ⌃ and press ok.
3. Mark **Setpoint influence** with ⌄ or ⌃ and press ok.
4. Mark **External setpoint influence** with ⌄ or ⌃ and press ok.
5. Mark **Set the influence function** with ⌄ or ⌃ and press ok.
6. Mark the menu line for number of points with ⌄ or ⌃ and press ok.
7. Select the required number of points with ⊕ or ⊖ and save with ok.
8. Mark **External input value** (point 1) with ⌄ or ⌃.
9. Set the value of the external input value with ⊕ or ⊖ and save with ok.
10. Mark **Reduce setpoint to** (point 1) with ⌄ or ⌃.
11. Set the value in per cent with ⊕ or ⊖ and save with ok.
12. Repeat points 5 to 11 for all desired parameters.

Factory setting

External setpoint influence is not activated.

10.7.8 Primary sensor (4.1.4)



TM03 2373 4005

Fig. 34 Primary sensor

Description

In this display, select the control parameter of Hydro MPC and the sensor to measure the value.

Usually the control parameter is the discharge pressure which is measured by a sensor fitted on the discharge manifold and connected to analog input AI1 of CU 351.

Alternative control parameters are

- External pressure
  Select this parameter if the pump performance is to be controlled according to a pressure measured outside the booster set.
- Flow rate
  Select this parameter if Hydro MPC is to deliver a constant flow rate.

If one of the alternative control parameters is selected, the sensor must be connected to AI3 (CU 351) which is then set to external pressure or flow rate as parameter.

Setting range

- Not used
- Discharge pressure (factory setting)
- External pressure
- Flow rate

From factory the discharge pressure sensor is connected to AI1 (CU 351). If one of the two other parameters is selected, the sensor in question must be connected to AI3 (CU 351) which is then set to function as the primary sensor.

Setting via control panel

1. Mark the **Settings** menu with ⌄.
2. Mark **Primary controller** with ⌄ or ⌃ and press ok.
3. Mark **Primary sensor** with ⌄ or ⌃ and press ok.

4. Mark **Go to setting of analog input** with ⌄ or ⌃ and press ok.
   Now the display *Overview of analog inputs (4.3.8)* appears. Select the analog input (AI) for the primary sensor and set the parameters for this sensor. Return to display *Primary sensor (4.1.4)* with esc.
5. Select the control parameter for the primary sensor with ⌄ or ⌃ and press ok.

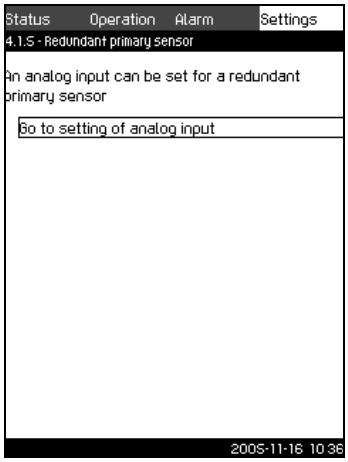
Note: If the primary parameter is discharge pressure, AI1 (CU 351) must be set to this parameter.

If the primary parameter is external pressure or flow rate, AI3 (CU 351) must be set to this parameter.

Factory setting

The primary parameter is discharge pressure. The sensor is connected to AI1 (CU 351).

10.7.9 Redundant primary sensor (4.1.5)



TM03 2369 4005

Fig. 35 Redundant primary sensor

Description

A redundant primary sensor functions as a backup sensor for the primary sensor. It measures the control parameter which in this case is the discharge pressure.

The CU 351 usually controls on the basis of the primary sensor connected to analog input AI1 (CU 351). If the primary sensor falls out of its sensor range, the redundant primary sensor connected to analog input AI3 (CU 351) will take over and then report to the PI controller. In this situation a warning is indicated.

If both the primary sensor and the redundant primary sensor fall out of their sensor range, all pumps will be stopped.

The CU 351 also indicates warning if the output signals from the primary sensor and the redundant primary sensor differ more than ±10% or more than 4% of full scale of the primary sensor, but the Hydro MPC will still be controlled by the primary sensor.

Note: The redundant primary sensor must be of the same type and size as the primary sensor and be mounted at the same position in Hydro MPC.

Setting range

The analog input AI3 (CU 351) can be set to this function.

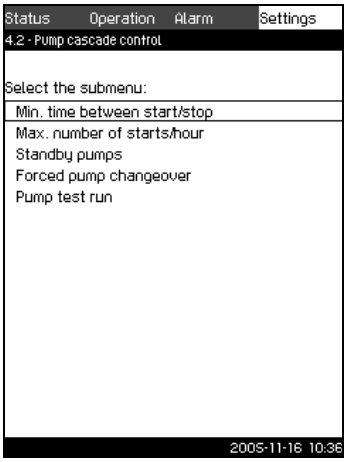
Setting via control panel

1. Mark the **Settings** menu with ⌄.
2. Mark **Primary controller** with ⌄ or ⌃ and press ok.
3. Mark **Redundant primary sensor** with ⌄ or ⌃ and press ok.
4. Mark **Go to setting of analog input** with ⌄ or ⌃ and press ok.
   Now the display *Overview of analog inputs (4.3.8)* appears. Select **AI3** and **Redundant primary sensor**. The range of the sensor will now automatically be set to the same values as the primary sensor, and these settings cannot be changed.

Factory setting

Usually, no redundant primary sensor is selected from factory. The function can, however, be selected as factory setting if the redundant primary sensor is ordered as option.

10.7.10 Pump cascade control (4.2)



TM03 2363 4005

Fig. 36 Pump cascade control

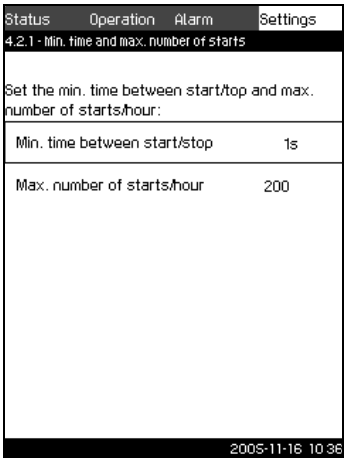
In this menu section it is possible to set the functions connected to pump cascade control.

It is only necessary to make setting in this menu if the functionality is to be expanded with for instance min. time between start/stop, permissible number of starts/hour and standby pumps.

The following menus can be selected:

- Min. time between start/stop
- Max. number of starts/hour
- Standby pumps
- Forced pump changeover
- Pump test run.

10.7.11 Min. time between start/stop (4.2.1)



TM03 2367 4005

Fig. 37 Min. time between start/stop

Description

This function ensures a delay between the starting/stopping of one pump and the starting/stopping of another pump.

The purpose of the function is to prevent constant starting and stopping of pumps.

Setting range

From 1 to 300 seconds.

Setting via control panel

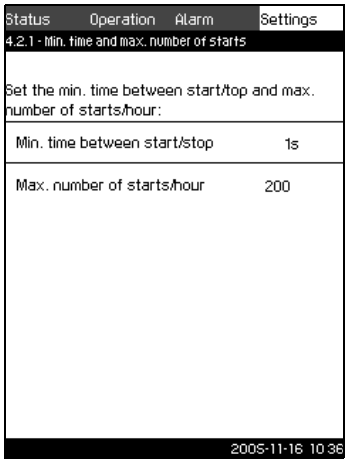
1. Mark the **Settings** menu with ▷.
2. Mark **Pump cascade control** with ▽ or △ and press ok.
3. Mark **Min. time between start/stop** with ▽ or △ and press ok.
4. Mark **Min. time between start/stop** with ▽ or △ and press ok.
5. Set the required minimum time with ⊕ or ⊖ and save with ok.

Factory setting

The minimum time between start/stop of pumps has been set to:

Hydro MPC-E and -EF:	1 second ≤15 HP 240 sec.
Other variants:	> 20 HP 360 sec.

10.7.12 Max. number of starts/hour (4.2.1)



TM03 2367 4005

Fig. 38 Max. number of starts/hour

Description

This function limits the number of pump starts and stops per hour for the complete system. It reduces noise emission and improves the comfort of booster sets with mains-operated pumps.

Each time a pump starts or stops, the controller calculates when the next pump is allowed to start/stop in order not to exceed the permissible number of starts per hour.

The function always allows pumps to be started to meet the requirement, but pump stops will be delayed, if needed, in order not to exceed the permissible number of starts/stops per hour.

The time between pump starts must be between the minimum time between start/stop, see display *10.7.11*, and 3600/n, n being the set number of starts per hour.

Setting range

1 to 253 starts per hour.

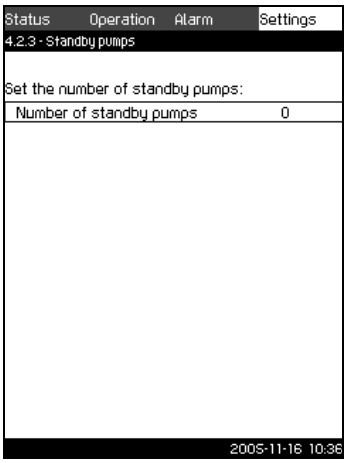
Setting via control panel

1. Mark the **Settings** menu with ▷.
2. Mark **Pump cascade control** with ▽ or △ and press ok.
3. Mark **Max. number of starts/hour** with ▽ or △ and press ok.
4. Mark **Max. number of starts/hour** with ▽ or △ and press ok.
5. Set the permissible number of starts per hour with ⊕ or ⊖ and save with ok.

Factory setting

Hydro MPC-E and -EF:	200 starts per hour ≤15 HP.
Other variants:	100 starts per hour > 20 HP

10.7.13 Standby pumps (4.2.3)



TM03 2366 4005

Fig. 39 Standby pumps

Description

This function makes it possible to limit the maximum performance of the Hydro MPC, by selecting one or more pumps as standby pumps.

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

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

The status as standby pump alternates between all pumps.

Setting range

The number of possible standby pumps in a Hydro MPC booster set is equal to the total number of pumps in the system minus 1.

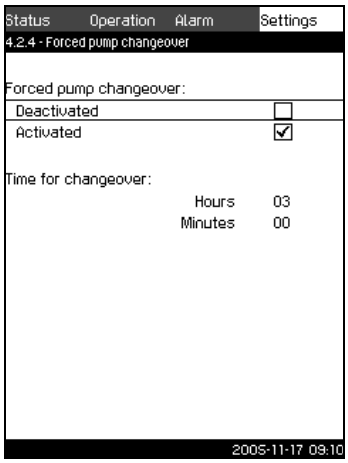
Setting via control panel

1. Mark the **Settings** menu with ▷.
2. Mark **Pump cascade control** with ▽ or △ and press ok.
3. Mark **Standby pumps** with ▽ or △ and press ok.
4. Select the number of standby pumps with ⊕ or ⊖ and save with ok.

Factory setting

The number of standby pumps is set to 0, i.e. function is deactivated.

10.7.14 Forced pump changeover (4.2.4)



TM03 2365 4005

Fig. 40 Forced pump changeover

Description

This 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, and forced pump changeover may thus be required. Once every 24 hours the controller checks if any pump running has a larger number of operating hours than pumps that are stopped. If this is the case, the pump is stopped and replaced by a pump with a lower number of operating hours.

Setting range

The function can be activated/deactivated. The hour of the day at which the changeover is to take place can be set.

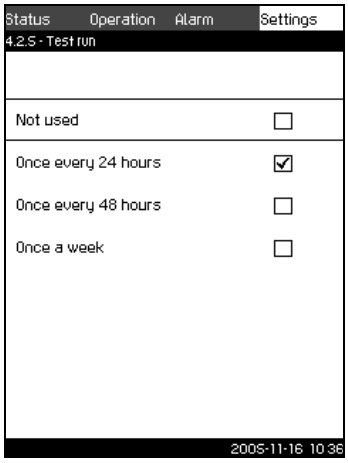
Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Pump cascade control** with ⊙ or ⊙ and press ⊙.
3. Mark **Forced pump changeover** with ⊙ or ⊙ and press ⊙.
4. Mark **Activated** with ⊙ or ⊙ and press ⊙. The check mark in the right box shows that the function is active.
5. Mark **Time for changeover** with ⊙ and press ⊙.
6. Set the time with ⊙ or ⊙ and save with ⊙.

Factory setting

The function is activated. The time is set to 03:00.

10.7.15 Test run (4.2.5)



TM03 2364 4005

Fig. 41 Test run

Description

This function is primarily used in situations where the forced pump changeover is deactivated, and/or if the Hydro MPC is set to operating mode *Stop*, for instance in a period when the system is not needed. In such situations, its important to test the pumps regularly. The function ensures that

- pumps do not seize up during a long standstill due to deposits from the pumped liquid.
- the pumped liquid does not decay in the pump.
- trapped air is removed from the pump.

Each pump is connected to a counter.

The pump starts automatically one by one and runs for 5 seconds.

Note: Pumps in *Manual* operating mode are not included in the test run. If there is an alarm, the test run will not be carried out.

Setting range

- Not used
- Once every 24 hours.
- Once every 48 hours.
- Once a week.

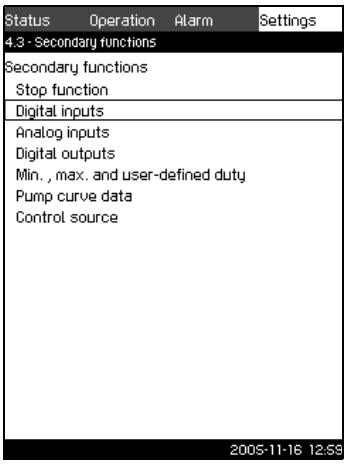
Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Pump cascade control** with ⊙ or ⊙ and press ⊙.
3. Mark **Test run** with ⊙ or ⊙ and press ⊙.
4. Mark the desired function with ⊙ or ⊙.
5. Activate the function with ⊙.

Factory setting

Test runs are set to once a week.

10.7.16 Secondary functions (4.3)



TM03 2332 4005

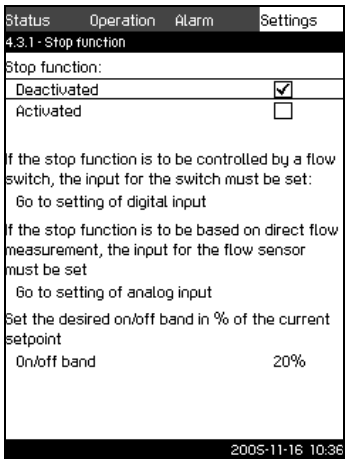
Fig. 42 Secondary functions

Description

Functions that are secondary in relation to the normal operation of the Hydro MPC booster set can be set in this display. Secondary functions are functions that offer additional functionality. The display makes it possible to open specific displays regarding:

- *Stop function (4.3.1)*
- *Overview of digital inputs (4.3.7)*
- *Overview of analog inputs (4.3.8)*
- *Overview of digital outputs (4.3.9)*)
- *Min., max. and user-defined duty (4.3.14)*
- *Pump curve data (4.3.19)*
- *Control source (4.3.20)*.

10.7.17 Stop function (4.3.1)



TM03 2355 4005

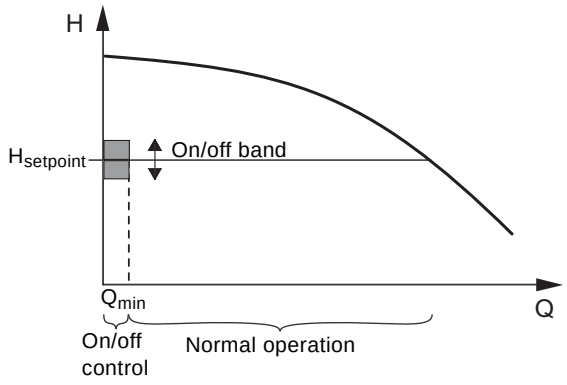
Fig. 43 Stop function

Description

This function makes it possible to stop the last pump if there is no or a very small consumption. The purpose is to

- save energy
- prevent heating of shaft seal faces due to increased mechanical friction as a result of reduced cooling by the pumped liquid
- prevent heating of the pumped liquid.

The description of the stop function applies to all Hydro MPC booster sets with variable-speed pumps. Hydro MPC-S will have on/off control of all pumps as described in *3. Product description*.



TM03 1692 2705

Fig. 44 On/off band

When the stop function is activated, the operation of Hydro MPC is continuously monitored to detect low flow rate. When the CU 351 detects no or a very low flow rate ($Q < Q_{min}$), it changes to on/off control of the last duty pump.

Before stopping, the pump increases the pressure to a value corresponding to $H_{setpoint}$ + 0.5 x on/off band. The pump is restarted when the pressure is $H_{setpoint}$ – 0.5 x on/off band.

As long as the flow rate is lower than Q_{min}, the pump runs on/off.

If the flow rate is increased to above Q_{min}, the pump returns to normal operation, $H_{setpoint}$.

$H_{setpoint}$ is equal to the current setpoint, see section *10.4.4*.

Detection of low flow rate

Low flow rate can be detected by means of

- direct flow measurement with a flowmeter or flow switch
- estimation of flow rate by measurement of current pressure and speed.

If the booster set is not connected to a flowmeter or flow switch, the stop function will use the estimating function.

If the detection of low flow rate is based on flow estimation, a diaphragm tank of a certain size and with a certain precharge pressure is required. The tank size and precharge pressure must be as follows:

Recommended minimum diaphragm tank size:

Pump type	Recommended diaphragm tank size [gallons]						
	-E	-ED	-ES	-EF	-EDF	-F	-S
CR(E) 3	4.4	4.4	4.4	4.4	4.4	4.4	20
CR(E) 5	4.4	4.4	4.4	4.4	4.4	4.4	34
CR(E) 10	10.2	10.2	10.2	10.2	10.2	10.2	62
CR(E) 15	34	34	34	34	34	34	211
CR(E) 20	34	34	34	34	34	34	211
CR(E) 32	44	44	44	44	44	44	317
CR(E) 45	86	86	86	86	86	86	528
CR(E) 64	132	132	132	132	132	132	1056
CR(E) 90	-	-	-	132	132	132	1056

Precharge pressure:

Hydro MPC-E, -ED, -ES, -EF, -EDF and -F: 0.7 x setpoint.

Hydro MPC-S: 0.9 x setpoint.

During each flow estimation (every 2 minutes) the estimating function will disturb the discharge pressure by ±10%. If this disturbance is not acceptable, the stop function must be based on direct flow measurement with a flowmeter or flow switch.

- The flow switch is set in the menu **Go to setting of digital input**, see *10.7.18 Overview of digital inputs (4.3.7)* and *10.7.19 Functions of digital inputs (4.3.7.1 to 4.3.7.12)*.
- Flowmeters are set in the menu **Go to setting of analog input**, see *10.7.20 Overview of analog inputs (4.3.8)*, *10.7.21 Setting of analog inputs (4.3.8.1 to 4.3.8.7)* and *10.7.22 Functions of analog inputs (4.3.8.1.1 to 4.3.8.7.1)*.

When the setting has been made, Q_{min} can be set, i.e. the flow rate at which the booster set changes to on/off control of the last duty pump.

If both a flowmeter and a flow switch are connected, the changeover to on/off control is determined by the unit first indicating low flow rate.

Setting range

On/off band:	5 to 30%
Min. flow rate:	2 to 50% of the nominal flow rate (Q_{nom}) of one of the pumps. (Can only be set if direct flow measurement by means of flowmeter has been selected.)

Setting via control panel

System without flow switch or flowmeter

1. Mark the **Settings** menu with ›.
2. Mark **Secondary functions** with ⌄ or ⌃ and press ok.
3. Mark **Stop function** with ⌄ or ⌃ and press ok.
4. Mark **Active** with ⌄ or ⌃ and press ok.
   The activation is indicated by a check mark in the box.
5. Mark **On/off band** with ⌄ or ⌃.
6. Set the on/off band with ⊕ or ⊖ and save with ok.

System with flow switch:

Make the following additional settings:

1. Mark **Go to setting of digital input** with ⌄ or ⌃ and press ok. Now the display *Overview of digital inputs (4.3.7)* appears.
2. Select the digital input where the flow switch is connected with ⌄ or ⌃ and press ok.
3. Mark **Flow switch** with ⌄ or ⌃, press ok and return with esc.

Note: An open contact indicates low flow.

System with flowmeter:

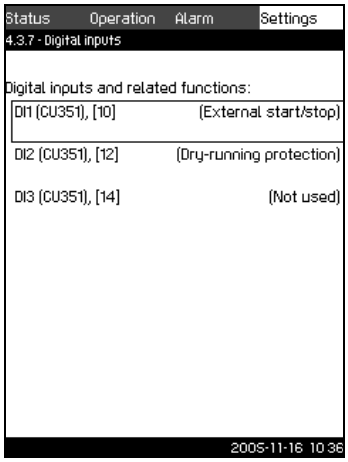
Make the following additional settings:

1. Mark **Go to setting of analog input** with ⌄ or ⌃ and press ok. Now the display *Overview of analog inputs (4.3.8)* appears.
2. Select the analog input where the flowmeter is connected and set up the input for the flowmeter. Return to **Stop function** with esc.
3. Mark **Min. flow rate** with ⌄ or ⌃.
4. Set the value with ⊕ or ⊖ and press ok.

Factory setting

On/off band:	20% for MPC-S & 10% for all other types
Min. flow rate:	10% of the nominal flow rate of one pump

10.7.18 Overview of digital inputs (4.3.7)



TM03 2359 4005

Fig. 45 Overview of digital inputs

Description

In this menu the digital inputs of the CU 351 can be set. Each input, except DI1 on CU 351, can be activated and related to a certain function.

As standard, the Hydro MPC has three digital inputs. If the Hydro MPC incorporates an IO 351B module (option), the number of digital inputs is 12.

In the display, all digital inputs are shown so that their physical position in the Hydro MPC can be identified.

Example

DI1 (IO 351-41), [10]:

DI1:	Digital input no. 1.
(IO 351-41):	IO 351, GENIbus number 41
[10]:	Terminal no. 10

For further information on the connection of various digital inputs, see the wiring diagram supplied with the control panel.

Setting range

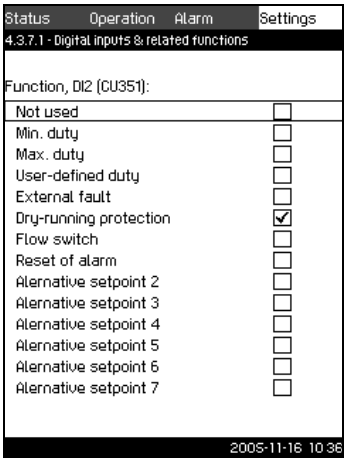
The digital input to be set is selected in display *Overview of digital inputs (4.3.7)*.

Note: DI1 (CU 351) cannot be selected.

Setting via control panel

1. Mark the **Settings** menu with ⌄.
2. Mark **Secondary functions** with ⌄ or ⌃ and press ok.
3. Mark **Digital inputs** ⌄ or ⌃ and press ok.
4. Select the digital input with ⌄ or ⌃ and press ok.

10.7.19 Functions of digital inputs (4.3.7.1 to 4.3.7.12)



TM03 2362 4005

Fig. 46 Functions of digital inputs

Description

In the displays 4.3.7.1 to 4.3.7.12, a function can be related to the digital inputs.

Setting range

It is possible to select one function in each display:

Function	Contact activated
Not used	
Min. duty	= Operating mode Min.
Max. duty	= Operating mode Max.
User-defined duty	= Operating mode User-defined
External fault	= External fault
Dry-running protection	= Water shortage
Flow switch	= Flow rate > Set switch value
Pressure switch	= Pressure > Set switch value
Reset of alarm	= Reset alarms
Alternative setpoint 2	= Setpoint 2, selected
Alternative setpoint 3	= Setpoint 3, selected
Alternative setpoint 4	= Setpoint 4, selected
Alternative setpoint 5	= Setpoint 5, selected
Alternative setpoint 6	= Setpoint 6, selected
Alternative setpoint 7	= Setpoint 7, selected

See the relevant sections for further information about the functions.

Generally a closed contact activates the function selected.

Setting via control panel

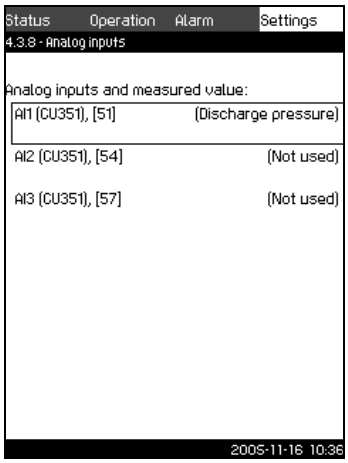
1. Mark the **Settings** menu with ▷.
2. Mark **Secondary functions** with ▽ or △ and press ok.
3. Mark **Digital inputs** with ▽ or △ and press ok.
4. Select the digital input with ▽ or △ and press ok.
5. Select the desired function with ▽ or △ and activate it with ok.
   The activation is indicated by a check mark in the box.

Factory setting

Digital input	Function
DI1 (CU 351) [10]	External start/stop. Open contact = stop **Note:** This digital input can not be changed.
DI2 (CU 351) [12]	Monitoring of water shortage (dry-running protection). Open contact = water shortage

Note: Monitoring of water shortage requires a pressure switch connected to the Hydro MPC.

10.7.20 Overview of analog inputs (4.3.8)



TM03 2356 4005

Fig. 47 Overview of analog inputs

Description

In this menu the analog inputs of the Hydro MPC can be set.

Each input can be activated and related to a certain function.

As standard, the Hydro MPC has three analog inputs. If the Hydro MPC incorporates an IO 351B module (option), the number of analog inputs is 5.

In the display, all analog inputs are shown so that their physical position in the Hydro MPC can be identified.

Example

AI1 (CU 351) [51]:

AI1:	Analog input no. 1
(CU 351):	CU 351
[51]:	Terminal no. 51

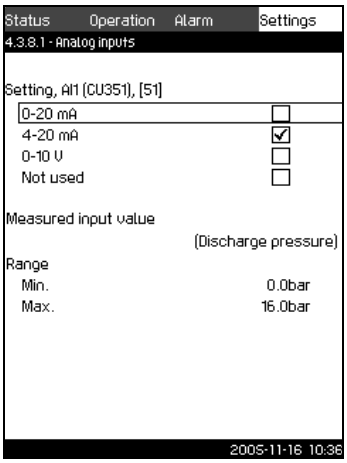
Setting range

In display *Overview of analog inputs (4.3.8)* the analog input to be set is selected.

Setting via control panel

1. Mark the **Settings** menu with ▷.
2. Mark **Secondary functions** with ▽ or △ and press ok.
3. Mark **Analog inputs** with ▽ or △ and press ok.
4. Select the analog input with ▽ or △ and press ok.

10.7.21 Setting of analog inputs (4.3.8.1 to 4.3.8.7)



TM03 2357 4005

Fig. 48 Setting of analog inputs

Description

In the displays 4.3.8.1 to 4.3.8.7, analog inputs can be set. Each display is divided into three parts:

- Setting of input signal, for instance 4-20 mA
- Measured input value, for instance discharge pressure
- Measuring range of the sensor/signal transmitter, for instance 0-16 bar.

Setting range

It is possible to set the following parameters in each display:

- Input deactivated
- Range of input signal, 0-10 V, 0-20 mA, 4-20 mA
- Measured input value
- Sensor range.

Setting via control panel

1. Mark the **Settings** menu with ▷.
2. Mark **Secondary functions** with ▽ or △ and press ok.
3. Mark **Analog inputs** with ▽ or △ and press ok.
4. Select the analog input with ▽ or △ and press ok.
5. Mark the setting of the analog input with ▽ or △ and activate it with ok.
   The activation is indicated by a check mark in the box.

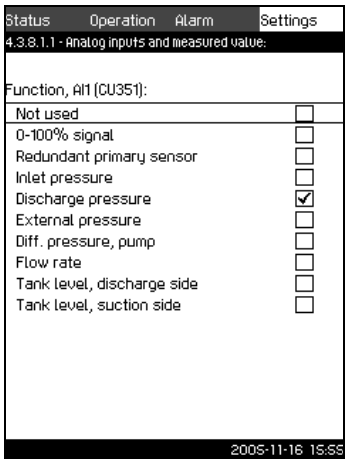
Note ***If an analog input is deactivated, the display will only show the top part, i.e. the setting of the analog input.***

If the input is activated, the middle part **Measured input value** is shown. This makes it possible to relate a function to the analog input in another display. The displays in *10.7.22* show an example.
When the analog input has been related to a function, CU 351 will return to the display for setting of analog inputs.

Factory setting

Analog input	Function
AI1 (CU 351) [51]	Discharge pressure
AI2 (CU 351) [54]	Precharge pressure (if Hydro MPC is supplied with measurement of precharge pressure)
AI3 (CU 351) [57]	Redundant primary sensor (if Hydro MPC is supplied with this option)

10.7.22 Functions of analog inputs (4.3.8.1.1 to 4.3.8.7.1)



TM03 2358 4005

Fig. 49 Functions of analog inputs

Description

In the displays *Functions of analog inputs (4.3.8.1.1 to 4.3.8.7.1)*, a function can be related to the individual analog inputs.

Setting range

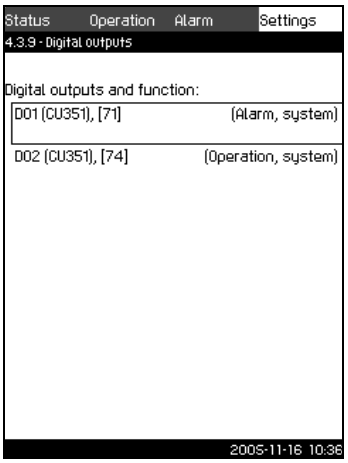
It is possible to select one function per analog input:

- Not used
- 0-100% signal
- Redundant primary sensor
- Inlet pressure
- Discharge pressure
- External pressure
- Differential pressure of pump
- Flow rate
- Tank level, discharge side
- Tank level, suction side.

Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Secondary functions** with ⊙ or ⊙ and press ⊙.
3. Mark **Analog inputs** with ⊙ or ⊙ and press ⊙.
4. Select the analog input with ⊙ or ⊙ and press ⊙.
5. Mark and set the setting range of the analog input with ⊙ or ⊙ and press ⊙.
   The activation is indicated by a check mark.
6. Mark **Measured input value** with ⊙ or ⊙ and press ⊙.
   Now the display 4.3.8.x.1 appears.
7. Select the input with ⊙ or ⊙ and press ⊙.
8. Press ⊙ to return to display 4.3.8.x.
9. Set the minimum sensor value with ⊙ or ⊙ and save with ⊙.
10. Set the maximum sensor value with ⊙ or ⊙ and save with ⊙.

10.7.23 Overview of digital outputs (4.3.9)



TM03 2333 4005

Fig. 50 Overview of digital outputs

Description

In this menu the digital relay outputs of the Hydro MPC can be set. Each output can be activated and related to a certain function.

As standard, the Hydro MPC has two digital outputs.

If the Hydro MPC incorporates an IO 351B module (option), the number of digital outputs is 9.

In the display, all analog outputs are shown so that their physical position in the Hydro MPC can be identified.

Example

DO1 (IO 351-41) [71]:

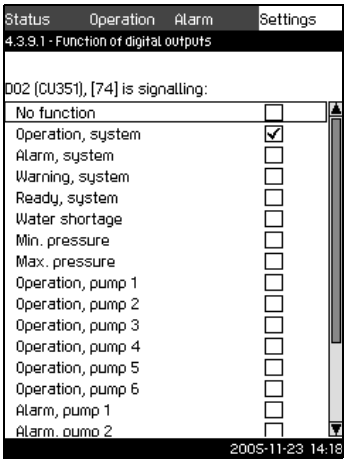
DO1	Digital output no. 1.
(IO 351-41)	IO 351B, GENIbus number 41
[71]	Terminal no. 71

For further information on the connection of various digital outputs, see the key diagram supplied with the CU 351.

Setting range

In display *Overview of digital outputs (4.3.9)* the digital output to be used is selected.

10.7.24 Function of digital outputs (4.3.9.1 to 4.3.9.16)



TM03 2334 4005

Fig. 51 Functions of digital outputs

Description

In displays *Function of digital outputs (4.3.9.1 to 4.3.9.16)*, a function can be related to the individual outputs.

Setting range

It is possible to select one function in each display:

- Not used
- System in operation
- Alarm, system
- Warning, system
- Ready, system
- Water shortage
- Min. pressure
- Max. pressure
- Pump 1 is running
- Pump 2 is running
- Pump 3 is running
- Pump 4 is running
- Pump 5 is running
- Pump 6 is running
- Alarm, pump 1
- Alarm, pump 2
- Alarm, pump 3
- Alarm, pump 4
- Alarm, pump 5
- Alarm, pump 6.

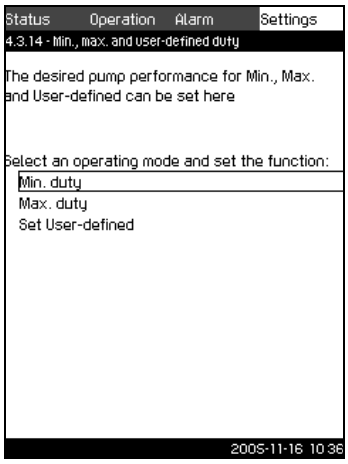
Setting via control panel

1. Mark the **Settings** menu with ▷.
2. Mark **Secondary functions** ▽ with or △ and press ok.
3. Mark **Digital outputs** with ▽ or △ and press ok.
4. Select the digital output with ▽ or △ and press ok.
5. Mark the desired function with ▽ or △ and activate it with ok.
   The activation is indicated by a check mark in the box.

Factory setting

Digital output	Function
DO1 (CU 351) [72]	Alarm, system
DO2 (CU 351) [75]	Operation, system

10.7.25 Min., max. and user-defined duty (4.3.14)



TM03 2351 4005

Fig. 52 Min., max. and user-defined duty

Description

Hydro MPC is usually controlled in a closed loop to maintain a discharge pressure. In certain periods it may be necessary to let the booster set run in open loop at a set pump performance.

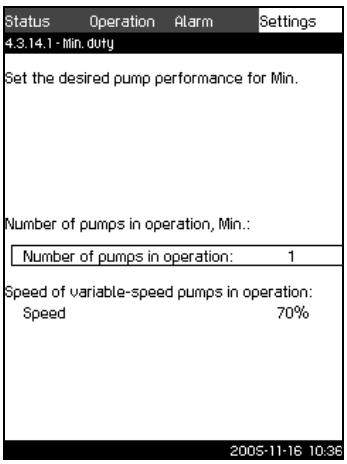
Setting range

The CU 351 makes it possible to change between three operating modes:

1. *Min. duty (4.3.14.1)*
2. *Max. duty (4.3.14.2)*
3. *User-defined duty (4.3.14.3)*.

Note ***For each of these modes, the number of operating pumps and the pump performance (speed) can be set.***

10.7.26 Min. duty (4.3.14.1)



TM03 2354 4005

Fig. 53 Min. duty

Description

In all booster sets apart from Hydro MPC-S, min. duty is only possible for variable-speed pumps. In Hydro MPC-S systems only the number of pumps running at 100% speed can be set.

Setting range

- Number of pumps in operation.
- Speed as percentage (25 to 100%) for variable-speed pumps.

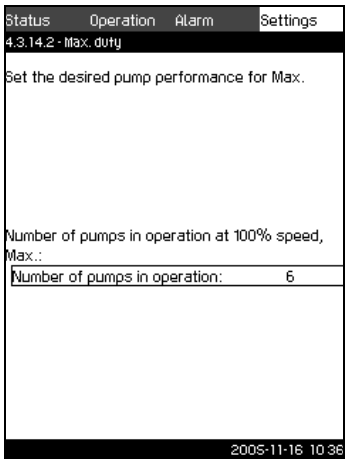
Setting via control panel

1. Mark the **Settings** menu with ▷.
2. Mark **Secondary functions** with ▽ or △ and press ok.
3. Mark **Min., max. and user-defined duty** with ▽ or △ and press ok.
4. Mark **Min. duty** with ▽ or △ and press ok.
5. Mark **Number of pumps in operation** with ▽ or △.
6. Set the number with ⊕ or ⊖ and save with ok.
7. Mark **Speed** with ▽ or △.
8. Set the value with ⊕ or ⊖ and save with ok.

Factory setting

Number of pumps in operation during min. duty:	1
Speed as percentage for variable-speed pumps:	70

10.7.27 Max. duty (4.3.14.2)



TM03 2353 4005

Fig. 54 Max. duty

Description

The function makes it possible for a set number of pumps to run at maximum speed when the function is activated.

Setting range

In this display the number of pumps to run in the operating mode *Max.* can be set. All pumps run at 100% speed.

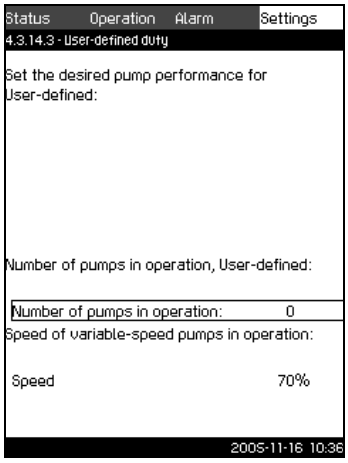
Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Secondary functions** with ⊙ or ⊙ and press ⊙.
3. Mark **Min., max. and user-defined duty** with ⊙ or ⊙ and press ⊙.
4. Mark **Max. duty** with ⊙ or ⊙ and press ⊙.
5. Mark **Number of pumps in operation** with ⊙ or ⊙.
6. Set the number with ⊙ or ⊙ and save with ⊙.

Factory setting

Number of pumps in operation during max. duty:	All pumps (except standby pumps)

10.7.28 User-defined duty (4.3.14.3)



TM03 2352 4005

Fig. 55 User-defined duty

Description

In this display it is possible to set a user-defined performance, typically a performance between min. and max. duty.

The function makes it possible to set a pump performance by selecting the number of pumps to run and the speed of variable-speed pumps.

This function primarily selects the variable-speed pumps. If the number of selected pumps exceeds the number of variable-speed pumps, mains-operated pumps are started too.

Setting range

- Number of pumps in operation.
- Speed as percentage for variable-speed pumps.
  Note: In Hydro MPC booster sets with only variable-speed pumps the speed can be set between 25 and 100%; in booster sets with both variable-speed pumps and mains-operated pumps the speed can be set between 70 and 100%.

Setting via control panel

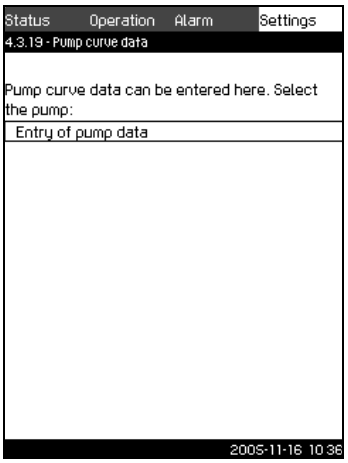
1. Mark the **Settings** menu with ⊙.
2. Mark **Secondary functions** with ⊙ or ⊙ and press ⊙.
3. Mark **Min., max. and user-defined duty** with ⊙ or ⊙ and press ⊙.
4. Mark **Set user-defined** with ⊙ or ⊙ and press ⊙.
5. Mark **Number of pumps in operation** with ⊙ or ⊙.
6. Set the number with ⊙ or ⊙ and save with ⊙.
7. Mark **Speed** with ⊙ or ⊙.
8. Set the value with ⊙ or ⊙ and save with ⊙.

Factory setting

The function is not activated as the following has been set:

Number of pumps in operation during user-defined duty:	0

10.7.29 Pump curve data (4.3.19)



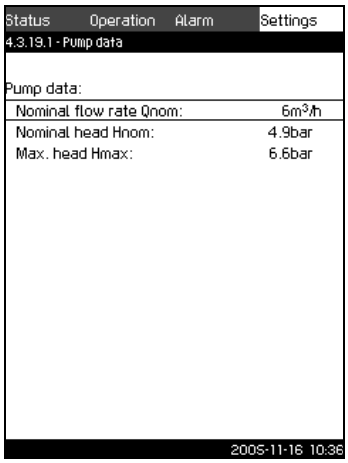
TM03 2343 4005

Fig. 56 Pump curve data

Description

The CU 351 has a number of functions using the pump performance curves. At delivery the CU 351 contains data describing these performance curves, but it is also possible to enter these data. For this purpose use the pump nameplate which contains data on nominal flow rate, Q_{nom}, nominal head, H_{nom}, and maximum head, H_{max}.

10.7.30 Pump data (4.3.19.1)



TM03 2346 4005

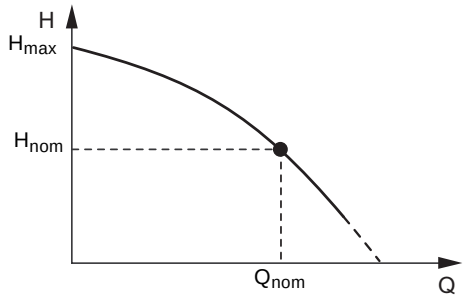
Fig. 57 Pump data

Description

In this menu it is possible to enter data describing the performance curve of pumps in order to optimise the operation.

Note ***This setting is not necessary, as pump curve data is entered at factory.***

Setting range



TM03 1706 2706

The following data can be entered:

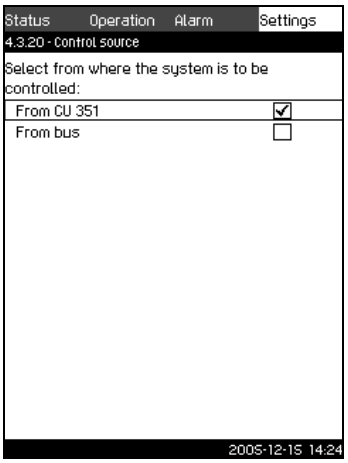
- Nominal flow rate Q_{nom} in m³/h
- Nominal head H_{nom} in metres
- Max. head H_{max} in metres.

Note ***Q_{nom} and H_{nom} are the rated duty point of the pumps and usually the duty point with the highest efficiency.***

Setting via control panel

1. Mark the **Settings** menu with ▷.
2. Mark **Secondary functions** with ▽ or △ and press ok.
3. Mark **Pump curve data** with ▽ or △ and press ok.
4. Mark **Entry of pump data** and press ok.
5. Mark **Nominal flow rate Q_{nom}** with ▽ or △.
6. Set the value with ⊕ or ⊖ and save with ok.
7. Mark **Nominal head H_{nom}** with ▽ or △.
8. Set the value with ⊕ or ⊖ and save with ok.
9. Mark **Max. head H_{max}** with ▽ or △.
10. Set the value with ⊕ or ⊖ and save with ok.

10.7.31 Control source (4.3.20)



TM03 2342 4005

Fig. 58 Control source

Description

Hydro MPC can be remote-controlled via an external bus connection (option), see *10.8.2 GENIbus*. The setpoint and operating mode are then set via the bus connection.

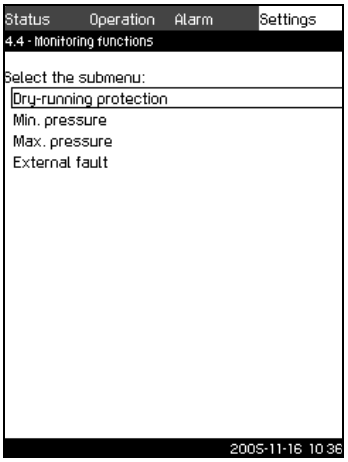
In this display the control source, CU 351 or the external bus connection, is selected.

1. Mark the **Settings** menu with ▷.
2. Mark **Secondary functions** with ▽ or △ and press ok.
3. Mark **Control source** with ▽ or △ and press ok.
4. Select the desired control source with ▽ or △ and save with ok.

Factory setting

The control source is CU 351.

10.7.32 Monitoring functions (4.4)



TM03 2312 4005

Fig. 59 Monitoring functions

Description

Hydro MPC has a series of functions that constantly monitor the operation of the booster set.

The primary purpose of the monitoring functions is to ensure that faults do not damage pumps or the system connected to the booster set.

Setting range

The following functions can be selected:

- *Dry-running protection (4.4.1)*
- *Min. pressure (4.4.2)*
- *Max. pressure (4.4.3)*
- *External fault (4.4.4)*.

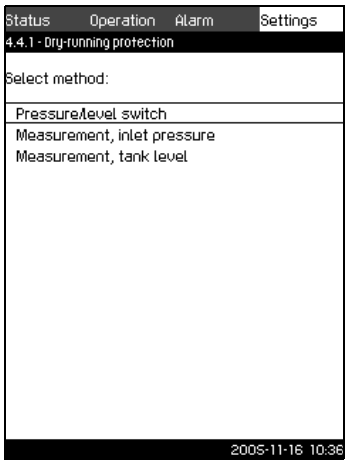
Setting via control panel

1. Mark the **Settings** menu with ▶.
2. Mark **Monitoring functions** with ▼ or ▲ and press OK.
3. Select the function with ▼ or ▲ and press OK.

Factory setting

No function has been selected.

10.7.33 Dry-running protection (4.4.1)



TM03 2320 4005

Fig. 60 Dry-running protection

Description

Dry-running protection is one of the most important monitoring functions, as bearings and shaft seal may be damaged if the pumps run dry. Grundfos thus "requires" dry-running protection in connection with Hydro MPC booster sets.

The function is based on monitoring of the inlet pressure or the level in a possible tank or pit on the suction side.

Level switches, pressure switches or analog sensors signalling water shortage at a set level can be used.

There are three different methods for detection of water shortage:

- Pressure switch on suction manifold or float switch/electrode relay in the supply tank.
- Measurement of inlet pressure in the suction manifold by means of an analog pressure transmitter.
- Measurement of level in the supply tank by means of an analog level transmitter.

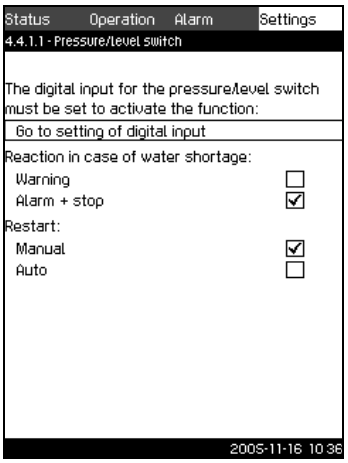
Setting via control panel

1. Mark the **Settings** menu with ▶.
2. Mark **Monitoring functions** with ▼ or ▲ and press OK.
3. Mark **Dry-running protection** with ▼ or ▲ and press OK.
4. Select the method with ▼ or ▲ and press OK.

Factory setting

If a pressure switch or pressure transmitter is fitted on the suction manifold, the relevant function has been selected and set.

10.7.34 Dry-running protection with pressure/level switch (4.4.1.1)



TM03 2329 4005

Fig. 61 Dry-running protection with pressure/level switch

Description

Dry-running protection can take place by means of a pressure switch on the suction manifold or a level switch in a possible tank on the suction side.

When the contact is **open**, the CU 351 will register water shortage after a time delay of approx. 5 sec. It is possible to set whether the indication is to be just a warning or an alarm stopping the pumps.

In the display it is possible to set whether restart and reset of the alarm is to be automatic or manual.

Setting range

- Selection of digital input for the function.
- Reaction in case of water shortage: Warning or alarm + stop.
- Restart: Manual or automatic.

Setting via control panel

1. Mark the **Settings** menu with ▶.
2. Mark **Monitoring functions** with ▼ or ▲ and press OK.
3. Mark **Dry-running protection** with ▼ or ▲ and press OK.
4. Mark **Pressure/level switch** with ▼ or ▲ and press OK.
5. Mark **Go to setting of digital input** and press OK. Now the display *Overview of digital inputs (4.3.7)* appears. Set the input to dry-running protection. Return with ESC.
6. Mark **Warning** or **Alarm + stop** with ▼ or ▲ and save with OK.
7. Mark **Manual** or **Auto** with ▼ or ▲ and save with OK.

Factory setting

If the booster set is equipped with a pressure switch for dry-running protection, it is set to alarm + stop in case of water shortage.

Restart: Automatic.

10.7.35 Dry-running protection with pressure transmitter (4.4.1.2)

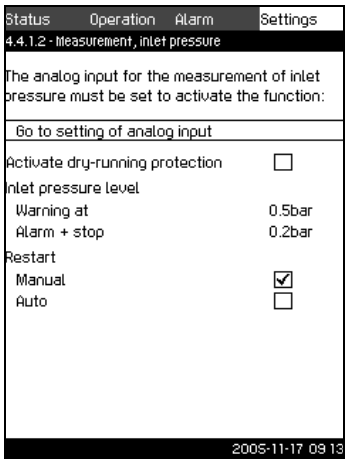


Fig. 62 Dry-running protection with pressure transmitter

Description

Dry-running protection can take place by means of a pressure transmitter measuring the inlet pressure.

It is possible to set two levels of inlet pressure: Warning (level 1) and alarm + stop (level 2).

In the display it is possible to set whether restart and reset of the alarm is to be automatic or manual.

Setting range

- Selection of analog input for the function.
- Activation of the function.
- Inlet pressure level for warning (level 1).
- Inlet pressure level for alarm + stop (level 2).
- Restart: Manual or automatic.

Setting via control panel

1. Mark the **Settings** menu with ▷.
2. Mark **Monitoring functions** with ▽ or △ and press ok.
3. Mark **Dry-running protection** with ▽ or △ and press ok.
4. Mark **Measurement, inlet pressure** with ▽ or △ and press ok.
5. Mark **Go to setting of analog input** and press ok. Now the display *Overview of analog inputs (4.3.8)* appears. Set the input to **Inlet pressure** and save with ok. Return with esc.
6. Mark **Activate** with ▽ or △ and press ok.
7. Mark **Warning** with ▽ or △. Set the level with ⊕ or ⊖ and save with ok.
8. Mark **Alarm + stop** with ▽ or △. Set the level with ⊕ or ⊖ and save with ok.
9. Mark **Manual** or **Auto** with ▽ or △ and save with ok.

Note ***If one of the levels is not required, the level value must be the minimum value of the inlet pressure transmitter. This deactivates the function.***

Factory setting

If the booster set is supplied with a pressure transmitter, the transmitter has been set.

The warning level is defined by customer at time of order. The function is activated.

Restart: Automatic.

10.7.36 Dry-running protection with level transmitter (4.4.1.3)

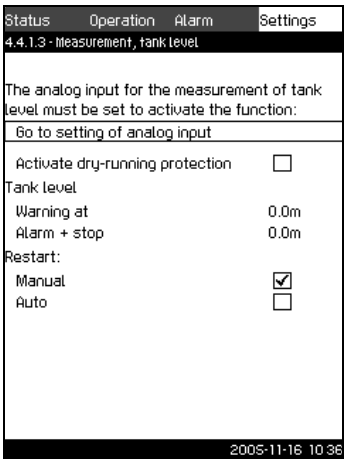


Fig. 63 Dry-running protection with level transmitter

Description

Dry-running protection can take place by means of a level transmitter measuring the level in a tank on the suction side.

It is possible to set two levels: Warning (level 1) and alarm + stop (level 2).

In the display it is possible to set whether restart and reset of alarms is to be automatic or manual.

Setting range

- Selection of analog input for the function.
- Activation of the function.
- Liquid level for warning (level 1).
- Liquid level for alarm + stop (level 2).
- Restart: Manual or automatic.

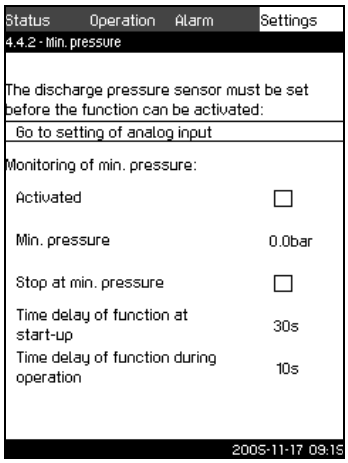
Setting via control panel

1. Mark the **Settings** menu with ▷.
2. Mark **Monitoring functions** with ▽ or △ and press ok.
3. Mark **Dry-running protection** with ▽ or △ and press ok.
4. Mark **Measurement, tank level** with ▽ or △ and press ok.
5. Mark **Setting of analog input** and press ok. Now the display *Overview of analog inputs (4.3.8)* appears. Set the input to **Tank level, suction side**, see 5.6.4. Return with esc.
6. Mark **Activate dry-running protection** with ▽ or △ and press ok to activate/deactivate the function.
7. Mark **Warning** with ▽ or △. Set the level with ⊕ or ⊖ and save with ok.
8. Mark **Alarm + stop** with ▽ or △. Set the level with ⊕ or ⊖ and save with ok.
9. Mark **Manual** or **Auto** with ▽ or △ and save with ok.

Factory setting

The function is deactivated.

10.7.37 Min. pressure (4.4.2)



TM03 2316 4005

Fig. 64 Min. pressure

Description

The discharge pressure can be monitored so that the CU 351 can react if the pressure becomes lower than a set minimum level for an adjustable time.

The minimum pressure can be monitored if a fault indication is required in situations where the discharge pressure becomes lower than the set minimum pressure.

It is possible to set whether the indication is to be just a warning or an alarm stopping the pumps. This may be desirable if Hydro MPC is used for an irrigation system where a very low discharge pressure may be due to pipe fracture and thus an extraordinarily high consumption and a very low counter pressure. In such situations it is desirable that the booster set stops and indicates alarm. This situation will require a manual reset of the Hydro MPC.

It is possible to set a start-up delay ensuring that the Hydro MPC can build up pressure before the function is activated. It is also possible to set a time delay, i.e. for how long time the discharge pressure may be lower than the set minimum pressure before the alarm is activated.

Setting range

- Activation of the function.
- Minimum pressure level within the range of the primary sensor.
- Activation of stop when the pressure falls below the minimum pressure.
- Time delay at start-up.
- Time delay during operation.

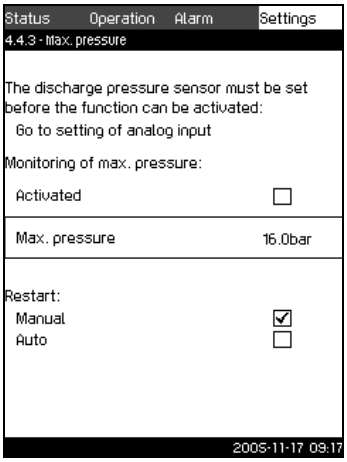
Setting via control panel

1. Mark the **Settings** menu with ▷.
2. Mark **Monitoring functions** with ▽ or △ and press OK.
3. Mark **Min. pressure** with ▽ or △ and press OK.
4. Mark **Activated** with ▽ or △ and press OK to activate/deactivate the function.
5. Mark **Min. pressure** with ▽ or △. Set the pressure with ⊕ or ⊖ and save with OK.
6. Mark **Stop at min. pressure** with ▽ or △ and press OK to activate/deactivate the function.
7. Mark **Time delay of function at start-up** with ▽ or △. Set the time with ⊕ or ⊖ and save with OK.
8. Mark **Time delay of function during operation** with ▽ or △. Set the time with ⊕ or ⊖ and save with OK.

Factory setting

The function is activated per data on customer order.

10.7.38 Max. pressure (4.4.3)



TM03 2520 4505

Fig. 65 Max. pressure

Description

The discharge pressure can be monitored so that the CU 351 can react if the pressure becomes higher than a set maximum level.

In certain installations a too high discharge pressure may cause damage. It may therefore be necessary to stop all pumps for a short period if the pressure is too high.

It is possible to set whether the Hydro MPC is to restart automatically after the pressure has dropped below the maximum level, or if the system must be reset manually. Restart will be delayed by an adjustable time, see *Min. time between start/stop (4.2.1)*.

Setting range

- Activation of the function.
- Maximum pressure level within the range of the primary sensor.
- Manual or automatic restart after fault.

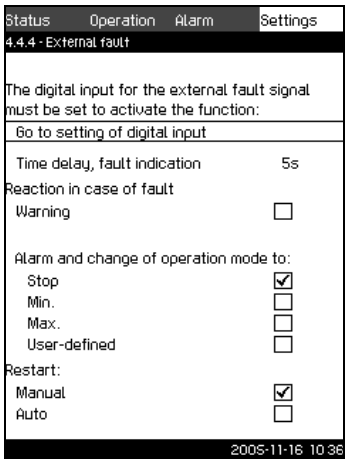
Setting via control panel

1. Mark the **Settings** menu with ▷.
2. Mark **Monitoring functions** with ▽ or △ and press OK.
3. Mark **Max. pressure** with ▽ or △ and press OK.
4. Mark **Activated** with ▽ or △ and press OK to activate/deactivate the function.
5. Mark **Max. pressure** with ▽ or △. Set the pressure with ⊕ or ⊖ and save with OK.
6. Mark **Manual** or **Auto** with ▽ or △. Activate the function with OK.

Factory setting

The function is activated per data on customer order.

10.7.39 External fault (4.4.4)



TM03 2313 4005

Fig. 66 External fault

Description

The function is used when the CU 351 is to be able to receive a fault signal from an external contact. In case of external fault, the CU 351 indicates warning or alarm. In case of alarm, the booster set changes to another manual operating mode, for instance *Stop*.

Setting range

- Selection of digital input for the function.
- Setting of time delay from closing of the contact until the CU 351 reacts.
- Reaction in case of external fault: Warning or alarm and change of operating mode.
- Restart after alarm: Manual or automatic.

Setting via control panel

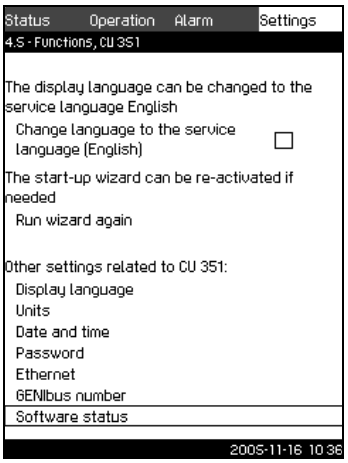
1. Mark the **Settings** menu with ▷.
2. Mark **Monitoring functions** with ▽ or △ and press OK.
3. Mark **External fault** with ▽ or △ and press OK.
4. Mark **Go to setting of digital input** with ▽ or △ and press OK. Now the display *Overview of digital inputs (4.3.7)* appears. Set the input to **External fault**. Return with ESC.
5. Mark **Time delay, fault indication** with ▽ or △. Set the time with + or − and save with OK.
6. Mark **Warning** with ▽ or △ if only a warning is required in case of external fault. Activate the function with OK.
7. Select operating mode with ▽ or △ if the booster set is to give alarm and change operating mode in case of external fault. Activate the function with OK.
8. Mark **Manual** or **Auto** with ▽ or △. Activate the function with OK.

Factory setting

The function is deactivated. If the function is activated, the following values have been set from factory:

- Time delay: 5 seconds
- Operating mode in case of alarm: Stop.
- Restart: Manual.
- per order default if active
- DI 3

10.7.40 Functions, CU 351 (4.5)



TM03 2295 4005

Fig. 67 Functions, CU 351

Description

In this submenu it is possible to make the basic settings of the CU 351.

CU 351 comes with most of these settings, or they are made at start-up and normally not to be changed.

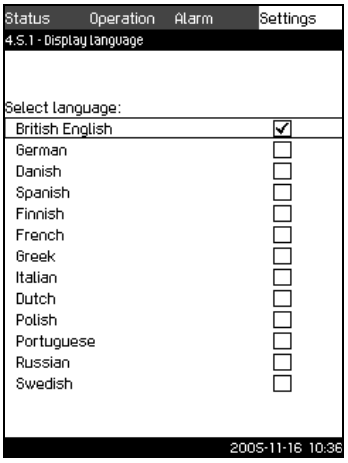
The service language, English, can be activated for service purposes. If no buttons are touched for 15 minutes, the display returns to the language selected at start-up or to the language set in *10.7.41 Display language (4.5.1)*.

Note ***If the service language is selected, the symbol will be shown to the right of the top line of all displays.***

Setting range

- Activation of service language, British English.
- Re-activation of start-up wizard.
  (After start-up, the wizard is inactive.)
- Selection of display language.
- Selection of units in the display.
- Setting date and time.
- Selection of password for the menus **Operation** and **Settings**.
- Setting of Ethernet communication.
- Setting of GENIbus number.
- Reading of software status.

10.7.41 Display language (4.5.1)



TM03 2311 4005

Fig. 68 Display language

Description

Here the language for the CU 351 display is selected.

Setting range

- English
- German
- French
- Italian
- Spanish
- Portuguese
- Greek
- Netherlands
- Swedish
- Finnish
- Danish
- Polish
- Russian
- Chinese
- Korean.

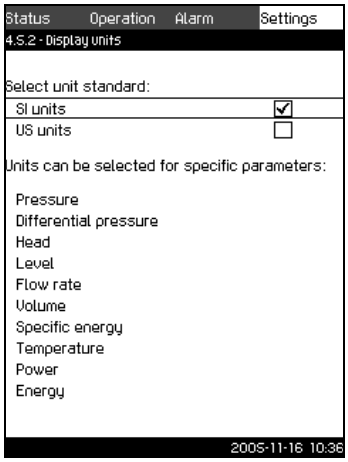
Setting via control panel

1. Mark the **Settings** menu with ▷.
2. Mark **Functions, CU 351** with ▽ or △ and press ok.
3. Mark **Display language** with ▽ or △ and press ok.
4. Select language with ▽ or △ and save with ok.

Factory setting

The display language is English. It can be changed at start-up.

10.7.42 Display units (4.5.2)



TM03 2300 4005

Fig. 69 Display units

Description

In this display it is possible to select units for the various parameters.

For the basic setting it is possible to select between SI and US units. It is also possible to select other units for the individual parameters.

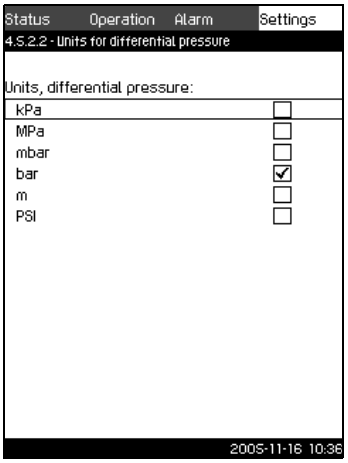
Setting range

Parameter	Basic setting		Possible units
	SI	US	
Pressure	bar	psi	kPa, MPa, mbar, bar, m, psi
Differential pressure	m	psi	kPa, MPa, mbar, bar, m, psi
Head	m	ft	m, cm, ft, in
Level	m	ft	m, cm, ft, in
Flow rate	m^3/h	gpm	m^3/s, m^3/h, l/s, gpm, yd^3/s, yd^3/min, yd^3/h
Volume	m^3	gal	l, m^3, gal, yd^3
Specific energy	kWh/m^3	Wh/gal	J/m^3, kWh/m^3, Wh/gal, Wh/kgal, BTU/gal, HPh/gal
Temperature	°C	°F	K, °C, °F
Differential temperature	K	K	K
Power	kW	HP	W, kW, MW, HP
Energy	kWh	kWh	J, kWh, MWh, BTU, HPh

Note ***If units are changed from SI to US or vice versa, all individually set parameters are changed to the basic setting in question.***

Setting via control panel

1. Mark the **Settings** menu with ▷.
2. Mark **Functions, CU 351** with ▽ or △ and press ok.
3. Mark **Display units** with ▽ or △ and press ok.
4. Select the unit with ▽ or △ and save with ok.
   A check mark shows that the unit has been selected.
5. Select the measuring parameter with ▽ or △ and press ok to open the display for the measuring parameter.
   See the example.



TM03 2310 4005

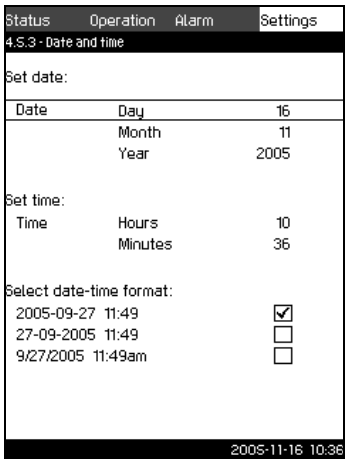
Fig. 70 Example of setting of display units

6. Select the unit with ▽ or △ and save with ok.
   A check mark shows that the unit has been selected.

Factory setting

CU 351 has been set to US units from factory.

10.7.43 Date and time (4.5.3)



TM03 2341 4005

Fig. 71 Date and time

Description

In this display, date and time are set as well as how they are to be shown in the display.

The clock has a built-in rechargeable voltage supply which can supply the clock for up to 20 days if the voltage supply to the Hydro MPC is interrupted.

If the clock is without voltage for more than 20 days, it must be set again.

Setting range

The date can be set as day, month and year. The time can be set as a 24-hour clock showing hours and minutes.

There are three formats.

Example of format
2005-02-01 17:10
01-02-2005 17:10
02/01/2005 5:10 pm

Setting via control panel

1. Mark the **Settings** menu with ▶.
1. Mark **Secondary functions** with ▼ or ▲ and press OK.
2. Mark **Date and time** with ▼ or ▲ and press OK.
3. Mark **Day**, **Month** and **Year** with ▼ or ▲ and set the date with + or −. Save with OK.
4. Mark **Hours** and **Minutes** with ▼ or ▲ and set the time with + or −. Save with OK.
5. Select the format with ▼ or ▲ and save with OK.

Factory setting

Local time.

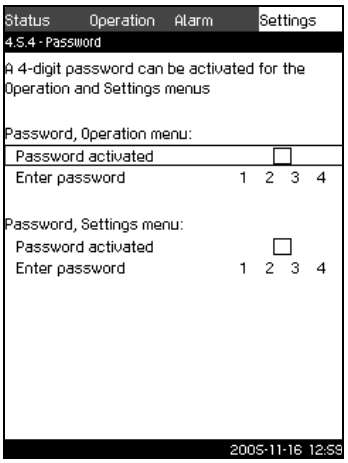
Note:

If the booster has been without voltage for more than 20 days since it left the factory, the clock may have returned to the original setting: 01-01-2005 0:00.

Date and time may have been changed during the setting of Hydro MPC.

Note ***There is no automatic changeover to/from daylight saving time.***

10.7.44 Passwords (4.5.4)



TM03 2899 4005

Fig. 72 Passwords

Description

In this display it is possible to limit the access to the **Operation** and **Settings** menus by means of a password. If the access is limited, it is not possible to view or set any parameters in the menus.

The password must consist of four digits and may be used for both menus.

Note: If you have forgotten the password(s), contact Grundfos.

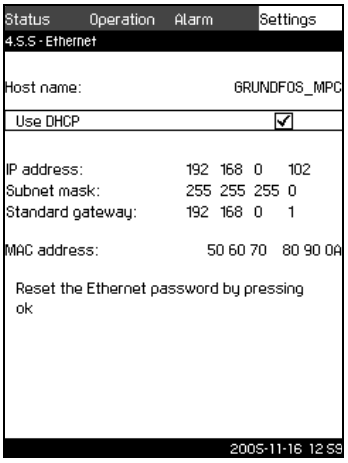
Setting via control panel

1. Mark the **Settings** menu with ▶.
2. Mark **Functions, CU 351** with ▼ or ▲ and press OK.
3. Mark **Password** with ▼ or ▲ and press OK.
4. Mark the password to be activated and press OK.
5. Mark **Enter password** and press OK.
   Now the first digit of the password is flashing.
6. Select the digit with + or − and save with OK.
   Now the second digit of the password is flashing.
7. Repeat points 4 to 6 to activate the other password.

Factory setting

Both passwords are deactivated. If a password is activated, the factory setting is "6814".

10.7.45 Ethernet (4.5.5)



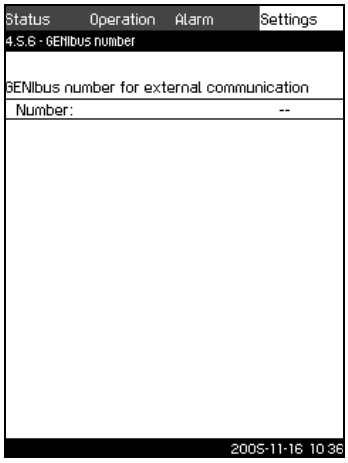
TM03 2298 4005

Fig. 73 Ethernet

Description

CU 351 is equipped with an Ethernet connection for communication with a computer, either directly or via Internet. For further information, see *10.8.1 Ethernet*.

10.7.46 GENIbus number (4.5.6)



TM03 2297 4005

Fig. 74 GENIbus number

Description

CU 351 can communicate with external units via an RS-485 interface (option). For further information see fig. 76 and *10.8.2 GENIbus*.

Communication is carried out according to the Grundfos bus protocol, GENIbus, and enables connection to a building management system or another external control system.

Operating parameters, such as setpoint and operating mode, can be set via the bus signal. Furthermore, status about important parameters, such as current value and input power, and fault indications can be read from the CU 351.

Contact Grundfos for further information.

Setting range

The number can be set between 1 and 64.

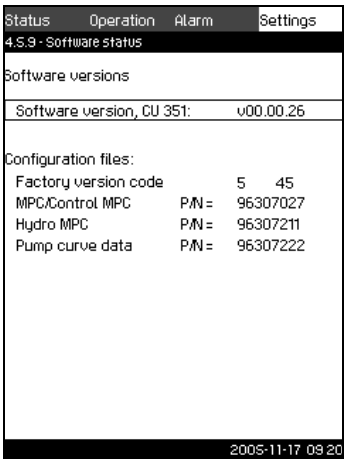
Setting via control panel

1. Mark the **Settings** menu with ›.
2. Mark **Functions, CU 351** with ∨ or ∧ and press OK.
3. Mark **GENIbus numbe**r with ∨ or ∧ and press OK.
4. Select the number with + or − and save with OK.

Factory setting

No number is set ("-").

10.7.47 Software status (4.5.9)



TM03 2296 4005

Fig. 75 Software status

Description

This display shows the status of the software installed in the CU 351. Furthermore the version code and the product numbers of configuration files (.gsc) read into the unit are shown.

As it is a status display, no settings can be made.

10.8 Data communication

CU 351 is equipped with a hardware enabling communication with external units, such as a computer, via an external GENIbus or Ethernet connection.

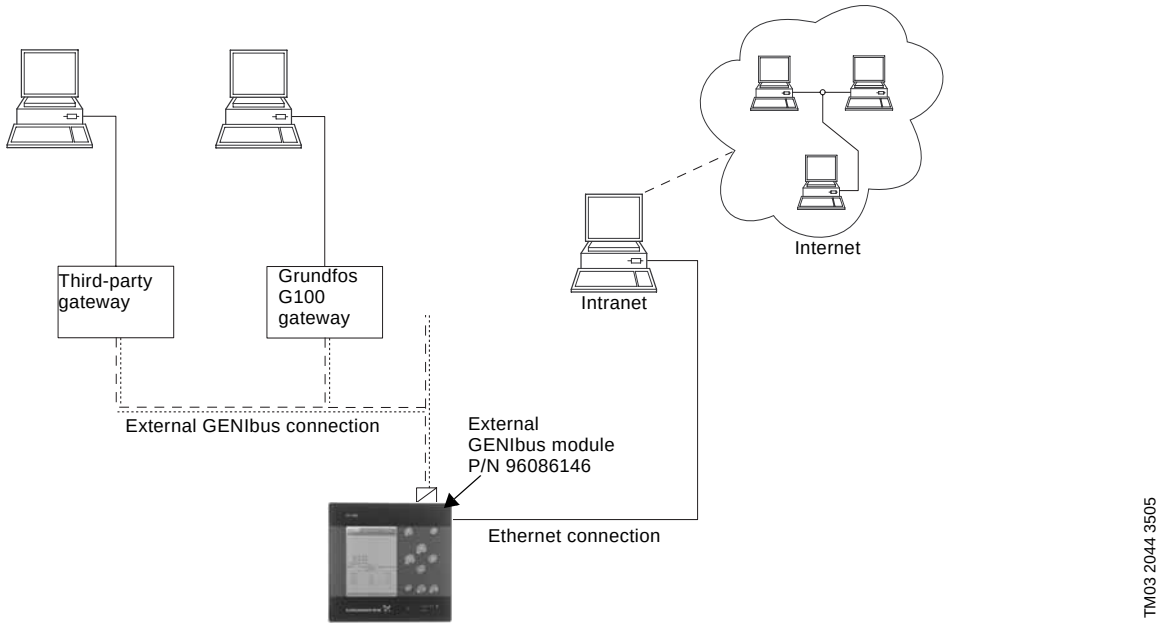


Fig. 76 Data communication via external GENIbus and Ethernet connection

10.8.1 Ethernet

Ethernet is the most widely used standard for local networks (LAN). The standardization of this technology has created some of the easiest way of creating communication between electrical units, for instance between computers or between computers and control units. The web server of the CU 351 makes it possible to connect a computer to the CU 351 via an Ethernet connection. The user interface can thus be exported from the CU 351 to a computer so that the CU 351 and consequently the Hydro MPC booster set can be monitored and controlled externally.

In order to use the web server, you must know the IP address of the CU 351. All network units must have a unique IP address in order to communicate with each other. The IP address of CU 351 from factory is 192.168.0.102.

Alternatively to the factory-set IP address it is possible to use a dynamic assignment of IP address. This is possible by activating a DHCP (Dynamic Host Configuration Protocol) either directly in the CU 351 or via the web server. See the example in fig. 77.

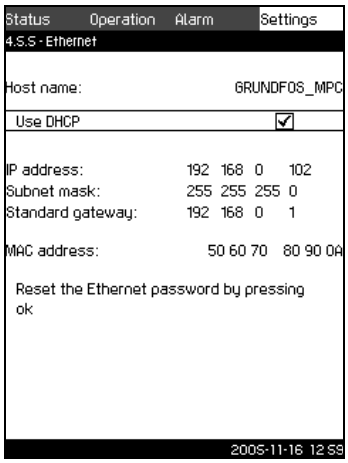


Fig. 77 Example of setting of Ethernet

Dynamic assignment of an IP address for the CU 351 requires a DHCP server in the network. The DHCP server assigns a number of IP addresses to the electrical units and makes sure that two units do not receive the same IP address.

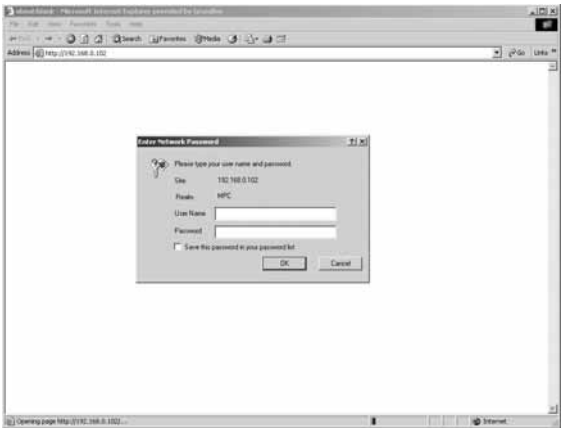
A traditional Internet browser is used for connection to the web server of the CU 351.

If you want to use the factory-set IP address, no changes are required in the display. Open the Internet browser and enter the IP address of the CU 351.

In order to use dynamic assignment, the function must be activated. Click (ok) **Use DHCP** in the menu line. A check mark next to the menu line shows that activation has been made. After activation in the display, open the Internet and enter the host name of the CU 351 instead of the IP address. The Internet browser will now try to connect to the CU 351. The host name can be read in the display, but can only be changed by either a .gsc-file (configuration file) or via a web server, see *Change of network setting* on page 49.

Note ***To use DHCP, a host name is required.***

This is the first display shown when connecting to the CU 351.



TM03 2048 3505

Fig. 78 Connection to CU 351

Factory setting

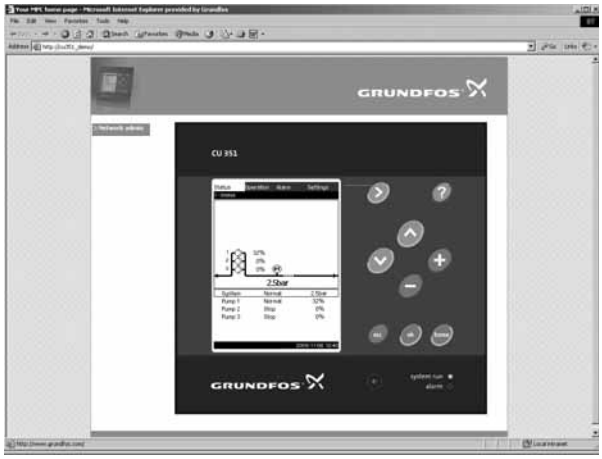
User name: admin
Password: admin

When user name and password have been entered, a Java Runtime Environment application starts up in the CU 351, provided that it has been installed on the computer in question. If this is not the case, but the computer is connected to Internet, then use the link on the screen to download and install the Java Runtime Environment application.

TM03 2049 3505

Fig. 79 Display with link to the JavaScript® program

The Java Runtime Environment application will then export the CU 351 user interface (including display and operating panel) to the computer screen. It is now possible to monitor and control the CU 351 from the computer.



TM03 2047 3505

Fig. 80 Network setting

Change of network setting

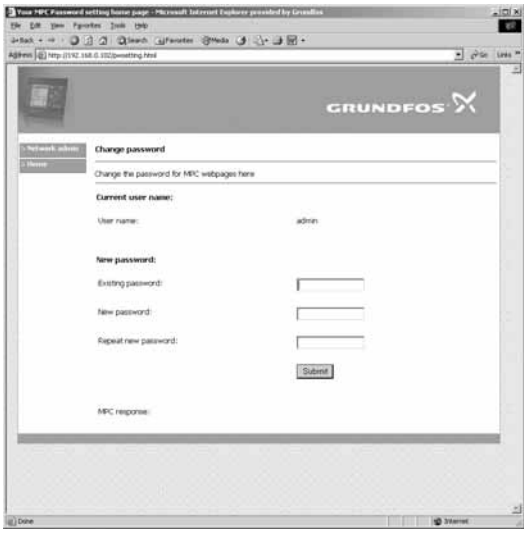
When connection to the web server of the CU 351 has been established, it is possible to change the network setting.

TM03 2050 3505

Fig. 81 Change of network setting

1. Press the icon **>Network admin**.
2. Enter the changes.
3. Press **Submit** to activate the changes.

Change of password



TM03 2051 3505

Fig. 82 Change of password

1. Press the icon **>Change password**.
2. Enter the new password.
3. Press **Submit** to activate the new password.

10.8.2 GENIbus

By installing a GENIbus module it is possible to connect a CU 351 to an external network. The connection can take place via a GENIbus-based network or a network based on another protocol via a gateway, see fig. 76. For further information, contact Grundfos.

The gateway may be a Grundfos G100 gateway or a third party gateway. For further information on the G100 gateway, see the G100 data booklet (publication number V7139522).

11. External frequency converter settings

External frequency converter(s) used in Hydro MPC booster set variants F, EF and EDF are delivered with the manufacturer's factory settings, see table below.

At start-up, the factory settings must be changed to the Grundfos settings in the table below.

11.1 VLT 2800

Press [QUICK MENU] + [+] to access all parameters.

Parameter	Factory setting		Grundfos setting	
	Function	Value or number in the display of VLT	Function	Value or number in the display of VLT
2	Local/remote operation		Local/remote operation	0
3	Local reference		Local reference	Default
101	Torque characteristics		Torque characteristics	2
102	Motor power		Motor power	Motor nameplate in kW
103	Motor voltage		Motor voltage	Motor nameplate
104	Motor frequency		Motor frequency	Motor nameplate, Hz
105	Motor current		Motor current	Motor nameplate, SFA
106	Rated motor speed		Rated motor speed	Motor nameplate RPM
107	Automatic motor adaptation		Automatic motor adaptation	2
128	Thermal motor protection		Thermal motor protection	4
204	Minimum reference		Minimum reference	20 Hz
205	Maximum reference		Maximum reference	62 Hz
206	Ramp type		Ramp type	2
207	Ramp up time		Ramp up time	1.5 sec
208	Ramp down time		Ramp down time	3 sec
214	Reference function		Reference function	2
215	Preset reference		Preset reference	100
302	Digital input		Digital input	7
304	Digital input		Digital input	0
305	Digital input6		Digital input6	24
323	Relay output		Relay output	1
406	Automatic restart time		Automatic restart time	10 sec
411	Switching frequency		Switching frequency	4500

* Thermistor function used for thermal protection of LC filter.

** For information about languages available, see relevant documentation.

*** Use data from the Hydro MPC booster set.

Factory setting of VLT 2800

To recall the factory settings of all parameters, follow one of the procedures below:

1. Set the parameter 620 to (3).
2. Disconnect the power supply.
3. Re-connect the power supply.
4. All parameters are now factory-set except from the fault log.

or

1. Disconnect the power supply.
2. Press and hold [QUICK MENU] + [+] + [CHANGE DATA] and re-connect the power supply.
3. All parameters are now factory-set, including the fault log.

11.2 Danfoss VLT 8000 factory settings

Parameter	Function	Grundfos setting	
		Value	
001	Language	English	0
002	Motor power	Motor nameplate	
003	Motor voltage	Motor nameplate	
004	Motor frequency	Motor nameplate	
005	Motor current	Motor nameplate (SFA)	
006	Motor speed	Motor nameplate (RPM)	
201	Minimum frequency	20 Hz	
202	Maximum frequency	62 Hz	
207	Ramp up time	1.5 sec	
208	Ramp down time	3 sec	
323	Relay 1 function	Ready signal	1
326	Relay 2 function	Running	3

11.3 Danfoss VLT 8000 extended menu programming

Parameter	Function	Grundfos setting	
		Value	
007	Large readout	Frequency [Hz]	3
008	Small display readout	Motor voltage [V]	16
009	Small display readout	Motor current	5
010	Small display readout	Power [Hp]	6
101	Torque characteristics	VT low	2
113	Motor Preheater DC Current	0%	
117	Motor Thermal Protection	ETR Trip 1	4
208	Automatic ramp-down	Disable	0
210	Reference type	External/preset	2
302	Pin 18	Start	1
303	Pin 19	Reverse and start	2
304	Pin 27	Safety interlock	3
308	Pin 53	Reference	1
309	Term. 53, min. scaling	0.0 V	
310	Term. 53, max. scaling	10 V	
325	Relay 01, off delay	1 sec.	
400	Reset function	Automatic reset x 10	6
401	Automatic restart time	5 sec.	
407	Switching frequency	4500	
408	Interference reduction method	Fixed switching freq.	0
016	Lock for data change	Locked	1

11.4 Baldor Smart motor settings

Section	Parameter	Grundfos setting	
		Value	
Level 2 blocks			
Output limts	Min. output frequency	12 Hz	
Output limts	Max. output	60 Hz	
Output limts	PK current limit	Max. of drive	
Output limts	PWM frequency	6 kHz	
Miscellaneous	Restart aut/man	Auto	
Motor data	Motor voltage	230 V	
Motor data	Motor rated amps	SFA on nameplate	
Level 1 blocks			
Preset speed	Preset speed #1	60 Hz	
Accel	Accel #1	CR 3 - CR 10	1.5 sec.
		CR 15 - CR 90	2.0 sec.
Decel rate	Decel #1	CR 3 - CR 10	3.0 sec.
		CR 15 - CR 90	4.0 sec.
Output	Opto output #1	Ready	
Input	Operating mode	#1 2 wire / 7 spd	
Input	ANA CMD select	Pot. / 0-10 V	
V/Hz and Boost	V/Hz profile	67% sqr. law	

Variable frequency drive setting notes

12. Fault finding chart

Warning

Before making any connections in pumps, terminal boxes or breaker cabinet, make sure that the electricity supply has been switched off for at least 5 minutes and that it cannot be accidentally switched on.

Fault	Possible cause	Remedy
Pumps do not run when started.	Current pressure is higher than or equal to the setpoint.	Wait until the pressure has dropped or lower the pressure on the discharge side of the Hydro MPC and check that the pumps start.
	Electricity supply disconnected.	Connect the electricity supply.
	Main switch cut out.	Cut in the main switch.
	Main switch is defective.	Replace the main switch.
	Motor protection is activated.	Contact Grundfos.
	Motor is defective.	Repair or replace the motor.
	Pressure transmitter fault - Pressure transmitter is defective.	Replace the pressure transmitter. Transmitters with 0-20 mA or 4-20 mA output signals are monitored by Hydro MPC.
	- Cable is broken or short-circuited.	Repair or replace the cable.
The pumps start, but stop immediately. The operating pressure is not reached.	Dry running or no inlet pressure.	Re-establish the supply of water to the Hydro MPC. When the inlet pressure has been re-established, the pumps will restart after 15 seconds.
The Hydro MPC is stopped and cannot restart.	Pressure transmitter fault - Pressure transmitter is defective.	Replace the pressure transmitter. Transmitters with 0-20 mA or 4-20 mA output signals are monitored by the Hydro MPC.
	- Cable is broken or short-circuited.	Repair or replace the cable.
	CU 351 fault - Electricity supply disconnected.	Connect the electricity supply.
	- CU 351 defective.	Contact Grundfos.
Unstable water delivery from Hydro MPC (applies to unstable water supply).	Inlet pressure is too low.	Check the suction pipe and possible suction strainer.
	Suction pipe or pumps partly blocked by impurities.	Clean the suction pipes or pumps.
	Pumps suck air.	Check the suction pipe for leakages.
	Pressure transmitter defective.	Replace the transmitter.
Pumps are running, but deliver no water.	The valves are closed.	Open the valves.
	Suction pipe or pumps blocked by impurities.	Clean the suction pipe or pumps.
	Non-return valve blocked in closed position.	Clean the non-return valve. The non-return valve must move freely.
	Suction pipe leaky.	Check the suction pipe for leakages.
	Air in suction pipe or pumps.	Vent and prime the pumps. Check the suction pipe for leakages.
The Hydro MPC is unable to reach the setpoint.	Too high consumption.	- Reduce consumption (if possible). - Install a bigger Hydro MPC booster set.
Leakage from the shaft seal.	Shaft seal is defective.	Replace the shaft seal.
	Height adjustment of pump shaft inaccurate.	Readjust the shaft height.
Noise.	The pumps are cavitating.	Clean the suction pipe/pumps and possibly the suction strainer.
	The pumps do not rotate freely (friction resistance) due to inaccurate height adjustment of the pump shaft.	Readjust the shaft height.
Very frequent starts and stops.	Wrong diaphragm tank precharge pressure.	Set correct precharge pressure.

13. Maintenance

Warning

Before starting work on the pumps, make sure that the electricity supply has been switched off. Lock the mains switch with a padlock to ensure that it cannot be accidentally switched on.

13.1 Pumps

Pump bearings and shaft seal are maintenance-free.

13.2 Motor bearings

Motors without grease nipples are maintenance-free.

Motors with grease nipples should be lubricated with a high-temperature lithium-based grease, see the instructions on the fan cover of Grundfos motors.

In the case of seasonal operation (motor is idle for more than 6 months of the year), it is recommended to grease the motor when the pump is taken out of operation.

13.3 CU 351

The CU 351 is maintenance-free. It must be kept clean and dry. Furthermore, the CU 351 must not be outside the ambient temperature range, see *16. Technical data*.

14. Frost protection

Pumps which are not being used during periods of frost should be drained to avoid damage.

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

Warning

Care must be taken to ensure that the escaping water does not cause injury to persons or damage to the motor or other components. In hot water installations, special attention should be paid to the risk of injury caused by scalding hot water.

Do not tighten the vent screw and replace the drain plug until the pump is to be used again.

15. Taking out of operation

Switch off the mains switch to take the booster set out of operation.

Warning

The conductors in front of the mains switch are still energized. Lock the mains switch with a padlock to ensure that it cannot be accidentally switched on.

Individual pumps are taken out of operation by switching off the corresponding motor starter, automatic circuit breaker or fuse.

Follow a lock out tag out procedure.

16. Technical data

16.1 Pressure

Inlet pressure

Hydro MPC booster sets can operate with a positive inlet pressure (precharged pressure system) or with a negative inlet pressure (i.e vacuum at the inlet manifold).

Calculation of the inlet pressure is recommended when

- water is drawn through long pipes,
- water is drawn from depths,
- inlet conditions are poor.

Note ***In this installation and operating instruction the term 'inlet pressure' is defined as the pressure/ vacuum which can be measured immediately before the booster set.***

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

$$H = P_b - NPSH - H_f - H_v - H_s$$

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

NPSH = **N**et **P**ositive **S**uction **H**ead in feet. NPSH can be read from the NPSH curve at the maximum capacity at which the pump will run. (See installation and operating instructions for CR, CRI, CRN).

HS = Safety margin = 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) if minimum "H" feet is required.

Maximum inlet pressure

Pump	Maximum inlet pressure [bar / psi]
50 Hz	
CR(E) 3-10	10 / 145
CR(E) 5-4 to CRI(E) 5-10	10 / 145
CR(E) 10-3 to CRI(E) 10-6	8 / 116
CR(E) 15-5	10 / 145
CR(E) 20-5	10 / 145
CR(E) 32-4	4 / 58
CR(E) 45-2	4 / 58
CR(E) 45-3 to CR(E) 45-4	10 / 145
CR(E) 64-4-2	10 / 145
CR(E) 90-3	15 / 218
60 Hz	
CR(E) 5-7	10 / 145
CR(E) 10-3	8 / 116
CR(E) 15-3	10 / 145
CR(E) 20-3	10 / 145
CR(E) 32-2	4 / 58
CR(E) 45-2-1	10 / 145
CR(E) 64-2-1	10 / 145
CR(E) 90-2-1	15 / 218

Note ***The maximum inlet pressure is determined by the construction of the pump, such as bearing pressure. For information about other CR pump sizes, see WebCAPS on www.grundfos.com.***

Operating pressure

As standard the maximum operating pressure is 230 psi [16 bar].

On request, Grundfos offers Hydro MPC booster sets with a maximum operating pressure higher than 230 psi [16 bar].

16.2 Temperature

Liquid temperature: 32°F to +158°F

Ambient temperature: 32°F to +104°F

16.3 Relative humidity

Max. relative humidity: 95%

16.4 Sound pressure

For sound pressure level, see the installation and operating instructions for the CR pumps.

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

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

$L_{max.}$ =Maximum sound pressure level.

L_{pump} =Sound pressure level for one pump.

n =Number of pumps.

17. Electrical data

Supply voltage

See nameplate of the Hydro MPC.

Back-up fuse

See the wiring diagram supplied with the Hydro MPC.

Digital inputs

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

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

Analog inputs

Input current and voltage:	0-20 mA 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, CU 351:	10 kΩ ±10%
Input resistance, voltage, IO 351:	> 50 kΩ ±10%
Supply to sensor:	24 V, maximum 50 mA, short-circuit protected

Note ***All analog inputs are supplied with PELV voltage (Protective Extra-Low Voltage).***

Digital outputs (relay outputs)

Maximum contact load:	240 VAC, 2 A
Minimum contact load:	5 VDC, 10 mA

All digital outputs are potential-free relay contacts.

Note ***Some outputs have a common C terminal. For further information, see the wiring diagram supplied with the Hydro MPC.***

Inputs for PTC sensor/thermal switch

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

Open circuit voltage:	12 VDC ±15%
Closed circuit current:	2.6 mA, DC

Note ***Inputs for PTC sensors are electrically separated from the other inputs and outputs of the Hydro MPC.***

18. Related documents

Further product information about Hydro MPC booster sets can be found in the following documents.

All documents are available in WebCAPS on Grundfos' homepage, www.grundfos.com.

Title	Frequency	Publication number
Data booklets		
Grundfos Hydro MPC	50 Hz	96605939
Grundfos Hydro MPC	60 Hz	L-BPQ-PG-01
Installation and operating instructions		
CR, CRI, CRN	60 Hz	L-CP-TL-003
CRE, CRIE, CRNE, CRKE, SPKE, MTRE, CHIE *	60 Hz	L-MLE-TL-02
Frequency converter **	50/60 Hz	-
Baldor smart motor	-	MN750
Service kits		
Service kits for Hydro MPC	50/60 Hz	96488862
Other documentation		
Wiring diagram	-	-

* Only relevant for Hydro MPC-E, -ED and -ES booster sets.

** Only relevant for Hydro MPC booster sets with external frequency converter.

19. Disposal

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

1. If this is not possible, contact the nearest Grundfos company or service workshop.

Subject to alterations.