BoosterpaQ®- Hydro MPC

(US) **Installation and operating instructions**

BoosterpaQ - Hydro MPC

Installation and operating instructions 4 US

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CONTENTS

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Warning

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

1. Symbols used in this document

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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 systems.

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

3. Product description

As standard, Hydro MPC booster systems consist of two to six CR(E) pumps coupled in parallel and mounted on a common base frame with all the necessary fittings and a control panel.

Note ***A diaphragm tank is required in most installations.***

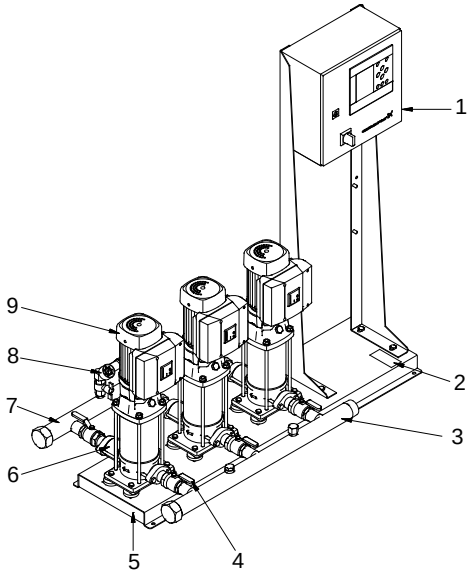

Fig. 1 Hydro MPC booster system

Pos.	Description	Quantity
1	Control panel	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	2
9	Pump	2 - 6

Hydro MPC booster systems are divided into three groups based on control variant:

Control variant	Description
-E	Each pump is equipped with either an integrated variable frequency drive motor (MLE motor) or an external Grundfos CUE variable frequency drive, depending upon horsepower and supply voltage requirements.
-F	Up to six CR pumps connected to an external Grundfos CUE variable frequency drive. The speed-controlled operation alternates between the pumps.
-S	Two to six constant speed CR pumps

See also section *6.1 Examples of control variants* on page 9.

Hydro MPC booster systems always includes application-optimized software for setting the booster system to the application in question.

4. Nameplate

The nameplate of the booster system is fitted on the base frame. See position 2 in fig. 1.

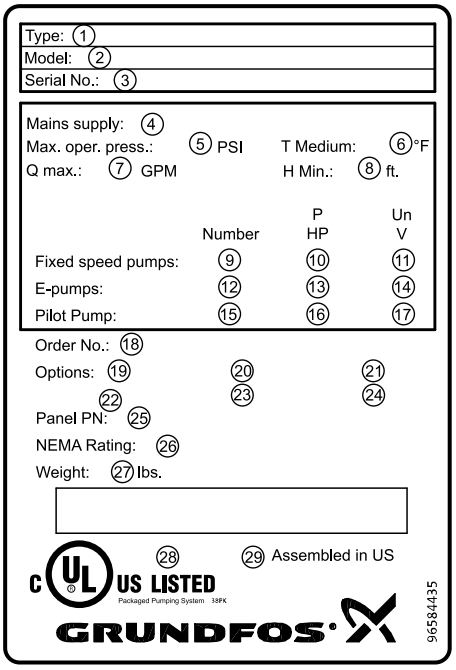

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Fig. 2 Nameplate

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 feet
9	Number of fixed speed and/or auxiliary pumps
10	Motor power in HP for fixed speed pumps
11	Nominal voltage in volts for fixed speed pumps
12	Number of E-pumps
13	Motor power in HP for E-pumps
14	Nominal voltage in volts for E-pumps
15	Number of pilot pumps
16	Motor power in HP for pilot pump
17	Nominal voltage in volts for pilot pump
18	Order number
19-24	Options
25	Panel PN
26	UL Type Rating
27	Weight
28	Approval marks
29	Production location and date code

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5. Software label

The software label is placed on the back of the CU 351 controller.

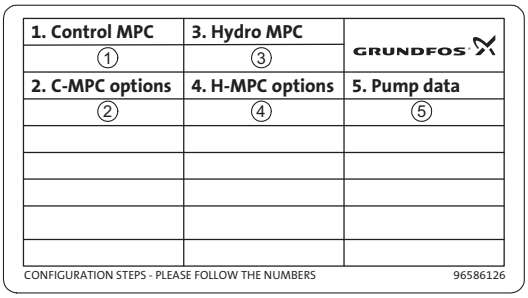

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Fig. 3 Software label

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	-E	2 CRE 5-10	or	2 CR 5-10	3x460 V, 60Hz

Type range

Subgroups:

-E Pumps with all integrated variable frequncy drives or external Grundfos CUE variable frequency drives (one per pump)

-F Pumps with one Grundfos CUE external VFD

-S Constant speed pumps (start/stop)

Number of pumps with integrated variable frequency drive and pump type

Number of constant speed pumps and pump type

Supply voltage, frequency

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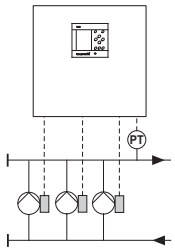
6.1 Examples of control variants

Systems with speed-controlled pumps

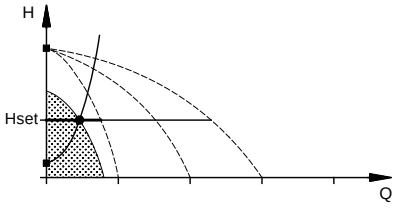
Hydro MPC-E

Hydro MPC booster system with three CRE pumps shown below.



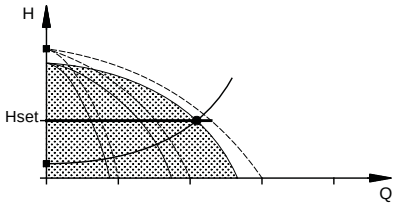
TM03 0993 0905

One CRE pump in operation.



TM00 7995 2296

Three CRE pumps in operation.



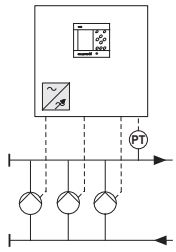
TM00 7996 2296

- The MPC-E system 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, operating hours and fault.
- All pumps in operation will run at equal speed.

Systems with pumps connected to one CUE variable frequency drive

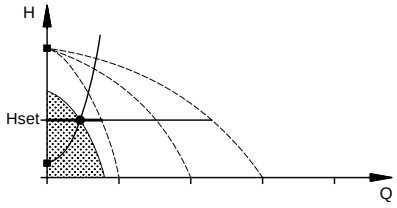
Hydro MPC-F

Hydro MPC booster system with three CR pumps connected to an external variable frequency drive in the control panel. The speed-controlled operation alternates between the pumps.



TM03 1265 1505

One CR pump connected to an external variable frequency drive in operation.



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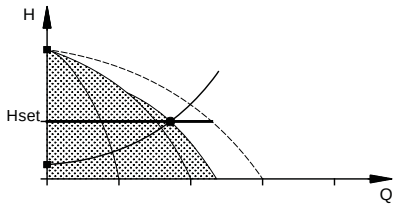
One CR pump connected to an external variable frequency drive and two constant speed CR pumps in operation.



TM00 7998 2296

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

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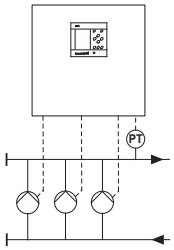
Booster system with constant speed pumps (on/off)

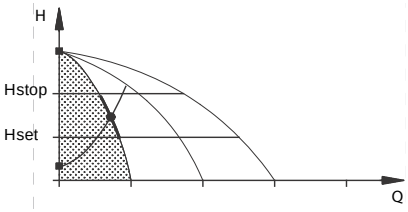
Hydro MPC-S

Hydro MPC booster system with three constant speed CR pumps.



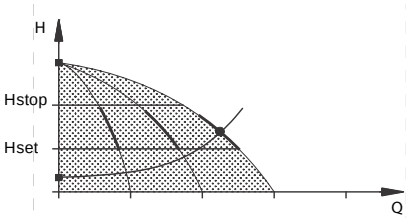
TM03 0999 0905

One constant speed CR pump in operation.



TM03 9204 3607

Three constant speed CR pumps in operation.



TM03 9203 3607

- Hydro MPC-S maintains a pressure differential 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).
- Pump changeover is automatic and depends on load, operating hours 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 system corresponds to the one ordered.
- no visible parts have been damaged.

7.1 Mechanical installation

7.1.1 Location

The booster system must be installed in a well ventilated room to ensure sufficient cooling of the motors and control panel.

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

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

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

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 system is to be installed where first customer on the line is close to the booster system, it is advisable to fit expansion joints on the suction and discharge pipes to prevent vibration being transmitted through the pipework.

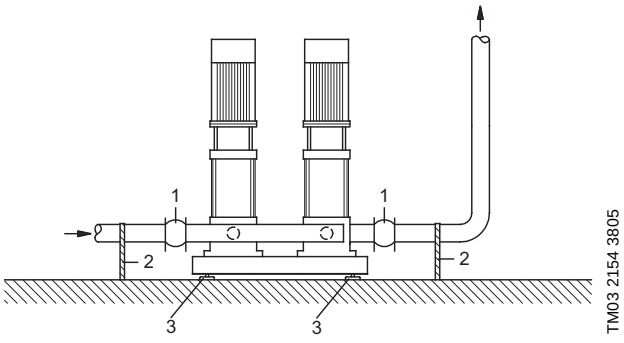


Fig. 4 Sketch showing the position of expansion joints, pipe supports and machine shoes

Pos.	Description
1	Expansion joint
2	Pipe support and good location for system isolation valve (not shown)
3	Machine shoe

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

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

Note ***As a rule the weight of a concrete foundation should be 1.5 x the weight of the booster system.***

7.1.4 Vibration dampers

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

The right damper varies from installation to installation, and a wrong damper may increase the vibration level. Vibration dampers should therefore be sized by the supplier of vibration dampers. If the booster system 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 system 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 1 1/2 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.

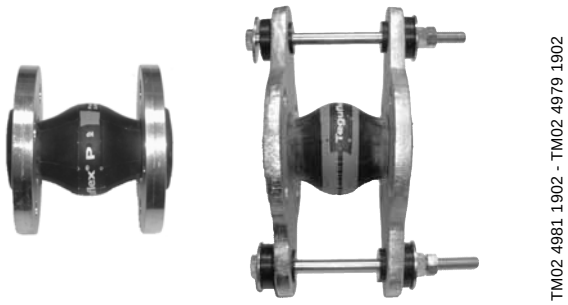


Fig. 5 Examples of rubber bellows expansion joints without and with limit rods

Expansion joints with limit rods can be used to minimise 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.

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7.2 Electrical installation

Warning

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

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- Make sure that the booster system 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.

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 disconnect switch.

Any BoosterpaQ that utilizes a variable frequency drive (E, ED, ES, EF, EDF, F) should be connected to an electrical supply with all phase lines 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). "Open delta" power is not recommended. 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.

7.3 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 and bleed off the pressure in the tank before 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 isolation valves are closed. Switch on main power.

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

7. If this is the first time the system has been powered on, the "Start-up wizard" may appear. Once you have completed the wizard, you may skip Step 8. If the wizard does not appear, please proceed to Step 8.
8. Run the "Start-up wizard" again by performing the following: Move top line display to "Settings". If prompted for password enter "6814", next move down to "Functions, CU 351" and press the "OK" button. Now move down to "Run wizard again" and press the "OK" button.
9. Vent the system by opening the vent plug on each pump (as in Step 3, while the pump is running starting in step 18 of the "Start-up wizard"). 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. 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 the BoosterpaQ into normal operation. With the discharge manifold isolation valves still closed, partially open each pump discharge isolation valve to allow water to enter into the discharge piping of the BoosterpaQ. Continue the process of filling the discharge piping until discharge piping pressure is approximately at the desired Setpoint pressure of the BoosterpaQ.
12. Open pump discharge isolation valves completely. System is now ready for operation.

It may be necessary to clear alarms in the fault log. Follow the steps in paragraph sections *9.6* to clear alarms.

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8. 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 monitoring of the performance of the Hydro MPC.

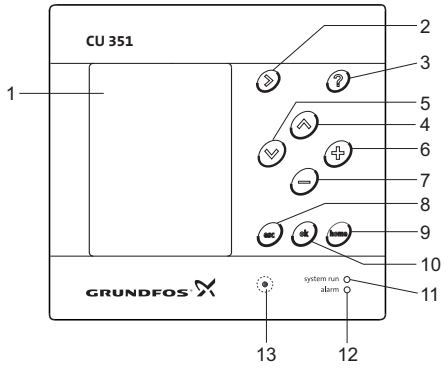

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Fig. 6 Control panel

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, alarm (red)
13	Contrast

8.1 Display (pos. 1)

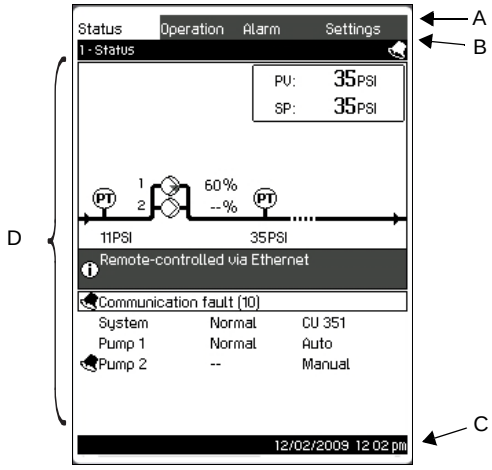

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Fig. 7 Display design

8.1.1 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)

8.1.2 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).

8.1.3 Graphical illustration

The graphical illustration (D) 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.

8.1.4 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.

8.1.5 Bottom line

The bottom line (C) shows the date and time.

8.2 Buttons and indicator lights

The buttons (pos. 2 to 10 in fig. 6) on the CU 351 are active when they are illuminated.

8.2.1 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.

8.2.2 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 button.

8.2.3 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.

8.2.4 Plus and minus (pos. 6 and 7)

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

8.2.5 Esc (pos. 8)

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

If a value has been changed and the button is pressed, the new value will not be saved. For further information, see section *8.2.7 Ok (pos. 10)*.

If the button is pressed before the button, the new value will be saved. For further information, see section *8.2.7 Ok (pos. 10)*.

8.2.6 Home (pos. 9)

Press the button to return to the **Status** menu.

8.2.7 Ok (pos. 10)

Use the button as an enter button.

The button is also used to start the setting of a value.

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

8.2.8 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.It 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.

8.2.9 Contrast (pos. 13)

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

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

8.2.10 Back light

If no button is touched for 15 minutes, the back light of the panel will be dimmed, and the first display in the **Status** menu will appear.

Press any button to re-activate the back light.

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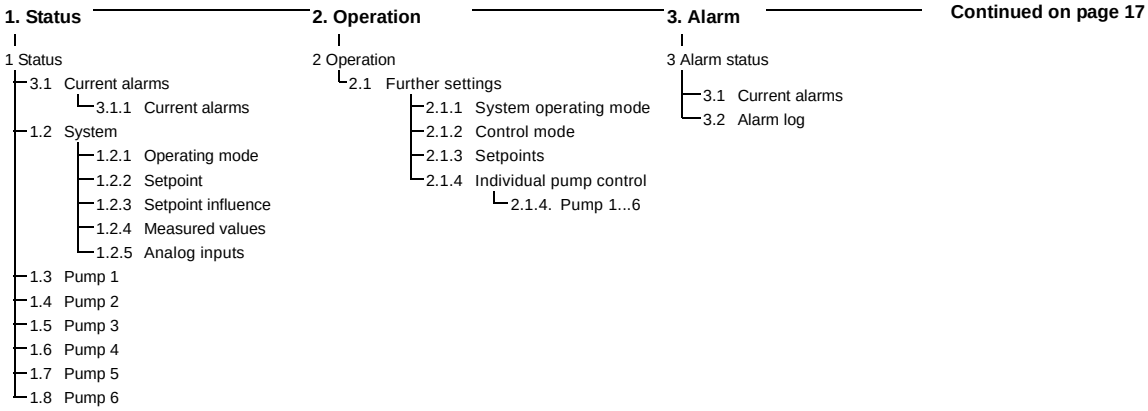
9. Functions

9.1 Tree of functions



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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 individual pump 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 alternative setpoints, external setpoint influence, primary sensor, clock program, proportional pressure and S-system configuration. • Pump cascade control Setting of min. time between start/stop, max. number of starts/hour, number of standby pumps, forced pump changeover, pump test run, pilot pump, pump stop attempt, pump start and stop speed, min. performance and compensation for pump start-up time. • Secondary functions Setting of stop function, soft pressure build-up, digital and analog inputs, digital outputs, emergency run, min., max. and user-defined duty, pump curve data, flow estimation, control source and fixed inlet pressure. • Monitoring functions Setting of dry-running protection, min. and max. pressure, external fault, limit 1 and 2 exceeded, pumps outside duty range and pressure relief. • Functions, CU 351 Selection of service language, main language and units. Setting of date and time, passwords, Ethernet connection, GENIbus number and software status.

Continued from page 16

4. Settings

- 4.1 Primary controller
  - 4.1.1 PI controller
  - 4.1.2 Alternative setpoints
    - 4.1.2.1 Alternative setpoints 2...7
  - 4.1.3 External setpoint influence
    - 4.1.3.1 Input value to be influenced by
      - 4.1.3.2 Setting of influence function
  - 4.1.4 Primary sensor
  - 4.1.6 Clock program
  - 4.1.7 Proportional pressure
  - 4.1.8 S-system configuration
- 4.2 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 Pump test run
  - 4.2.6 Pilot pump
  - 4.2.7 Pump stop attempt
  - 4.2.8 Pump start and stop speed
  - 4.2.9 Min. performance
  - 4.2.10 Compensation for pump start-up time
- 4.3 Secondary functions
  - 4.3.1 Stop function
    - 4.3.1.1 Stop parameters
  - 4.3.3 Soft pressure build-up
  - 4.3.5 Emergency run
  - 4.3.7 Digital inputs
    - Function, DI1..DI3 (CU 351), [10, 12, 14]
    - Function, DI1..DI9 (IO 351-41), [10...46]
    - Function, DI1..DI9 (IO 351-42), [10...46]
  - 4.3.8 Analog inputs
    - Setting, analog input AI1..AI3 (CU 351), [51, 54, 57]
      - Function, AI1...AI3 (CU 351), [51, 54, 57]
    - Setting, AI1..AI2 (IO 351-41), [57, 60]
      - Function, AI1..AI2 (IO 351-41), [57, 60]
    - Setting, AI1..AI2 (IO 351-42), [57, 60]
      - Function, AI1..A2 (IO 351-42), [57, 60]
  - 4.3.9 Digital outputs
    - Function, DO1 and DO2 (CU 351), [71, 74]
    - Function, DO1...DO7 (IO 351-41), [77...88]
    - Function, DO1...DO7 (IO 351-42), [77...88]
  - 4.3.14 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
  - 4.3.19 Pump curve data
    - 4.3.23 Flow estimation
  - 4.3.20 Control source
  - 4.3.22 Fixed inlet pressure
  - 4.3.23 Flow estimation
- 4.4 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
  - 4.4.5 Limit 1 exceeded
  - 4.4.6 Limit 2 exceeded
  - 4.4.7 Pumps outside duty range
  - 4.4.8 Pressure relief

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US

4. Settings

- 4.5 Functions, CU 351
  - Change language 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
    - 4.5.2.10 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

9.2 Overview

9.3 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.

9.4 Status (1)

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.

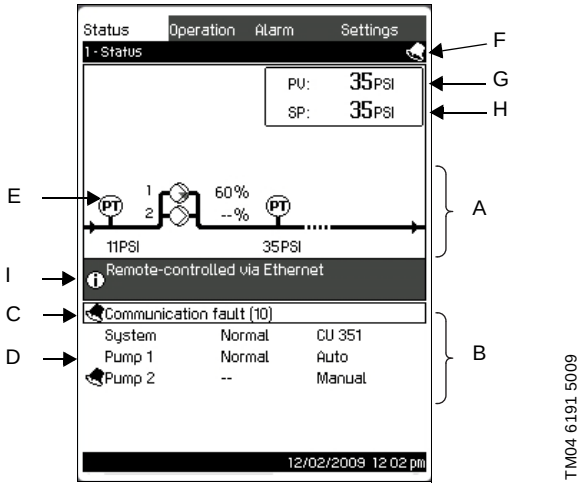

Fig. 8 Status

Description

No settings can be made in this menu.

The current value (process value, PV) of the control parameter, usually the discharge pressure, is shown in the upper right corner (G) together with the selected setpoint (SP) (H).

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

In the middle of the display, an information field (I) is shown if any of the following events occur:

- Emergency run active
- Stopped due to low flow
- Limited operation due to standby pump
- Pump in test run
- Proportional pressure influence active
- External setpoint influence active
- Alternative setpoint active
- Clock program active
- Remote-controlled via Ethernet
- Remote-controlled via GENI (RS-485).

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 control source
- pump status with current operating mode and manual/auto.

Note

If a fault has occurred, the symbol will be shown in the alarm line (C) together with the cause and fault code, for instance: Communication fault (10).

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 .

The display makes it possible to open status displays showing

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

9.4.1 Current alarms (3.1)

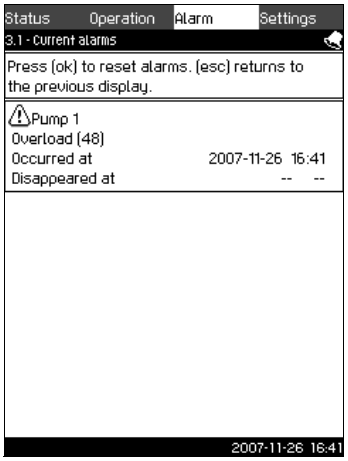

Fig. 9 Current alarms

Description

In this display, current unreset alarms and warnings are shown.

For further information, see sections *9.6.2 Current alarms (3.1)* and *9.6.3 Alarm log (3.2)*.

9.4.2 System (1.2)

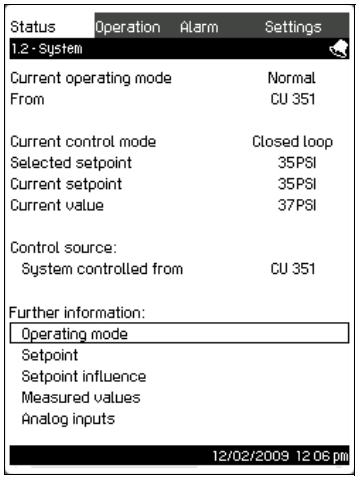

Fig. 10 System

Description

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

The display makes it possible to open specific displays about

- operating mode
- setpoint
- setpoint influence
- measured values
- analog inputs.

US

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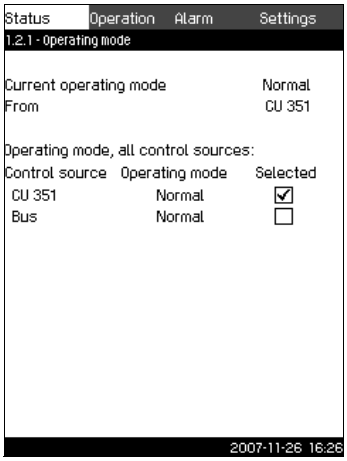
9.4.3 Operating mode (1.2.1)



TM03 2273 4807

Fig. 11 Operating mode

Description

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

Operating modes

Hydro MPC has six operating modes:

1. *Normal*
   The booster system adapts its performance to the requirement.
2. *Max.*
   The pumps run at a constant high speed. Normally, all pumps run at maximum speed.
3. *User-defined*
   The pumps run at a constant speed set by the user. Usually it is a performance between *Max.* and *Min*.
4. *Min.*
   The pumps run at a constant low speed. Normally, one pump is running at a speed of 70 %.
5. *Stop*
   All pumps have been stopped.
6. *Emergency run*
   The pumps run according to the setting made in the display *Emergency run (4.3.5)*.

The performance required in the operating modes *Max., Min., User-defined* and *Emergency run* can be set in the **Settings** menu. See sections *9.7.33 Min., max. and user-defined duty (4.3.14)* and *9.7.25 Emergency run (4.3.5)*.

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

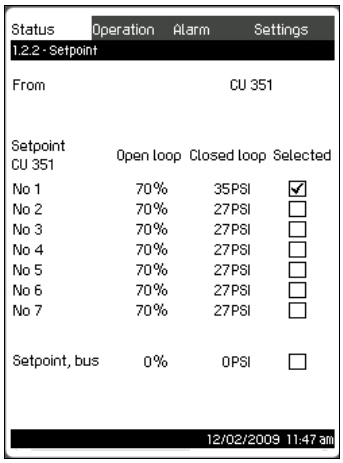
Control source

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**.

9.4.4 Setpoint (1.2.2)



TM04 6186 5009

Fig. 12 Setpoint

Description

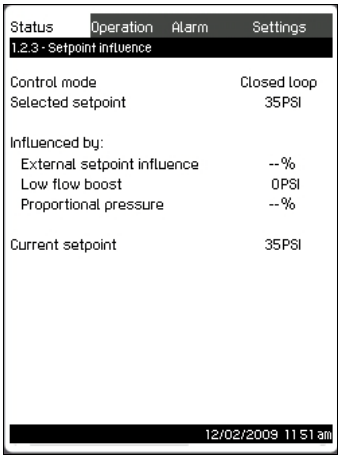
This display shows the selected setpoint and whether it comes from the CU 351 or an external bus.

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** or **Settings** menu. See section *9.7.3 Alternative setpoints (4.1.2)* on page 35.

9.4.5 Setpoint influence (1.2.3)



TM04 6192 5009

Fig. 13 Setpoint influence

Description

The selected setpoint can be influenced by parameters. The parameters are shown as percentage from 0 to 100 % or as a pressure measured in psi. They can only reduce the setpoint, as the influence in percentage divided with 100 is multiplied with the selected setpoint:

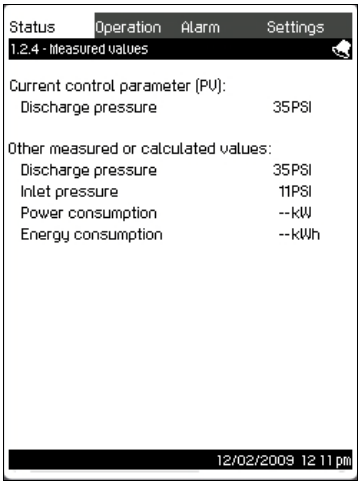
$$\text{Setpoint}_{\text{current(SP)}} = \text{Setpoint}_{\text{selected}} \times \text{Infl.(1)} \times \text{Infl.(2)} \times \ldots$$

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

Some of the possible parameters can be set in the display *External setpoint influence (4.1.3)*. The parameter low flow boost is set as an on/off band as a percentage of the setpoint set in the display *Stop function (4.3.1)*. The parameter is set as a percentage in the display *Proportional pressure (4.1.7)*.

Finally the resulting current setpoint (SP) is shown.

9.4.6 Measured values (1.2.4)



TM04 6185 5009

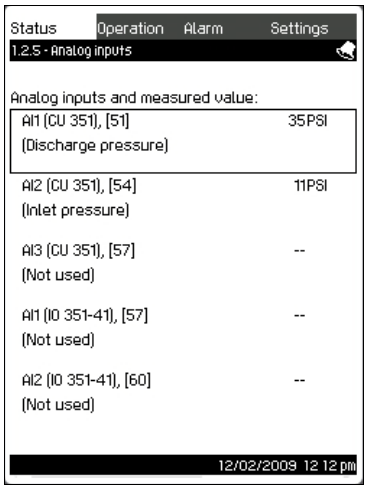
Fig. 14 Measured values

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 systems.***

9.4.7 Analog inputs (1.2.5)



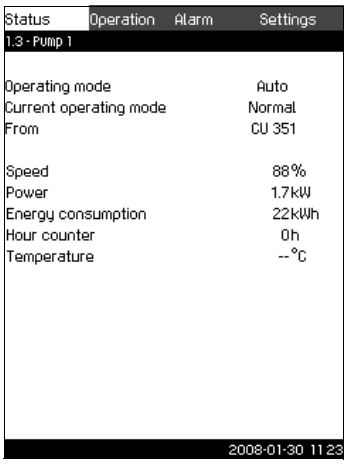
TM04 6193 5009

Fig. 15 Analog inputs

Description

The display shows an overview of the analog inputs and the current measured values of each input. See sections *9.7.28 Analog inputs (4.3.8)*, *9.7.29 Analog inputs (4.3.8.1 to 4.3.8.7)* and *9.7.30 Analog inputs and measured value (4.3.8.1.1 to 4.3.8.7.1)*.

9.4.8 Pump 1...6 (1.3 to 1.8)



TM03 2268 4807

Fig. 16 Pump 1

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 system 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. (This operating mode can only be selected for variable-speed pumps.)
  – *Normal*
    The pump runs at a set speed.
  – *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 these:

- current operating mode
- control source
- speed (only 0 or 100 % are shown for mains-operated pumps)
- power consumption (only CRE pumps and CUE controlled pumps)
- energy consumption (only CRE pumps and CUE controlled pumps)
- operating hours.

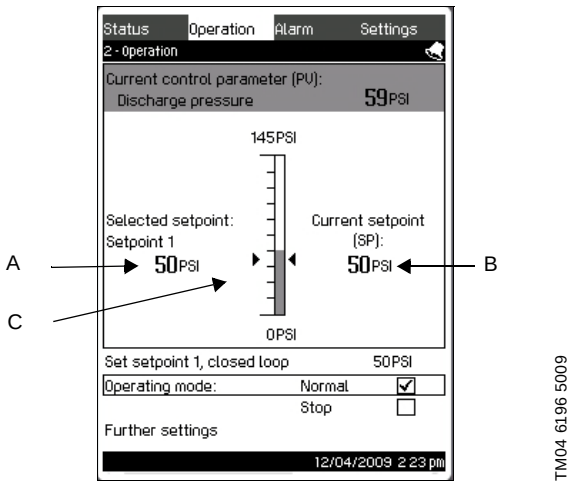
9.5 Operation (2)

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

US

US

9.5.1 Operation (2)



TM04 6196 5009

Fig. 17 Operation

Description

The column shows the setting range. In closed-loop control, it corresponds to the range of the primary sensor, here 0-145 psi. In open-loop control, the setting range is 0-100 %.

At the left hand of the column, the selected 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 external setpoint influence has been selected, the two values will be identical. The current measured value (discharge pressure) is shown as the grey part of the column (C). See sections *9.7.5 External setpoint influence (4.1.3)* and *9.7.6 Setting of influence function (4.1.3.2)*.

Below the display is a menu line for setting of setpoint 1 and selection of operating mode, including the operating modes *Normal* and *Stop*. It is possible to select further settings: system operating mode, control mode, setpoints for closed and open loop as well as individual pump control.

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 Setpoint 1 with ⊙ or ⊙. Set the value with ⊕ or ⊖.
3. Save with ⊙.

Operating mode:

1. Mark the **Operation** menu with ⊙.
2. Mark operating mode **Normal** or **Stop** with ⊙ or ⊙. Save with ⊙.

Further settings:

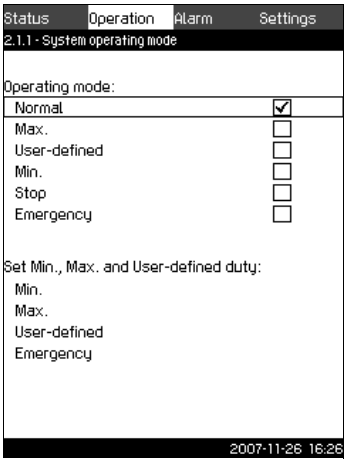
1. Mark the **Operation** menu with ⊙.
2. Mark **Further settings** with ⊙ or ⊙, and press ⊙.
3. Select one of the settings below with ⊙ or ⊙, and press ⊙:

- system operating mode (see section *9.5.2*)
- control mode (see section *9.5.3*)
- setpoints (see section *9.5.4*)
- individual pump control (see section *9.5.6*).

Factory setting

The setpoint is a value suitable for the Hydro MPC booster system in question. The factory setting may have been changed in the start-up menu.

9.5.2 System operating mode (2.1.1)



TM03 8951 4807

Fig. 18 System operating mode

Description

Hydro MPC can be set to six different operating modes. *Normal* is the typical setting. See section *9.4.3 Operating mode (1.2.1)*.

The performance of the operating modes *Max., Min.*, *User-defined* and *Emergency run* 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 or the setpoint.

Setting range

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

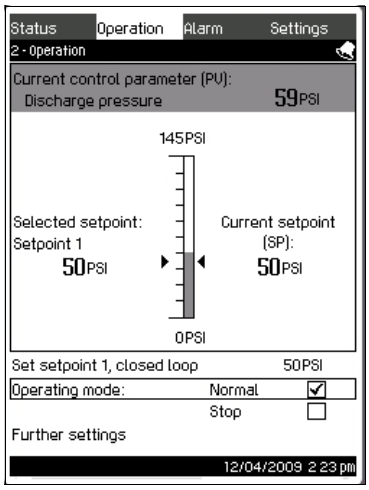
Setting via control panel

1. Mark the **Operation** menu with ⊙.
2. Mark **Further settings** with ⊙ or ⊙, and press ⊙.
3. Mark **System operating mode** with ⊙ or ⊙, and press ⊙.
4. Select the desired operating mode by marking one of the lines with check boxes with ⊙ or ⊙, and press ⊙.
5. In order to set the performance in min., max., user-defined duty or emergency run, mark the desired line at the bottom of the display, and press ⊙.
   See sections *9.7.33 Min., max. and user-defined duty (4.3.14)* and *9.7.25 Emergency run (4.3.5)*.

Factory setting

Normal.

9.5.3 Control mode (2.1.2)



TM04 6194 5009

Fig. 19 Control mode

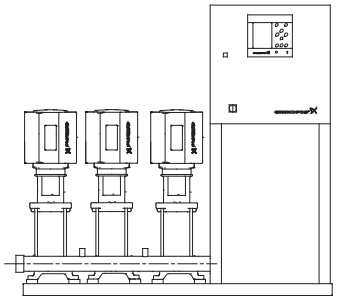
Description

There are two control modes, namely closed and open loop.

Examples:

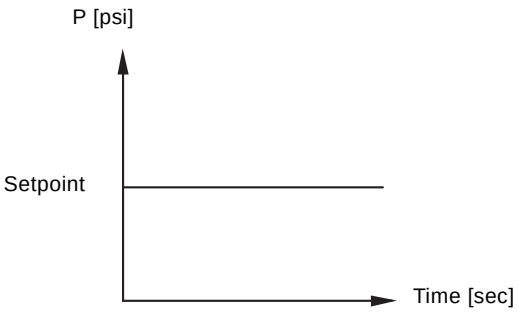
Closed loop

The typical control mode is closed loop where the built-in PI controller ensures that the booster system delivers the discharge pressure required (setpoint). The performance is based on the setpoint set for closed loop. See figs 20 and 21.



TM03 2231 3905

Fig. 20 Booster system controlled by built-in PI controller (closed loop)



TM03 2390 4105

Fig. 21 Regulation curve for closed loop

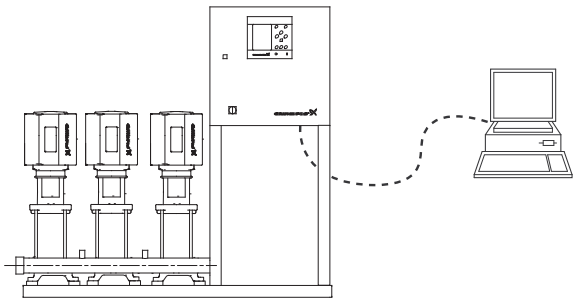
Setting via control panel

1. Mark the **Operation** menu with ›.
2. Mark **Further settings** with ⌄ or ⌃, and press ok.
3. Mark **Control mode** with ⌄ or ⌃, and press ok.
4. Select **Closed loop** with ⌄ or ⌃, and press ok.
5. Set the setpoint. See sections *9.5.4 Setpoints (2.1.3)* and *9.5.1 Operation (2)*.

Open loop

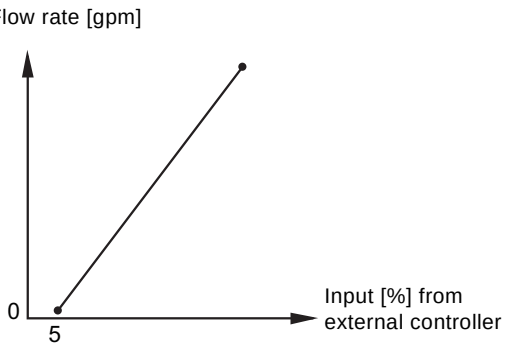
In open-loop control, the pumps run at a fixed speed.
The pump speed is calculated from the performance set by the user (0-100 %). The pump performance in percentage is proportional with the flow rate.

Open-loop control is usually used when the booster system is controlled by an external controller which controls the performance via an external signal. The external controller could for instance be a building management system connected to the Hydro MPC. In such cases, the Hydro MPC is like an actuator. See figs 22 and 23.



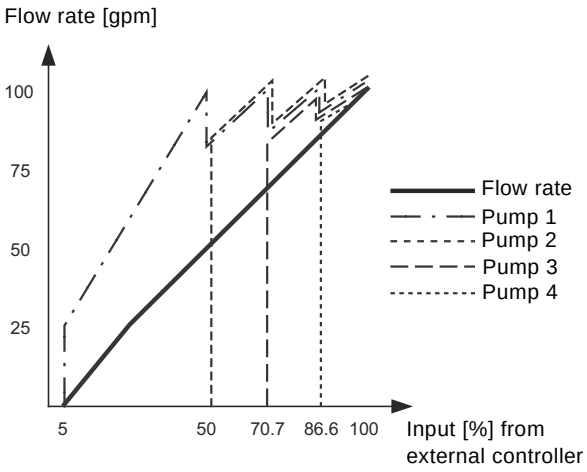
TM03 2232 3905

Fig. 22 Booster system with external controller (open loop)



TM03 2391 3607

Fig. 23 Regulation curve for open loop



TM03 9977 4807

Fig. 24 Regulation curve for Hydro MPC-E in open loop

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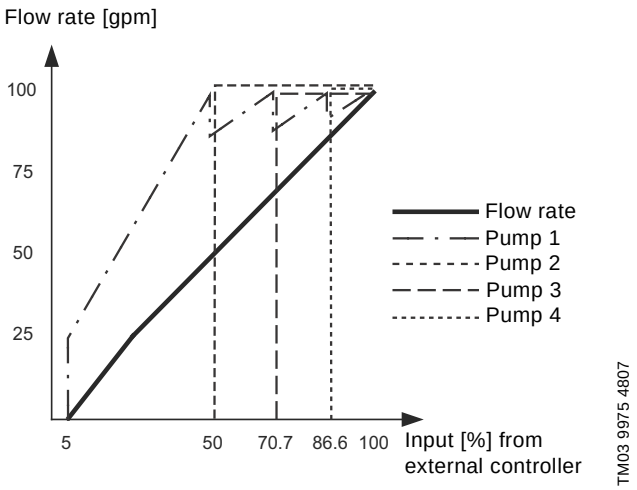


Fig. 25 Regulation curve for Hydro MPC-F in open loop

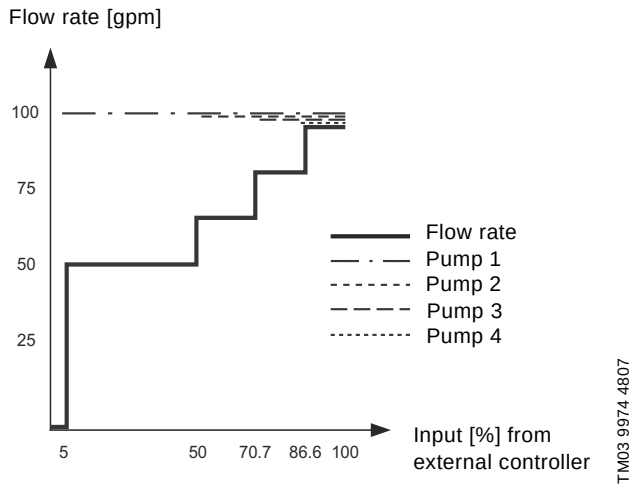


Fig. 26 Regulation curve for Hydro MPC-S in open loop

Correlating open loop input setpoint percentage with number of pumps in operation. Example: MPC system with (4) pumps

- Setpoint 0% to 5% = All pumps stopped

One pump operation from setpoint from 5% to √ (1-pump/4-pumps) = 50%

- Two pump operation from 50% to √ (2-pump/4-pumps) = 70.7%
- Three pump operation from 70.7% to √ (3-pumps/4-pumps) = 86.6%
- Four pump operation from 86.6% to 100%

For staging pumps off the cut-out is 2% less then cut-in. Example: staging from 4-pump to 3-pump operation will occur at 84.6% reference signal.

Setting range

These settings must be made in connection with open loop:

- selection of operating mode *Stop*
- selection of control mode *Open loop*
- setting of setpoint 1, open loop
- setting of external setpoint influence
- selection of operating mode *Normal*.

Setting via control panel

To set an external control source to control the Hydro MPC booster system, proceed as follows:

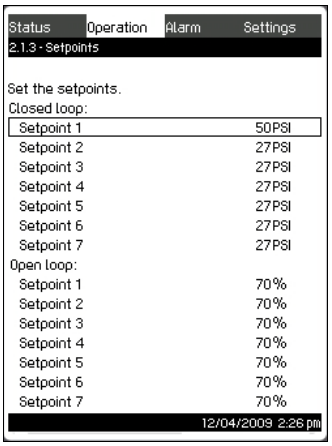
1. Mark the **Operation** menu with ›.
2. Mark the operating mode **Stop** with ⌄ or ⌃, and press ok. The check mark in the right box shows that the operation has been stopped.
3. Mark **Further settings** with ⌄ or ⌃, and press ok.
4. Mark **Control mode** with ⌄ or ⌃, and press ok.
5. Select **Open loop** with ⌄ or ⌃, and press ok.
6. Return by pressing esc twice.
7. Mark **Set setpoint 1, open loop** with ⌄ or ⌃.
8. Set the setpoint to 100 % with +, and save with ok.
9. Mark the **Settings** menu with ›.
10. Mark **Primary controller** with ⌄ or ⌃, and press ok.
11. Mark **External setpoint influence** with ⌄ or ⌃, and press ok.
12. Mark **Go to setting of analog input** with ⌄ or ⌃, and press ok.
13. Select the analog input with ⌄ or ⌃, and press ok.
14. Select the range of the analog input with ⌄ or ⌃, and press ok. The selection is indicated by a check mark.
15. Mark **Measured input value** with ⌄ or ⌃, and press ok. Now the display 4.3.8.1.1 appears.
16. Select **0-100 % signal** with ⌄ or ⌃, and press ok.
17. Press esc to return to display 4.3.8.1.
18. Set the minimum sensor value with + or −, and save with ok.
19. Set the maximum sensor value with + or −, and save with ok.
20. Return by pressing esc twice.
21. Mark **Input value to be influenced by** with ⌄ or ⌃, and press ok.
22. Mark **0-100 % signal** with ⌄ or ⌃, and press ok.
23. Return with esc.
24. Mark **Set the influence function** with ⌄ or ⌃, and press ok. For details, see section *9.7.6 Setting of influence function (4.1.3.2)*.
25. Mark the menu line for number of points with ⌄ or ⌃, and press ok.

26. Select the required number of points with ⊕ or ⊖, and save with ok.
27. Mark **External input value** (point 1) with ⌄ or ⌃.
28. Set the value of the external input value with ⊕ or ⊖, and save with ok.
29. Mark **Reduce setpoint to** (point 1) with ⌄ or ⌃.
30. Set the value as a percentage with ⊕ or ⊖, and save with ok.
31. Repeat 27 to 31 for all chosen points.
32. Return with esc.
33. Mark **Filter time** with ⌄ or ⌃, set the time in seconds with ⊕ or ⊖, and save with ok.
34. Mark **Activated** with ⌄ or ⌃, and press ok. The check mark in the right box shows that the function has been activated.
35. Return by pressing esc twice.
36. Mark the **Operation** menu with ›.
37. Mark the operating mode **Normal** with ⌄ or ⌃, and press ok. The check mark in the right box shows that the operation is normal. The booster system can now be controlled by an external controller.

Factory setting

Closed-loop control.

9.5.4 Setpoints (2.1.3)



TM04 6195 5009

Fig. 27 Setpoints

Description

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

As described in sections *9.7.3 Alternative setpoints (4.1.2)* and *9.7.4 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 section *9.7.7 Primary sensor (4.1.4)*.

In open loop control, the setting range is 0 - 100 %.

Setting via control panel

1. Mark the **Operation** menu with ›.
2. Mark **Further settings** with ⌄ or ⌃, and press ok.
3. Mark **Setpoints** with ⌄ or ⌃, and press ok.
4. Select the setpoint with ⌄ or ⌃.
5. Set the setpoint with ⊕ or ⊖, and press ok.

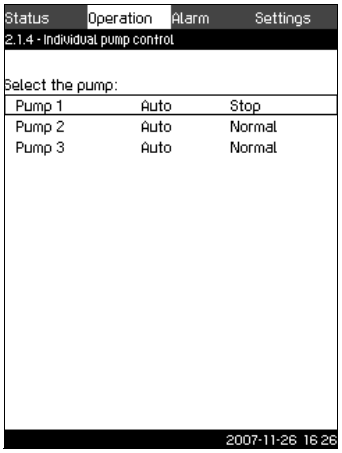
Factory setting

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

The alternative setpoints for closed-loop control are 27 psi.

All setpoints for open-loop control are 70 %.

9.5.5 Individual pump control (2.1.4)



TM03 8953 4807

Fig. 28 Individual pump 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 system 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. (This operating mode can only be selected for variable-speed pumps.)
- *Normal*
  The pump runs at a set speed.
- *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 **Further settings** with ⌄ or ⌃, and press ok.
3. Mark **Individual pump control** with ⌄ or ⌃, and press ok.
4. Select the pump with ⌄ or ⌃, and press ok.

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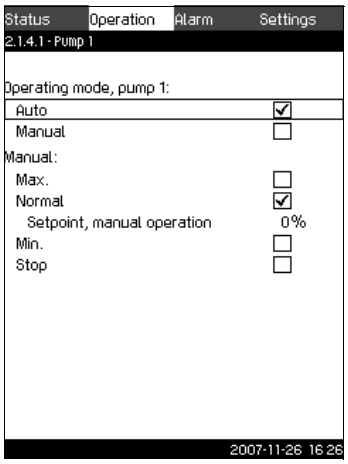
9.5.6 Setting of individual operating mode (2.1.4.1 to 2.1.4.6)



TM03 8954 4807

Fig. 29 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 - *Max.*, *Normal*, *Min.* or *Stop*. For constant speed pumps only *Normal* or *Stop* can be selected.

Setting via control panel

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

Factory setting

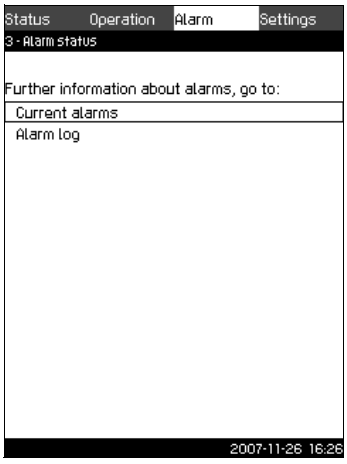
Auto.

9.6 Alarm (3)

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

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

9.6.1 Alarm status (3)



TM03 2291 4807

Fig. 30 Alarm status

Description

A fault in the Hydro MPC booster system or one of the components monitored can cause an alarm ⊗ or a warning ⚠. Besides the fault signal via the alarm/warning signal relay and the red indicator light on the 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 system changes in case of alarm, and whether restart of the booster system 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 sections *9.7.24 Soft pressure build-up (4.3.3)* and *9.7.41 Monitoring functions (4.4)* to *9.7.51 Pressure relief (4.4.8)*.

Fault	Warning(⚠)/alarm(⊗)	Change of operating mode to	Reset of alarm Restart	Set in the Settings menu	Alarm code
Water shortage	⚠		Auto		206
Water shortage	⊗	Stop	Man/auto	X	214
Pressure high	⊗	Stop	Auto		210
Pressure low	⚠		Auto	X	211
	⊗	Stop	Man		
Pressure relief	⚠		Auto	X	219
Alarm, all pumps	⊗	Stop	Auto		203
External fault	⚠		Auto	X	3
	⊗	Stop	Man		
Dissimilar sensor signals	⚠		Auto		204
Fault, 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
Motor temperature too high	⚠		Auto		64, 65, 67, 70
Other fault, pump	⚠		Auto		76, 83
Internal fault, CU 351	⚠		Auto		72, 83, 157
Internal fault, IO 351	⊗	Stop	Auto		83, 157
VFD not ready	⚠		Auto		213
Fault, Ethernet	⚠		Auto		231, 232
Limit 1 exceeded	⚠ ⊗		Man/auto	X	190
Limit 2 exceeded	⚠ ⊗		Man/auto	X	191
Pressure build-up fault	⚠ ⊗		Man/auto	X	215
Pumps outside duty range	⚠		Man/auto	X	208
Pilot pump fault	⚠		Auto		216

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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. Phase failure, pump	2	Pump 1-6	-	1. Check that all three power supply phases are within a 15 V window.	Auto	Warning
2. Undervoltage	7	Pump 1-6	HSD = hardware shut-down. There has been a fault, and the permissible number of restarts for the fault type has been exceeded. a) Fault in power supply. a) Terminal box defective.	1. Restore power supply. 2. Replace terminal box.	Auto	Warning
3. Undervoltage, pump	40	Pump 1-6	a) Power supply voltage is too low at start.	1. Bring voltage back to prescribed level.	Auto	Warning
4. Undervoltage, pump	42	Pump 1-6	a) Faulty power supply at the time of staging on a pump.	1. Restore proper power supply.	Auto	Warning
5. Undervoltage, pump	73	Pump 1-6	a) Low supply voltage. b) Power supply failure while motor is running.	1. Restore proper power supply.	Auto	Warning
6. Overvoltage, pump	32	Pump 1-6	a) Supply voltage is too high at start.	1. Bring voltage back to prescribed level.	Auto	Warning
7. Overload, associated device	48	Pump 1-6	a) Heavy overload has caused software shutdown (SSD).	1. Check and possibly reduce load.	Auto	Warning
8. Overload, associated device	50	Pump 1-6	a) MPF = motor protection function. The built-in motor protection has detected a sustained overload (MPF 60 sec. limit)>	1. Check and possibly reduce load/improve cooling.	Auto	Warning
9. Overload, associated device	51	Pump 1-6	a) Heavy overload (Imax. very high). Pump blocked at start.	1. Unblock the pump.	Auto	Warning
10. Overload, associated device	54	Pump 1-6	a) The built-in motor protection has detected a transitory overload (MPF 3 sec. limit).	1. Check and possibly reduce load/improve cooling	Auto	Warning
11. Over temperature, pump	65	Pump 1-6	a) PTC sensor in the motor has signalled over temperature.	1. Check and possibly reduce load/improve cooling.	Auto	Warning
12. Over temperature, pump	67	Pump 1-6	a) Terminal box has indicated over temperature.	1. Check and possibly reduce load/improve cooling. (Temperature during operation can be read via PC Tool E-products.)	Auto	Warning

MPC alarm indication "Protocol description"	Alarm code	Associated device and device no.	Description/cause	Remedy	Reset type[1]	Alarm/warning Action type[2]
13. Other fault, associated device	76	Pump 1-6	a) Internal communication error has occurred in the pump.	Try to reset the fault: 1. Switch off the supply power. 2. Wait until all LEDs are out. 3. Switch on the supply power. If this does not remedy the fault, replace the terminal box.	Auto	Warning
14. Limit 1 exceeded	190	Measured parameter	a) The measured parameter has exceeded the limit set.	1. Remove the cause of the fault.	Auto/ manual	Alarm/warning Stop/ unchanged
15. Limit 2 exceeded	191	Measured parameter	a) The measured parameter has exceeded the limit set.	1. Remove the cause of the fault.	Auto/ manual	Alarm/warning Stop/ unchanged
16. Pressure relief	219	System	a) The monitored pressure could not be reduced sufficiently.	1. Reduce the pressure to below the limit.	Auto	Warning Unchanged
17. Pressure build-up fault	215	System	a) The pressure set cannot be reached within the configured time.	1. Check limit and pipes.	Auto/ manual	Alarm/warning Stop/ unchanged
18. Pumps outside duty range	208	System	a) The pump is running outside the defined range.	1. Check the system.	Auto/ manual	Warning Unchanged
19. Pilot pump fault	216	Pilot pump	a) Pilot pump fault	1. Check wires. 2. Check the pump.	Auto	Warning

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MPC alarm indication "Protocol description"	Alarm code	Associated device and device no.	Description/cause	Remedy	Reset type[1]	Alarm/warning Action type[2]
20. Water shortage, level 1 *Water shortage, level 1	206	System	a) The inlet 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
21. Water shortage, level 2 *Water shortage, level 2	214		a) The inlet pressure (or the level in the feed tank) is below its programmable warning limit.		Auto/ Manual	Alarm Stop
			b) The inlet pressure switch detect water shortage.			Warning Unchanged
22. 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)
23. 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
24. All pumps in alarm *All pumps in alarm	203		a) All pumps, set to Auto, are stopped on account of pump alarm	Troubleshoot according to the alarm message/code: 1. System 2. Use fault finding documentation for the type of pump installed.	Auto	Alarm Stop
			b) Pumps are not indicating alarm	Check the Genibus wires eg. connection, polarisation.		
25. 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
26. 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
27. 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		
28. 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]
29. 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
30. Ethernet fault *Ethernet: No address from DHCP server	231		a) No address from DHCP server	1. Communication error. 2. Please contact the system integrator or network administrator.		
31. Ethernet fault *Ethernet: Auto disabled due to misuse	232		a) Auto-disabled due to misuse			
32. FLASH parameter verification error *FLASH parameter verification error	083		a) Verification error in CU 351 FLASH memory	Replace the CU 351		
33. 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.		
34. 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.		
35. 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.		
36. 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 acknowledge (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)

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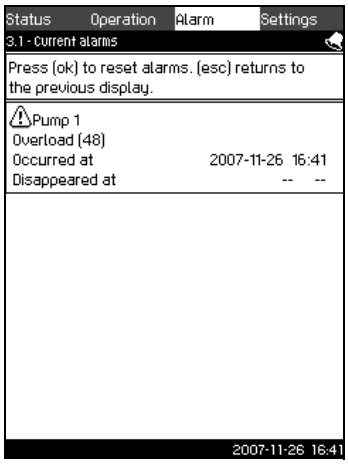
9.6.2 Current alarms (3.1)



TM03 2293 4807

Fig. 31 Current alarms

Description

This submenu shows the following:

- Warnings ⚠ caused by faults that still exist.
- Warnings ⚠ caused by faults that have disappeared, but the warning requires manual reset.
- 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 when the fault has disappeared.

Alarms requiring manual reset are reset in this display by pressing (ok). An alarm cannot be reset until the fault has disappeared.

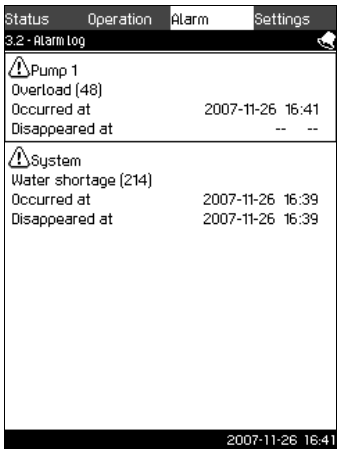
For every warning or alarm, the following is shown:

- 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 (214), 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.

9.6.3 Alarm log (3.2)

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



TM03 2292 4807

Fig. 32 Alarm log

Description

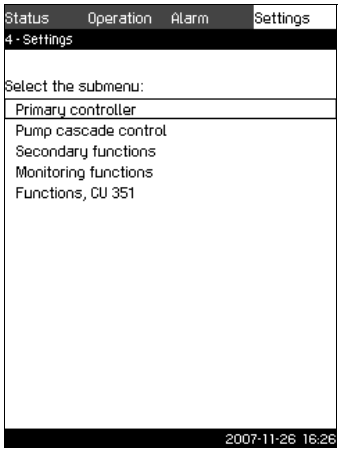
Here warnings and alarms are shown.

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 (214), 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.

9.7 Settings (4)



TM03 2294 4807

Fig. 33 Settings

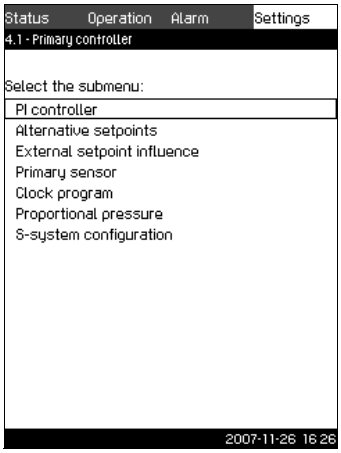
In the **Settings** menu, it is possible to set the following functions:

- Primary controller
  Setting of PI controller, alternative setpoints, external setpoint influence, primary sensor, clock program, proportional pressure and S-system configuration.
- Pump cascade control
  Setting of min. time between start/stop, max. number of starts/hour, number of standby pumps, forced pump changeover, pump test run, pilot pump, pump stop attempt, pump start and stop speed, min. performance and compensation for pump start-up time.
- Secondary functions
  Setting of stop function, soft pressure build-up, digital and analog inputs, digital outputs, emergency run, min., max. and user-defined duty, pump curve data, flow estimation, control source and fixed inlet pressure.
- Monitoring functions
  Setting of dry-running protection, min. and max. pressure, external fault, limit 1 and 2 exceeded, pumps outside duty range and pressure relief.
- Functions, CU 351
  Selection of service language, main language and units. Setting of time and date, passwords, Ethernet connection, GENIbus number and software status.

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 or setpoint influence, or if the settings of the CU 351 are to be adjusted.

9.7.1 Primary controller (4.1)



TM03 8955 4807

Fig. 34 Primary controller

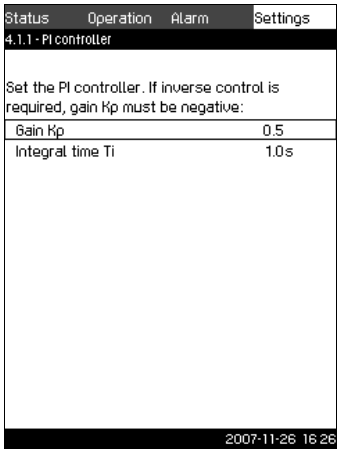
Description

In this menu section, it is possible to set the functions related to the primary controller.
It is only necessary to make settings in this menu if the functionality is to be expanded with for instance alternative setpoints, external setpoint influence, clock program or proportional pressure.

The following menus can be selected:

- PI controller
- Alternative setpoints
- External setpoint influence
- Primary sensor
- Clock program
- Proportional pressure
- S-system configuration.

9.7.2 PI controller (4.1.1)



TM03 2387 4807

Fig. 35 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: –30 to 30.
  Note: For inverse control, set K_p to a negative value.
- Integral time T_i: 0.1 to 3600 seconds.

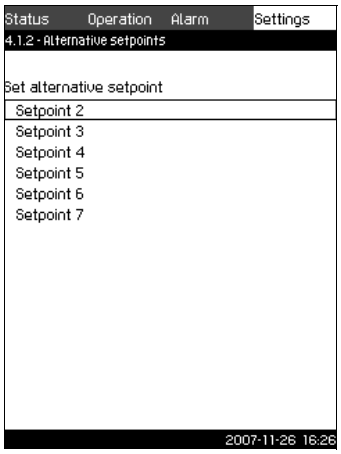
Setting via control panel

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

Factory setting

- K_p: 0.5
- T_i: 1 second

9.7.3 Alternative setpoints (4.1.2)



TM03 2383 4807

Fig. 36 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 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.

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9.7.4 Alternative setpoints 2 to 7 (4.1.2.1 to 4.1.2.7)

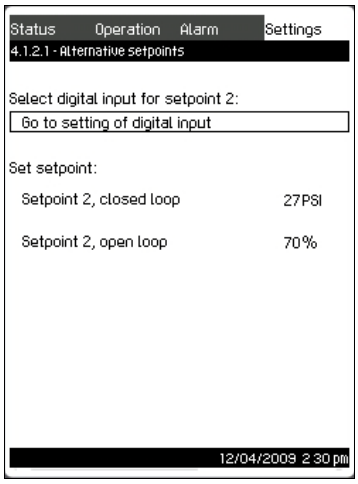

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Fig. 37 Alternative setpoints 2 to 7

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.

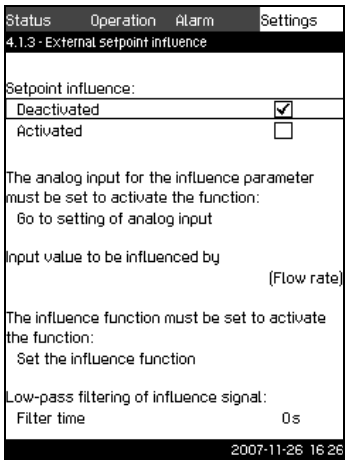
Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Primary controller** with ⊙ or ⊙, and press ⊙.
3. Mark **Alternative setpoints** 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 *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.

9.7.5 External setpoint influence (4.1.3)



TM03 8956 4807

Fig. 38 External setpoint influence

Description

This function makes it possible to adapt the setpoint by letting measuring parameters influence the setpoint. Typically an analog signal from a flow or temperature transmitter, or a similar transmitter.

As an example, the setpoint can be adapted to parameters that can influence the discharge pressure or temperature of the system. The parameters which influence the performance of the booster system are shown as a percentage from 0 to 100 %. They can only reduce the setpoint, as the influence as a percentage divided with 100 is multiplied with the setpoint:

$$\text{Setpoint}_{\text{current(SP)}} = \text{Setpoint}_{\text{selected}} \times \text{Infl.(1)} \times \text{Infl.(2)} \times \ldots$$

The influence values can be set individually.

A low-pass filter ensures smoothing of the measured value which influences the setpoint. This results in stable setpoint changes.

Setting range

The following parameters can be selected.

- 0-100 % signal
- Inlet pressure
- Discharge pressure
- External pressure
- Differential pressure, pump
- Differential pressure, external
- Flow rate
- Tank level, discharge side
- Tank level, suction side
- Flow pipe temperature
- Return pipe temperature
- Ambient temperature
- Return pipe temperature, external
- Differential temperature.

Setting via control panel

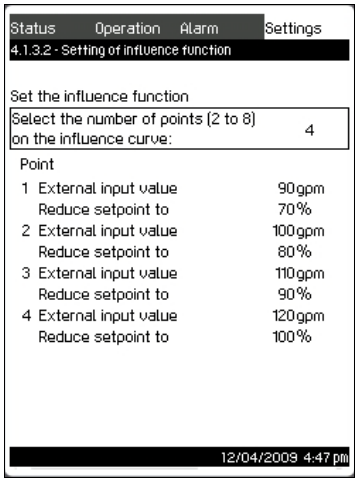
1. Mark the **Settings** menu with ⊙.
2. Mark **Primary controller** with ⊙ or ⊙, and press ⊙.
3. Mark **External setpoint influence** with ⊙ or ⊙, and press ⊙.
4. Mark **Input value to be influenced by** with ⊙ or ⊙, and press ⊙.
   Now a list of available parameters appear.
5. Mark the parameter which is to influence the setpoint with ⊙ or ⊙, and press ⊙.
6. Return with ⊙.
7. Mark **Set the influence function** with ⊙ or ⊙, and press ⊙. For details, see section *9.7.6 Setting of influence function (4.1.3.2)*.
8. Mark the menu line for number of points with ⊙ or ⊙, and press ⊙.
9. Select the required number of points with ⊙ or ⊙, and save with ⊙.
10. Mark **External input value** (point 1) with ⊙ or ⊙.
11. Set the value of the external input value with ⊙ or ⊙, and save with ⊙.
12. Mark **Reduce setpoint to** (point 1) with ⊙ or ⊙.
13. Set the value as a percentage with ⊙ or ⊙, and save with ⊙.
14. Repeat points 8 to 13 for all desired parameters.
15. Return with ⊙.
16. Mark **Filter time** with ⊙ or ⊙, set the time in seconds with ⊙ or ⊙, and save with ⊙.

17. Mark **Activated** with ⌄ or ⌃, and press ok. The check mark in the right box shows that the function has been activated.

Factory setting

Setpoint influence is not activated.

9.7.6 Setting of influence function (4.1.3.2)



TM04 6189 5009

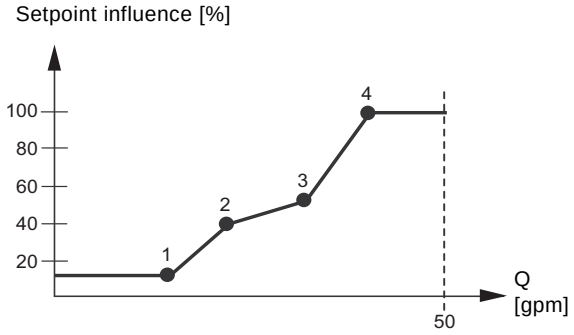
Fig. 39 Setting of influence function

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 a maximum of eight points by means of the control panel.

Example with four points:



TM03 1691 4807

Fig. 40 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.

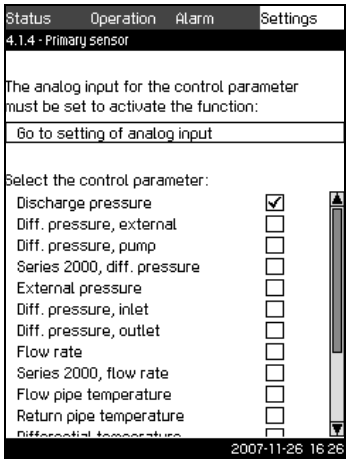
Setting via control panel

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

Factory setting

External setpoint influence is not activated.

9.7.7 Primary sensor (4.1.4)



TM03 8958 4807

Fig. 41 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 the CU 351.

If another control parameter is selected, the sensor must be connected to AI3 (CU 351) which is then set to one of the chosen parameters listed below.

Setting range

- Discharge pressure (factory setting)
- Differential pressure, external
- Differential pressure, pump
- Series 2000, differential pressure
- External pressure
- Differential pressure, inlet
- Differential pressure, outlet
- Flow rate
- Series 2000, flow rate
- Flow pipe temperature
- Return pipe temperature
- Differential temperature
- Ambient temperature
- Return pipe temperature, external
- 0-100 % signal
- Not used.

US

US

Setting via control panel

1. Mark the **Settings** menu with .
2. Mark **Primary controller** with or , and press .
3. Mark **Primary sensor** with or , and press .
4. Mark **Go to setting of analog input** with or , and press .
   Now the display *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 .
5. Select the control parameter for the primary sensor with or , and press .

Note

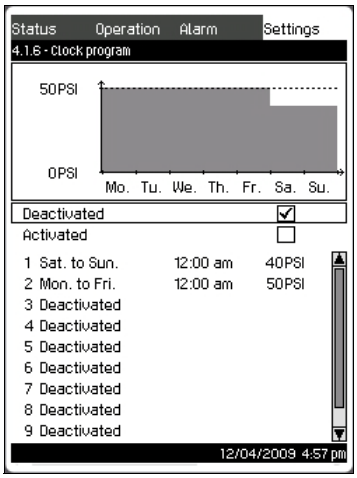
If the primary parameter is discharge pressure, AI1 (CU 351) must be set to this parameter.

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).

9.7.8 Clock program (4.1.6)



TM04 6206 5009

Fig. 42 Clock program

Description

With this function, it is possible to set setpoints and day and time for their activation. It is also possible to set day and time for stop of the Hydro MPC system.

If the clock program is deactivated, the setpoint of the program will remain active.

Note

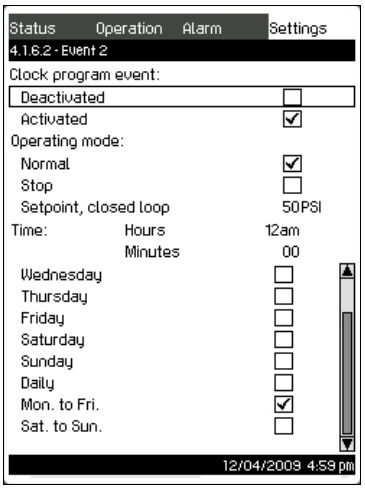
A minimum of two events are required when activating the clock program; one to start the system and one to stop the system.

Setting range

- Activation of the function.
- Activation and setting of event.

Setting via control panel

1. Mark the **Settings** menu with .
2. Mark **Primary controller** with or , and press .
3. Mark **Clock program** with or , and press .
4. Mark **Event 1** with or , and press .



TM04 6196 5009

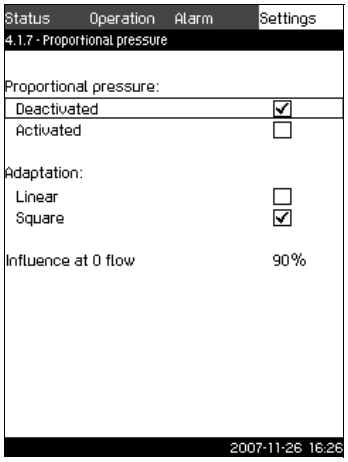
Fig. 43 Event 1

5. Mark operating mode **Normal** or **Stop** with or , and press . (If **Stop** is selected, Step 6 is skipped.)
6. Mark **Setpoint, closed loop** with or . Set the pressure with or , and save with .
7. Mark **Time (hours, minutes)** with or .
8. Set the time with or , and save with .
9. Mark day of week on which the settings are to be activated with or , and press .
10. Mark **Activated** with or , and press .
11. Repeat Steps 4 to 10 if several events are to be activated.
    Note: Up to ten events can be set.
12. Return with .
13. Mark **Activated** with or , and press . The check mark in the right box shows that the function has been activated.

Factory setting

The function is deactivated.

9.7.9 Proportional pressure (4.1.7)

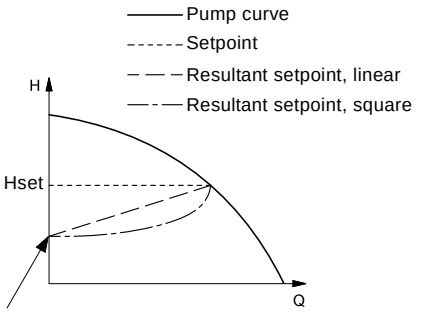


TM03 8960 4807

Fig. 44 Proportional pressure

Description

The function can only be activated in pressure-controlled systems and automatically adapts the setpoint set to the current flow rate. The adaptation can be linear or square. See fig. 45.



Starting point of proportional pressure control
(Influence at 0 flow = x % of H_{set})

TM03 8524 1807

Fig. 45 Proportional pressure

The function has these purposes:

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

Setting range

- Activation of the function.
- Selection of control mode.
- Setting of setpoint influence.

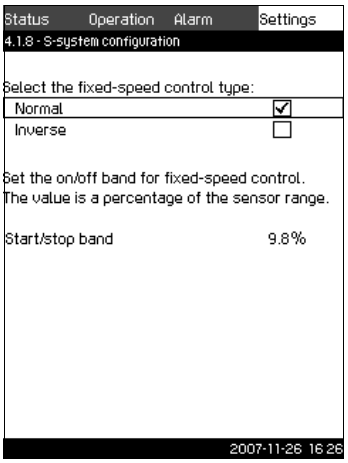
Setting via control panel

1. Mark the **Settings** menu with ›.
2. Mark **Primary controller** with ⌄ or ⌃, and press ok.
3. Mark **Proportional pressure** with ⌄ or ⌃, and press ok.
4. Mark **Activated** with ⌄ or ⌃, and press ok. The check mark in the right box shows that the function has been activated.
5. Mark **Adaptation, linear** or **square** with ⌄ or ⌃, and press ok.
6. Mark **Influence at 0 flow** with ⌄ or ⌃. Set the value with + or −, and save with ok.

Factory setting

The function is deactivated.

9.7.10 S-system configuration (4.1.8)



TM03 8961 4807

Fig. 46 S-system configuration

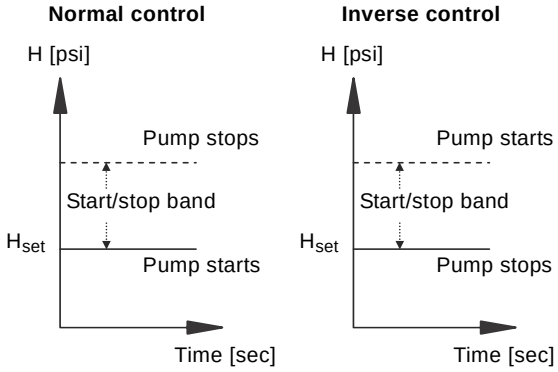
Description

The function makes it possible to invert the control of constant speed pumps (Hydro MPC-S). That is to set whether pumps are to be started or stopped depending on the current value.

A start/stop band must be set in order to use this function. See fig. 47.

Normal control: A pump is stopped when the current value becomes higher than H_{set} + start/stop band. And a pump is started when the current value becomes lower than H_{set}. See fig. 47.

Inverse control: A pump is started when the current value becomes higher than H_{set} + start/stop band. And a pump is stopped when the current value becomes lower than H_{set}. See fig. 47.



TM03 9205 3607 - TM03 9205 3607

Fig. 47 Normal and inverse control

Setting range

- Selection of configuration (normal or inverse control).
- Setting of start/stop band.

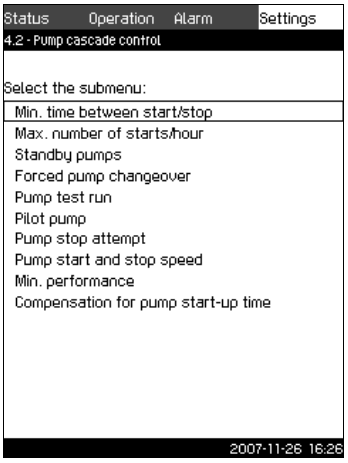
Setting via control panel

1. Mark the **Settings** menu with ›.
2. Mark **Primary controller** with ⌄ or ⌃, and press ok.
3. Mark **S-system configuration** with ⌄ or ⌃, and press ok.
4. Mark **Inverse** with ⌄ or ⌃, and press ok.
5. Mark **Start/stop band** with ⌄ or ⌃. Set the value + with or −, and save with ok.

Factory setting

Normal.

9.7.11 Pump cascade control (4.2)



TM03 8962 4807

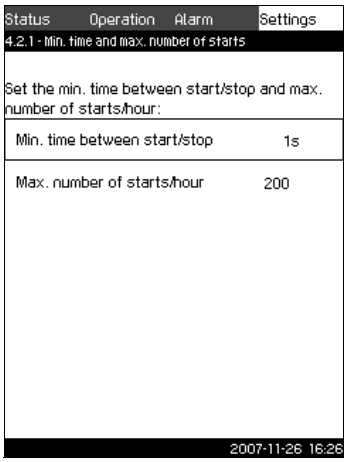
Fig. 48 Pump cascade control

US

In this menu section, it is possible to set the functions connected to pump cascade control. The following menus can be selected:

- Min. time between start/stop
- Max. number of starts/hour
- Standby pumps
- Forced pump changeover
- Pump test run
- Pilot pump
- Pump stop attempt
- Pump start and stop speed
- Min. performance
- Compensation for pump start-up time.

9.7.12 Min. time between start/stop (4.2.1)



TM03 2367 4807

Fig. 49 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 is to prevent hunting when pumps start and stop continuously.

Setting range

From 1 to 3600 seconds.

Setting via control panel

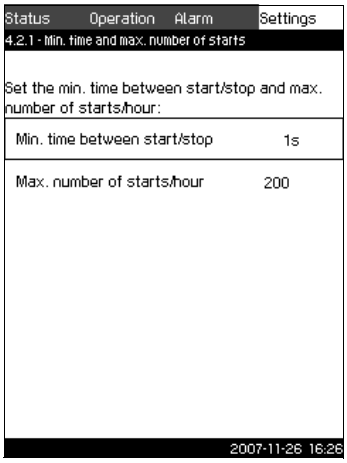
1. Mark the **Settings** menu with ⊙.
2. Mark **Pump cascade control** with ⊙ or ⊙, and press ⊙.
3. Mark **Min. time between start/stop** with ⊙ or ⊙, and press ⊙.
4. Mark **Min. time between start/stop** with ⊙ or ⊙, and press ⊙.
5. Set the required minimum time with ⊙ or ⊙, and save with ⊙.

Factory setting

Minimum time between start/stop of pumps:

Hydro MPC-E:	1 second
Hydro MPC-F and -S:	5 seconds

9.7.13 Max. number of starts/hour (4.2.1)



TM03 2367 4807

Fig. 50 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 systems with mains-operated pumps.

Each time a pump starts or stops, the CU 351 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 per hour.

The time between pump starts must be between the minimum time between start/stop, see section *9.7.12*, and 3600/n, n being the set number of starts per hour.

Setting range

1 to 1000 starts per hour.

Setting via control panel

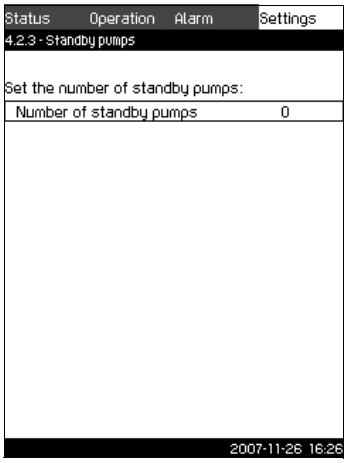
1. Mark the **Settings** menu with ⊙.
2. Mark **Pump cascade control** with ⊙ or ⊙, and press ⊙.
3. Mark **Max. number of starts/hour** with ⊙ or ⊙, and press ⊙.
4. Mark **Max. number of starts/hour** with ⊙ or ⊙, and press ⊙.
5. Set the permissible number of starts per hour with ⊙ or ⊙, and save with ⊙.

Factory setting

Hydro MPC-E:	200 starts per hour
Hydro MPC-F and -S:	100 starts per hour

Note **This function has no influence on *Stop function (4.3.1)*.**

9.7.14 Standby pumps (4.2.3)



TM03 2366 4807

Fig. 51 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 stopped, the standby pump will be started. The performance of the booster system is thus not reduced.

The status as standby pump alternates between all pumps.

Setting range

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

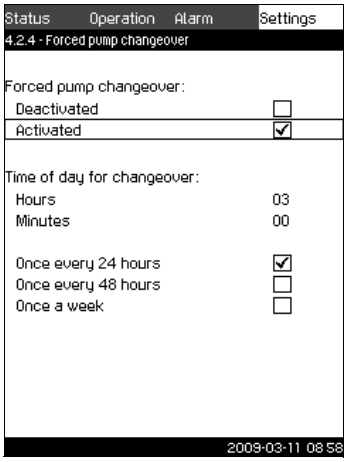
Setting via control panel

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.

9.7.15 Forced pump changeover (4.2.4)



TM03 2365 1109

Fig. 52 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 CU 351 checks if any pump running has a larger number of operating hours than pumps that are stopped. If this is the case, the pump will be 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.

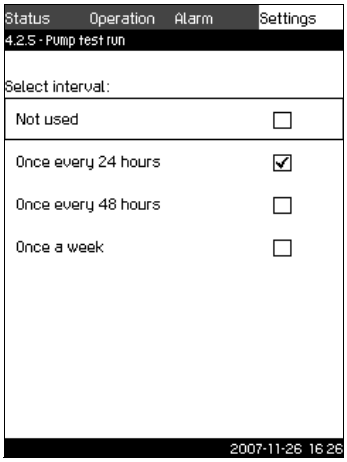
Setting via control panel

1. Mark the **Settings** menu with ›.
2. Mark **Pump cascade control** with ⌄ or ⌃, and press ok.
3. Mark **Forced pump changeover** with ⌄ or ⌃, and press ok.
4. Mark **Activated** with ⌄ or ⌃, and press ok. The check mark in the right box shows that the function has been activated.
5. Mark **Time for changeover** with ⌄, and press ok.
6. Set the time with ⊕ or ⊖, and save with ok.

Factory setting

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

9.7.16 Pump test run (4.2.5)



TM03 2364 4807

Fig. 53 Pump 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, it is 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.

The pumps start automatically one by one and run for five seconds.

US

US

Note

Pumps in the operating mode Manual are not included in the test run. If there is an alarm, the test run will not be carried out. Pilot pumps are included in the pump test run.

Setting range

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

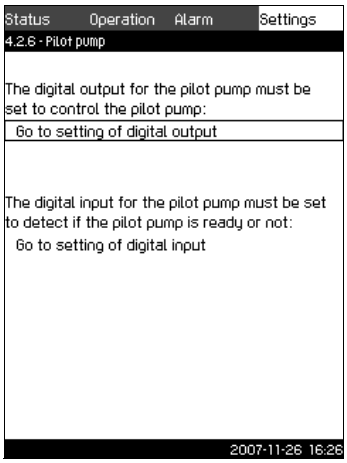
Setting via control panel

1. Mark the **Settings** menu with ▶.
2. Mark **Pump cascade control** with ▼ or ▲, and press OK.
3. Mark **Pump test run** with ▼ or ▲, and press OK.
4. Select the interval with ▼ or ▲.
5. Activate the function with OK.

Factory setting

Test runs are set to **Not Used**.

9.7.17 Pilot pump (4.2.6)



TM03 8963 4807

Fig. 54 Pilot pump

Description

The function controls a pilot pump via a digital output. The pilot pump takes over the operation from the main pumps in periods when the consumption is so small that the stop function of the main pumps is activated. See section *9.7.23 Stop function (4.3.1)*.

Via a digital input, the operational state of the pilot pump is monitored, i.e. whether it is operational or in a fault condition.

The purpose is to

- save energy
- reduce the number of operating hours of the main pumps.

If the pilot pump cannot keep the pressure by itself, one or more main pumps are started. If only one main pump is started and runs on/off operation, the pilot pump remains cut in. If one or more main pumps run continuously, the pilot pump is cut out.

Note

Set the setpoint of the pilot pump to this value:
H_{set} + 1/8 on/off band + 10 psi
If the setpoint of the main pumps is changed, the setpoint of the pilot pump must be changed too.

Setting range

- See section *9.7.31 Digital outputs (4.3.9)*.
- See section *9.7.26 Digital inputs (4.3.7)*.

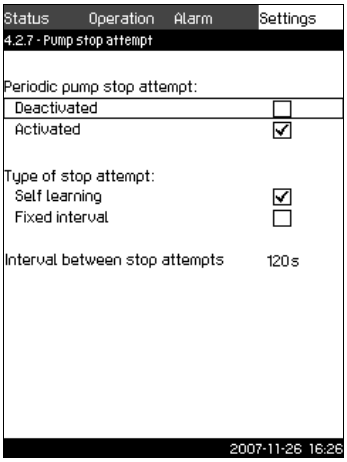
Setting via control panel

1. Mark the **Settings** menu with ▶.
2. Mark **Pump cascade control** with ▼ or ▲, and press OK.
3. Mark **Pilot pump** with ▼ or ▲, and press OK.
4. Mark **Go to setting of digital output** with ▼ or ▲, and press OK.
5. Select a digital output with ▼ or ▲, and press OK.
6. Mark **Pilot pump control** with ▼ or ▲, and save with OK.
7. Return by pressing ESC twice.
8. Mark **Go to setting of digital input** with ▼ or ▲, and press OK.
9. Select a digital input ▼ or ▲, and press OK.
10. Mark **Pilot pump fault** with ▼ or ▲, and save with OK.

Factory setting

The function is deactivated.

9.7.18 Pump stop attempt (4.2.7)



TM03 8964 4807

Fig. 55 Pump stop attempt

Description

The function makes it possible to set automatic stop attempts of a pump when several pumps are running. It ensures that the optimum number of pumps is always running, in terms of energy consumption. At the same time, the purpose is to avoid disturbances in connection with automatic stop of pumps.

Stop attempts can either take place with a fixed interval set under **Interval between stop attempts** or by self learning. If self learning is selected, the interval between stop attempts will be increased if repeated attempts to stop the pump fail.

Setting via control panel

1. Mark the **Settings** menu with ▶.
2. Mark **Pump cascade control** with ▼ or ▲, and press OK.
3. Mark **Pump stop attempt** with ▼ or ▲, and press OK.
4. Mark **Self learning** or **Fixed interval** with ▼ or ▲, and press OK.
5. If **Fixed interval** is selected:
6. Mark **Interval between stop attempts** with ▼ or ▲.
7. Set the interval with ⊕ or ⊖, and save with OK.
8. Mark **Activated** with ▼ or ▲, and press OK. The check mark in the right box shows that the function has been activated.

Factory setting

The function is activated.

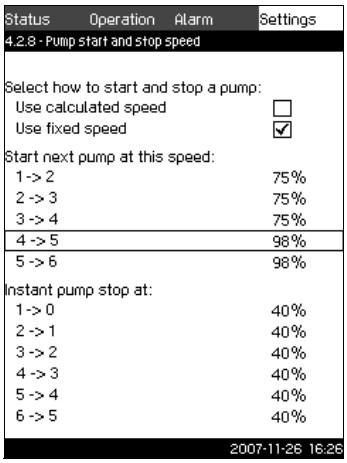
9.7.19 Pump start and stop speed (4.2.8)

Description

The function controls the starting and stopping of pumps. There are two options:

1. Use calculated speed
   This function ensures that the optimum number of pumps is always running at a desired duty point, in terms of energy consumption. The CU 351 calculates the required number of pumps and their speed. This requires that the differential pressure of the pump is measured by a differential pressure sensor or separate pressure sensors on the inlet and discharge side.
   When calculated speed has been selected, the CU 351 ignores the percentages set.
2. Use fixed speed
   The pumps are started and stopped at speeds set by the user.

1. Use calculated speed



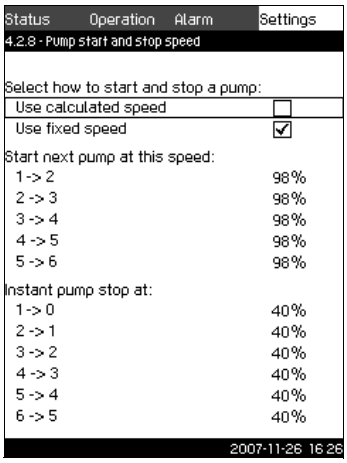
TM03 8966 4807

Fig. 56 Calculated pump start and stop speed

Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Pump cascade control** with ⊙ or ⊙, and press ⊙.
3. Mark **Pump start and stop speed** with ⊙ or ⊙, and press ⊙.
4. Mark **Use calculated speed** with ⊙ or ⊙, and press ⊙.

2. Use fixed speed



TM03 8965 4807

Fig. 57 Fixed pump start and stop speed

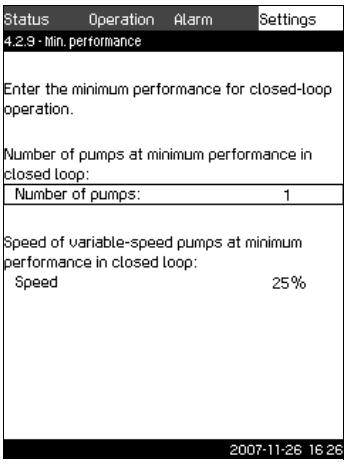
Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Pump cascade control** with ⊙ or ⊙, and press ⊙.
3. Mark **Pump start and stop speed** with ⊙ or ⊙, and press ⊙.
4. Mark **Use fixed speed** with ⊙ or ⊙, and press ⊙.
5. Mark **Start of next pump at: 1->2** with ⊙ or ⊙, and press ⊙.
6. Set the speed as percentage with ⊕ or ⊖, and save with ⊙. Set the other pumps in the same way.
7. Mark **Instant pump stop at: 1->0** with ⊙ or ⊙, and press ⊙.
8. Set the speed as percentage with ⊕ or ⊖, and save with ⊙. Set the other pumps in the same way.

Factory setting

The function is set to calculated speed.

9.7.20 Min. performance (4.2.9)



TM03 8967 4807

Fig. 58 Min. performance

Description

This function ensures circulation in a system. Note that the stop function, if activated, can influence this function. See section *9.7.23 Stop function (4.3.1)*. Examples:

- If 0 or 1 pump has been selected as a minimum, the stop function can stop the pump if there is no or a very small consumption.
- If two or more pumps have been selected as a minimum, the stop function is not active.

Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Pump cascade control** with ⊙ or ⊙, and press ⊙.
3. Mark **Min. performance** with ⊙ or ⊙, and press ⊙.
4. Set **Number of pumps** with ⊕ or ⊖, and save with ⊙.
5. Mark **Speed** with ⊙ or ⊙. Set the speed with ⊕ or ⊖, and save with ⊙.

Factory setting

The number of pumps is set to 1. The speed in closed loop is set to 25 %.

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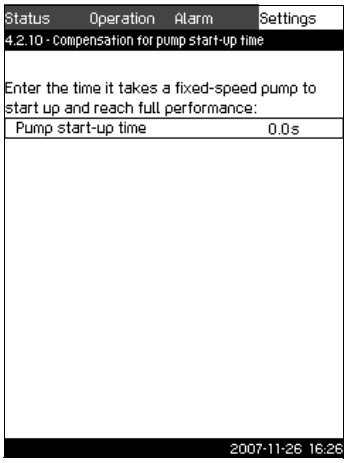
9.7.21 Compensation for pump start-up time (4.2.10)



TM03 8968 4807

Fig. 59 Compensation for pump start-up time

Description

The function is used for the Hydro MPC-F systems only.

The purpose is to avoid disturbances when a constant speed pump with fixed speed is started. The function compensates for the time it takes a constant speed pump to reach its full performance after start. The start-up time of the constant speed pump must be known.

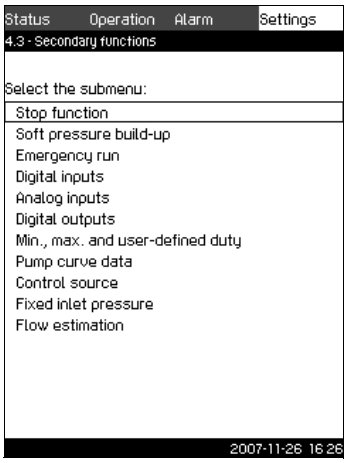
Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Pump cascade control** with ⊙ or ⊙, and press ok.
3. Mark **Compensation for pump start-up time** with ⊙ or ⊙, and press ok.
4. Set the start-up time with ⊕ or ⊖, and save with ok.

Factory setting

The start-up time is set to 0 seconds.

9.7.22 Secondary functions (4.3)



TM03 8969 4807

Fig. 60 Secondary functions

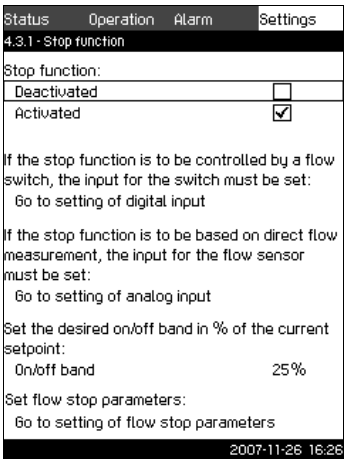
Description

Functions that are secondary in relation to the normal operation of the Hydro MPC booster system 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)*
- *Soft pressure build-up (4.3.3)*
- *Digital inputs (4.3.7)*
- *Analog inputs (4.3.8)*
- *Digital outputs (4.3.9)*
- *Emergency run (4.3.5)*
- *Min., max. and user-defined duty (4.3.14)*
- *Pump curve data (4.3.19)*
- *Flow estimation (4.3.23)*
- *Control source (4.3.20)*
- *Fixed inlet pressure (4.3.22)*.

9.7.23 Stop function (4.3.1)



TM03 2355 4807

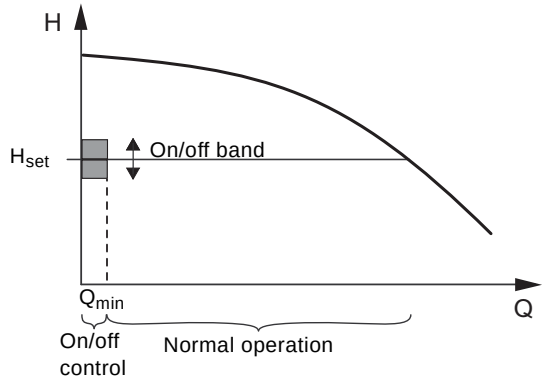
Fig. 61 Stop function

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 systems with variable-speed pumps. Hydro MPC-S will have on/off control of all pumps as described in section *6.1 Examples of control variants*.



TM03 1692 2705

Fig. 62 On/off band

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

Before stopping, the pump increases the pressure to a value corresponding to H_{set} + 0.5 x on/off band. The pump is restarted when the pressure is H_{set} – 0.5 x on/off band. See fig. 63.

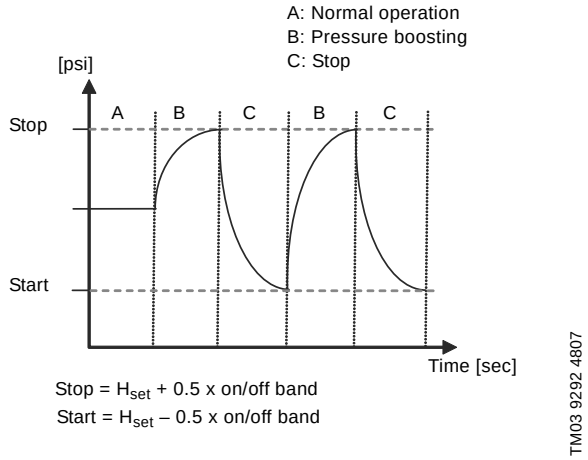


Fig. 63 On/off operation

The flow rate is estimated by the CU 351 when the pump is in the stop period. As long as the flow rate is lower than Q_{min}, the pump will run on/off. If the flow rate is increased to above Q_{min}, the pump returns to normal operation, H_{set}. H_{set} is equal to the current setpoint. See section *9.4.4 Setpoint (1.2.2)*.

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 system 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.

Diaphragm tank size

- The diaphragm tank needs to be installed on the discharge side of the booster system. If the tank is installed on the discharge in a location with a higher elevation then the booster system, then the pre-charge pressure should be adjusted to negate the elevation pressure difference from the tank location and where the booster system is installed.
- The diaphragm tank should be installed on the discharge side of the booster sytem with an isolation valve, then a drain valve, and then connected to the diaphragm tank.

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

Precharge pressure

Hydro MPC-E 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 % of the setpoint. If this disturbance is not acceptable, the stop function must be based on direct flow measurement with a flowmeter or flow switch.

The minimum flow rate can be set, i.e. the flow rate at which the booster system changes to on/off control of the last pump in operation.

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 **Activated** 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.
7. Mark **Go to setting of flow stop parameters** with ⌄ or ⌃, and press OK.
   Now the display below is shown.

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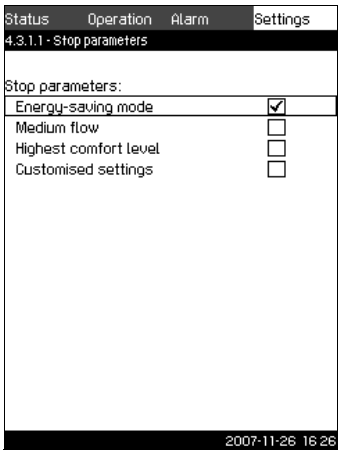
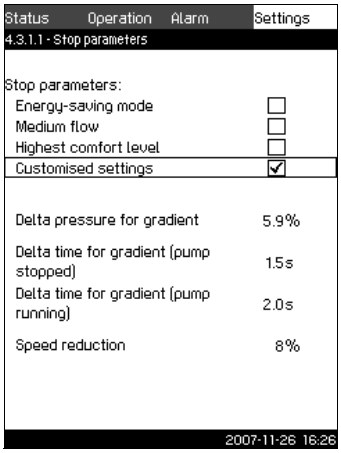


TM03 9966 4807

Fig. 64 Stop parameters

8. Select one of the stop parameters with ⌄ or ⌃, and save with ok. If **Customised settings** are selected, the parameters shown in fig. 65 must be set. See examples below.



TM03 8957 4807

Fig. 65 Customized settings

Note ***Rule of thumb: Speed reduction = 2 x delta pressure for gradient.***

Example 1: Increasing the stop limit, Q_{min} (high flow limit)

- Increase the delta pressure for gradient.
- Reduce the delta time for gradient (pump stopped).
- Reduce the delta time for gradient (pump running).
- Increase the speed reduction.

Example of increased stop limit	
Parameter	**Value**
Delta pressure for gradient	6 %
Delta time for gradient (pump stopped)	1.5 sec
Delta time for gradient (pump running)	2.0 sec
Speed reduction	10 %

Example 2: Reducing the stop limit, Q_{min} (low flow limit)

- Reduce the delta pressure for gradient.
- Increase the delta time for gradient (pump stopped).
- Increase the delta time for gradient (pump running).
- Reduce the speed reduction.

Note ***The stop limit depends on the tank size.***

Example of reduced flow limit	
Parameter	**Value**
Delta pressure for gradient	3 %
Delta time for gradient (pump stopped)	15.0 sec
Delta time for gradient (pump running)	25.0 sec
Speed reduction	6 %

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 *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 *Analog inputs (4.3.8)* appears.
2. Select the analog input where the flowmeter is connected, and set up the input for the flowmeter by selecting **Flow rate**.
3. Return to **Stop function** by pressing esc twice.
4. Mark **Stop limit** with ⌄ or ⌃.
5. Set the value with ⊕ or ⊖, and save with ok.

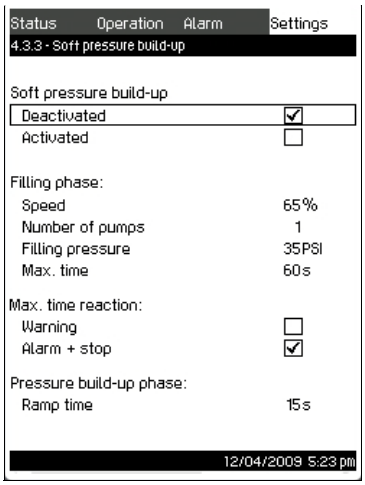
Factory setting

The function is activated.

On/off band: 25 %

Min. flow rate: 30 % of the nominal flow rate of one pump

9.7.24 Soft pressure build-up (4.3.3)



TM04 6197 5009

Fig. 66 Soft pressure build-up

Description

The function ensures a smooth start-up of systems with for instance empty pipes.

Start-up takes place in two phases. See fig. 67.

1. Filling phase.
   The pipework is slowly filled with water. When the pressure sensor of the system detects that the pipework has been filled, phase two begins.

2. Pressure build-up phase.
   The system pressure is increased until the setpoint is reached. The pressure build-up takes place over a ramp time. If the setpoint is not reached within a given time, a warning or an alarm can be given, and the pumps can be stopped at the same time.

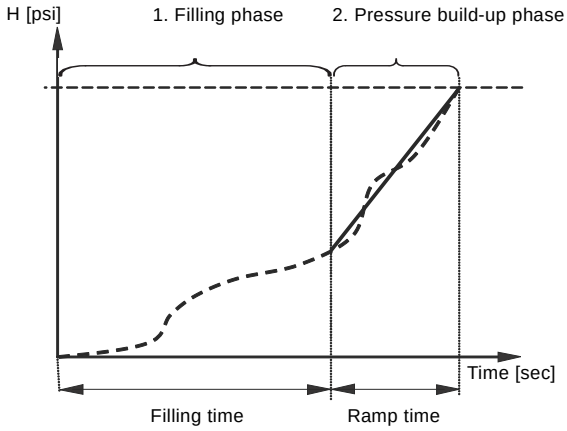


Fig. 67 Filling and pressure build-up phases

Setting range

- Activation of the function.
- Setting of pump speed.
- Setting of number of pumps.
- Setting of filling pressure.
- Setting of maximum filling time.
- Setting of warning or alarm + stop.
- Setting of ramp time for the pressure build-up phase.

Setting via control panel

1. Mark the **Settings** menu with ⊙
2. Mark **Secondary functions** with ⊙ or ⊙, and press ⊙.
3. Mark **Soft pressure build-up** with ⊙ or ⊙, and press ⊙.
4. Mark **Speed** with ⊙ or ⊙.
5. Set the value with ⊙ or ⊙, and save with ⊙.
6. Mark **Number of pumps** with ⊙ or ⊙.
7. Set the value with ⊙ or ⊙, and save with ⊙.
8. Mark **Filling pressure** with ⊙ or ⊙.
9. Set the value with ⊙ or ⊙, and save with ⊙.
10. Mark **Max. time** with ⊙ or ⊙.
11. Set the value with ⊙ or ⊙, and save with ⊙.
12. Mark **Warning** or **Alarm + stop** with ⊙ or ⊙, and press ⊙.
13. Mark **Ramp time** with ⊙ or ⊙.
14. Set the value with ⊙ or ⊙, and save with ⊙.
15. Mark **Activated**, and press ⊙.

Factory setting

The function is deactivated.

9.7.25 Emergency run (4.3.5)

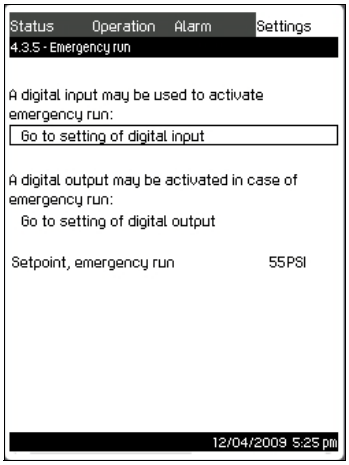


Fig. 68 Emergency run

Description

When this function has been activated, the pumps will keep running regardless of warnings or alarms. The pumps will run according to a setpoint set specifically for this function.

Caution ***In case of sensor fault, both main and standby pumps will run at 100 % speed!***

Setting range

- Setting of digital input (*9.7.26 Digital inputs (4.3.7)*).
- Setting of digital output (*9.7.31 Digital outputs (4.3.9)*).
- Setting of setpoint for emergency run.

Setting via control panel

1. Mark the **Settings** menu with ⊙
2. Mark **Secondary functions** with ⊙ or ⊙, and press ⊙.
3. Mark **Emergency run** with ⊙ or ⊙, and press ⊙.
4. Mark **Go to setting of digital input** with ⊙ or ⊙, and press ⊙.
5. Select a digital input with ⊙ or ⊙, and press ⊙.
6. Mark **Emergency run** with ⊙ or ⊙, and save with ⊙.
7. Return by pressing ⊙ twice.
8. Mark **Go to setting of digital output** with ⊙ or ⊙, and press ⊙.
9. Select a digital output with ⊙ or ⊙, and press ⊙.
10. Mark **Emergency run** with ⊙ or ⊙, and save with ⊙.
11. Return by pressing ⊙ twice.
12. Mark **Setpoint, emergency run** with ⊙ or ⊙.
13. Set the value with ⊙ or ⊙, and save with ⊙.

Note ***When this function has been set as described above, it can also be activated via the display System operating mode (2.1.1).***

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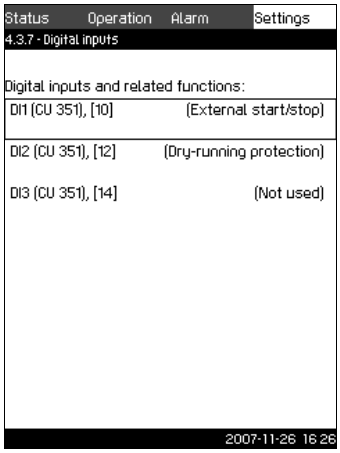
9.7.26 Digital inputs (4.3.7)



TM03 2359 4807

Fig. 69 Digital inputs

Description

In this menu, the digital inputs of the CU 351 can be set. Each input, except DI1, 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 cabinet.

Setting range

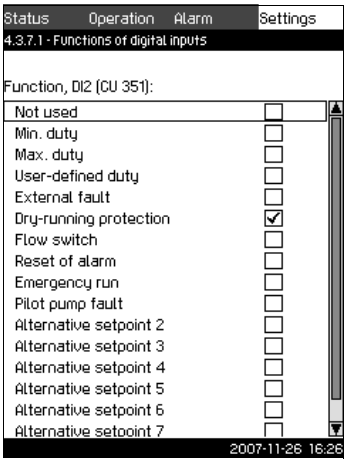
The digital input to be set is selected in the display *Digital inputs (4.3.7)*.

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 ⊙.
3. Mark **Digital inputs** ⊙ or ⊙, and press ⊙.
4. Select the digital input with ⊙ or ⊙, and press ⊙.

9.7.27 Functions of digital inputs (4.3.7.1)



TM03 8972 4807

Fig. 70 Functions of digital inputs

Description

In the displays 4.3.7.1, 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
Reset of alarm	= Reset alarms
Emergency run	= Operating mode *Emergency run*
Pilot pump fault	= Pilot pump fault
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

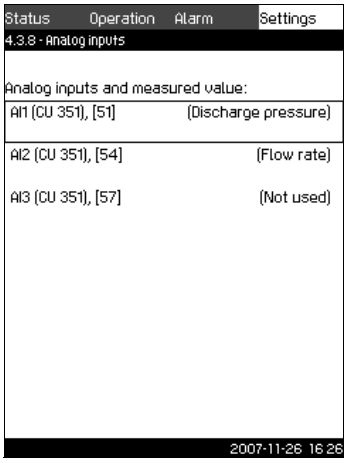
1. Mark the **Settings** menu with ⊙.
2. Mark **Secondary functions** with ⊙ or ⊙, and press ⊙.
3. Mark **Digital inputs** with ⊙ or ⊙, and press ⊙.
4. Select the digital input with ⊙ or ⊙, and press ⊙.
5. Select the desired function with ⊙ or ⊙, and activate it with ⊙.
   The activation is indicated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

Factory setting

Digital input	Function
DI1 (CU 351) [10]	External start/stop. Open contact = stop. **Note:** Input No 1 cannot be changed.
DI2 (CU 351) [12]	Monitoring of water shortage (dry-running protection). Open contact = water shortage (if the Hydro MPC is supplied with this option).

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

9.7.28 Analog inputs (4.3.8)



TM03 2356 4807

Fig. 71 Analog inputs

Description

In this display, 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. A redundant primary sensor can be fitted as back-up for the primary sensor in order to increase reliability and prevent stop of operation.

Note ***If two sensors are to be redundant, each must have a separate analog input.***

Example

AI1 (CU 351) [51]:

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

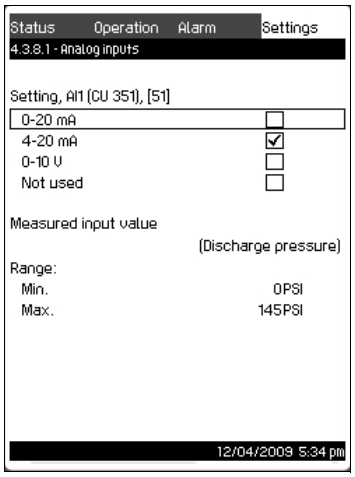
Setting range

In the display *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 ⊙.
3. Mark **Analog inputs** with ⊙ or ⊙, and press ⊙.
4. Select the analog input with ⊙ or ⊙, and press ⊙.

9.7.29 Analog inputs (4.3.8.1 to 4.3.8.7)



TM04 6187 5009

Fig. 72 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 0-145 psi.

Setting range

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

- Not used
- Range of input signal, 0-20 mA, 4-20 mA, 0-10 V
- Measured input value
- Sensor range.

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 the setting of the analog input with ⊙ or ⊙, and activate it with ⊙.
   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. When the analog input has been related to a function, CU 351 will return to the display for setting of analog inputs.

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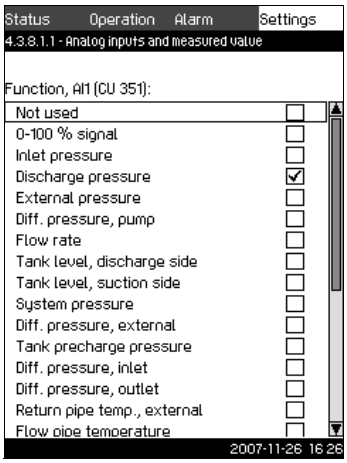
Factory setting

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

9.7.30 Analog inputs and measured value (4.3.8.1.1 to 4.3.8.7.1)



TM03 8973 4807

Fig. 73 Analog inputs and measured value

Description

In the display *Analog inputs and measured value (4.3.8.1.1 to 4.3.8.7.1)*, a function can be related to the individual analog inputs.

Setting range

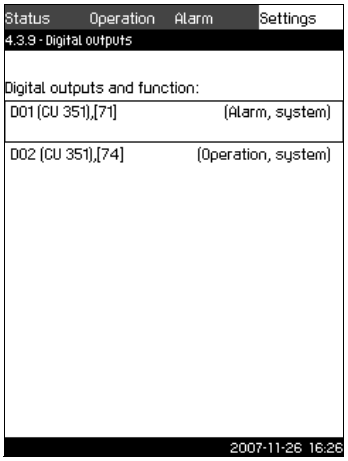
It is possible to select one function per analog input.

- Not used
- 0-100 % signal
- Inlet pressure
- Discharge pressure
- External pressure
- Differential pressure, pump
- Flow rate
- Tank level, discharge side
- Tank level, suction side
- System pressure
- Differential pressure, external
- Tank precharge pressure
- Differential pressure, inlet
- Differential pressure, outlet
- Return pipe temperature, external
- Flow pipe temperature
- Return pipe temperature
- Differential temperature
- Ambient temperature
- Power, pump 1 to 6
- Power, VFD.

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. Set the range of the analog input with ⌄ or ⌃, and press ok.
   The activation is indicated by a check mark.
6. Mark **Measured input value** with ⌄ or ⌃, and press ok.
   Now the display 4.3.8.1.1 appears.
7. Select the input with ⌄ or ⌃, and press ok.
8. Press esc to return to display 4.3.8.1.
9. Set the minimum sensor value with ⊕ or ⊖, and save with ok.
10. Set the maximum sensor value with ⊕ or ⊖, and save with ok.

9.7.31 Digital outputs (4.3.9)



TM03 2333 4807

Fig. 74 Digital outputs

Description

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

Example

DO1 (IO 351-41) [71]:

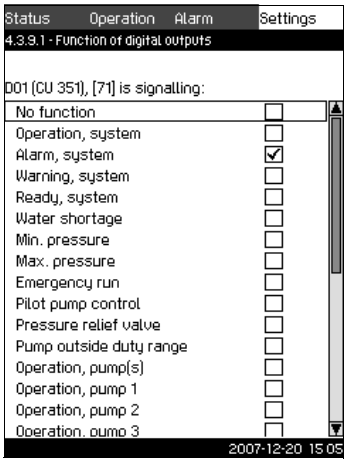
DO1	Digital output No 1
(IO 351-41)	IO 351B, GENIbus number 41
[71]	Terminal No 71

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

Setting range

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

9.7.32 Functions of digital outputs (4.3.9.1 to 4.3.9.16)



TM03 8974 4807

Fig. 75 Functions of digital outputs

Description

In the displays *Functions 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:

- No function
- Operation, system
- Alarm, system
- Warning, system
- Ready, system
- Water shortage
- Min. pressure
- Max. pressure
- Emergency run
- Pilot pump control
- Pressure relief valve
- Operation, pump 1 to 6
- Alarm, pump 1 to 6
- Alarm, limit 1 exceeded
- Warning, limit 1 exceeded
- Alarm, limit 2 exceeded
- Warning, limit 2 exceeded.

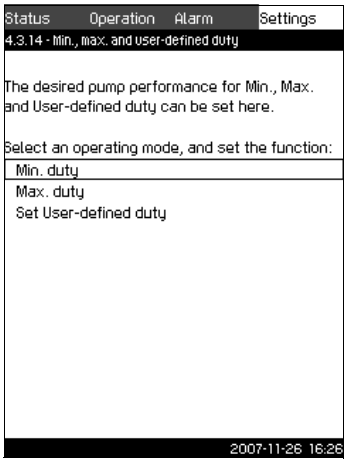
Setting via control panel

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) [71]	Alarm, system
DO2 (CU 351) [74]	Operation, system

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



TM03 2351 4807

Fig. 76 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 system run in open loop at a set pump performance.

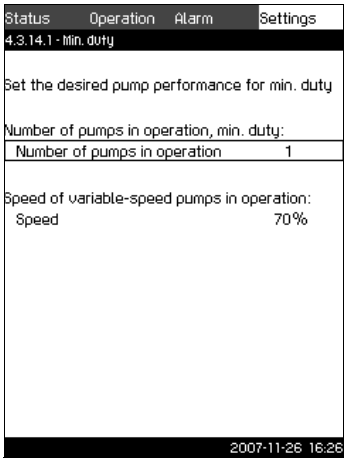
Setting range

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.***

9.7.34 Min. duty (4.3.14.1)



TM03 2354 4807

Fig. 77 Min. duty

Description

In all booster systems apart from Hydro MPC-S, minimum 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.

US

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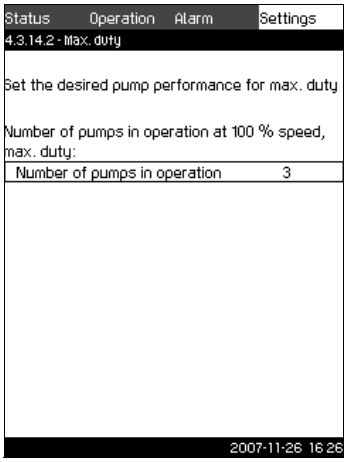
Setting via control panel

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 **Min. duty** with ⊙ or ⊙, and press ⊙.
5. Mark **Number of pumps in operation, min. duty** 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

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

9.7.35 Max. duty (4.3.14.2)



TM03 2353 4807

Fig. 78 Max. duty

Description

The function makes it possible for a set number of pumps to run at maximum performance 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.

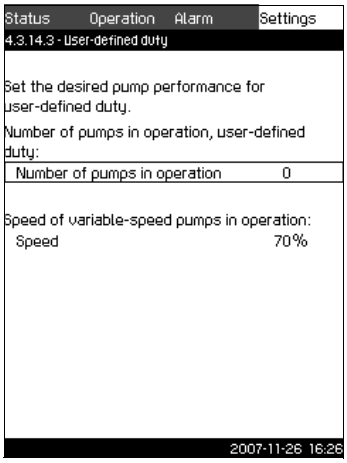
Setting via control panel

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 at 100 % speed, max. duty** 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)

9.7.36 User-defined duty (4.3.14.3)



TM03 2352 4807

Fig. 79 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 systems with only variable-speed pumps, the speed can be set between 25 and 100 %; in booster systems with both variable-speed pumps and constant speed pumps the speed can be set between 70 and 100 %.

Setting via control panel

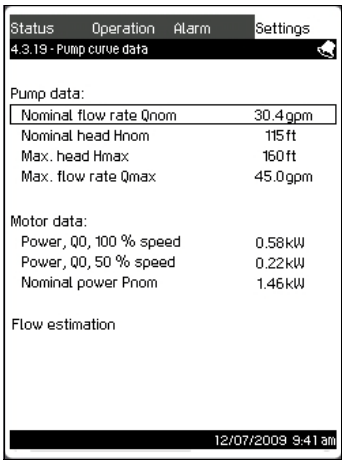
1. Mark the **Settings** menu with ⊙.
2. Mark **Secondary functions** with ⊙ or ⊙, and press ⊙.
3. Mark **Min., max. and user-defined duty** with ⊙ or ⊙, and press ⊙.
4. Mark **User-defined duty** with ⊙ or ⊙, and press ⊙.
5. Mark **Number of pumps in operation, user-defined duty** with ⊙ or ⊙.
6. Set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

9.7.37 Pump curve data (4.3.19)



TM04 6199 5009

Fig. 80 Pump curve data

Description

The CU 351 has a number of functions using these pump data:

- Nominal flow rate, Q_{nom}, in gpm
- Nominal head, H_{nom}, in feet
- Max. head, H_{max}, in feet
- Max. flow rate, $Q_{max,}$ in gpm
- Power, Q_0, 100 % speed, in kW
- Power, Q_0, 50 % speed, in kW
- Nominal power, P_{nom}, in kW.

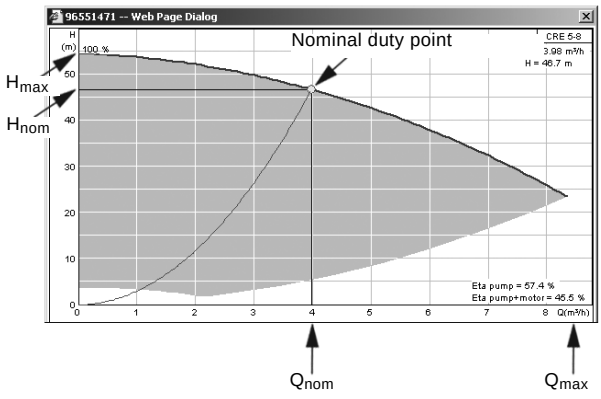
Note ***Grundfos can supply hydraulic data for CR, CRI, CRE and CRIE pumps where GSC files can be downloaded directly to the CU 351.***

Note ***The electrical data, "Power, Q0, 100 % speed" and "Power, Q0, 50 % speed" must be entered manually.***

For Grundfos E-pumps, the data of input power (P1) must be entered.

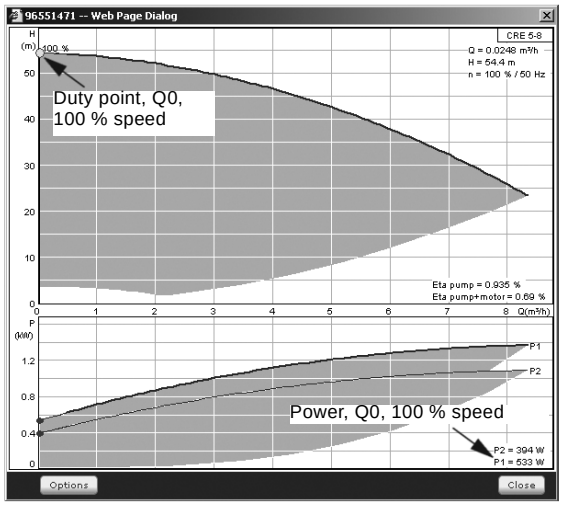
The data are read by means of the pump performance curves which can be found in WebCAPS on Grundfos' homepage, www.grundfos.com. See examples in figs 81 to 84.

If WebCAPS is not accessible, try to bring a pump into the three duty points: Power, Q0, 100 % speed, Power, Q0, 50 % speed and Nominal power, Pnom. Read the power values in displays 1.3 to 1.8, depending on the pump. See section *9.4.8 Pump 1...6 (1.3 to 1.8)*.



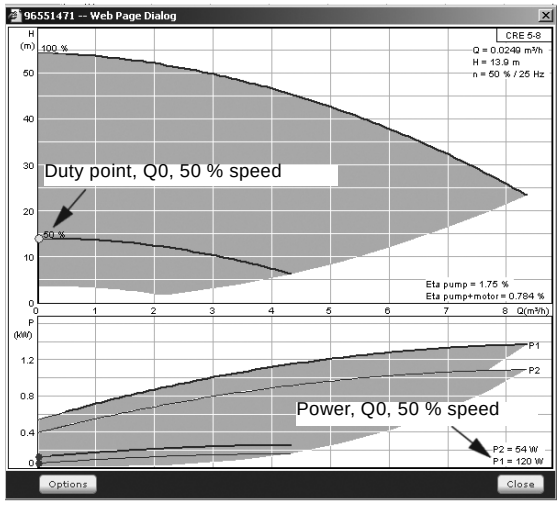
TM03 9993 4807

Fig. 81 Reading of Q_{nom}, H_{nom}, H_{max} and Q_{max} (WebCAPS)



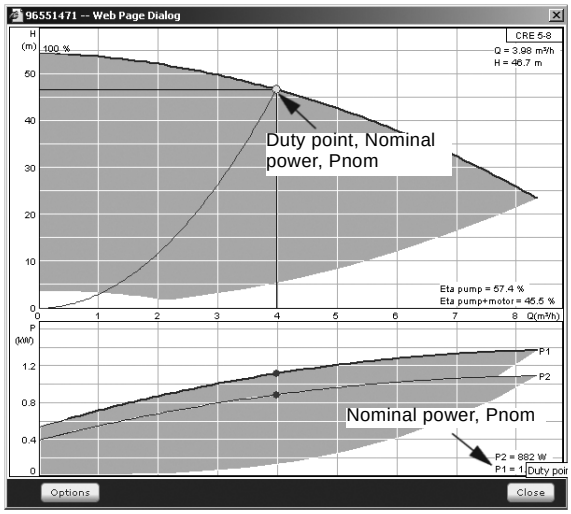
TM03 9994 4807

Fig. 82 Reading of Power, Q0, 100 % speed (WebCAPS)



TM03 9995 4807

Fig. 83 Reading of Power, Q0, 50 % speed (WebCAPS)



TM03 9996 4807

Fig. 84 Reading of Nominal power, Pnom (WebCAPS)

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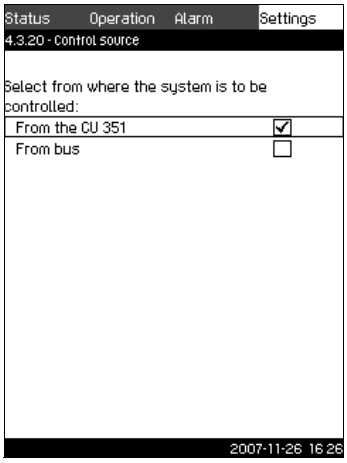
Note

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 ⊙.
3. Mark **Pump curve data** with ⊙ or ⊙, and press ⊙.
4. Mark **Nominal flow rate Q_{nom}** with ⊙ or ⊙.
5. Set the value with ⊙ or ⊙, and save with ⊙.
6. Mark **Nominal head H_{nom}** with ⊙ or ⊙.
7. Set the value with ⊙ or ⊙, and save with ⊙.
8. Mark **Max. head H_{max}** with ⊙ or ⊙.
9. Set the value with ⊙ or ⊙, and save with ⊙.
10. Mark **Max. flow rate Q_{max}** with ⊙ or ⊙.
11. Set the value with ⊙ or ⊙, and save with ⊙.
12. Mark **Power, Q_0, 100 % speed** with ⊙ or ⊙.
13. Set the value with ⊙ or ⊙, and save with ⊙.
14. Mark **Power, Q_0, 50 % speed** with ⊙ or ⊙.
15. Set the value with ⊙ or ⊙, and save with ⊙.
16. Mark **Nominal power P_{nom}** with ⊙ or ⊙.
17. Set the value with ⊙ or ⊙, and save with ⊙.

9.7.38 Control source (4.3.20)



TM03 2342 4807

Fig. 85 Control source

Description

Hydro MPC can be remote-controlled via an external bus connection (option). See section *9.8.2 GENIbus*. Control of the Hydro MPC can also take place via the bus connection. For further information, see section *9.8 Data communication*.

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

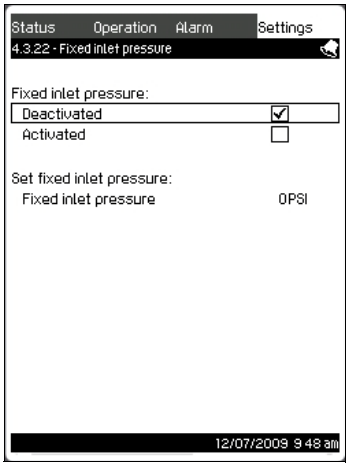
Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Secondary functions** with ⊙ or ⊙, and press ⊙.
3. Mark **Control source** with ⊙ or ⊙, and press ⊙.
4. Select the desired control source with ⊙ or ⊙, and save with ⊙.

Factory setting

The control source is CU 351.

9.7.39 Fixed inlet pressure (4.3.22)



TM04 6200 5009

Fig. 86 Fixed inlet pressure

Description

This function is only used when no inlet pressure sensor is fitted in the system and the inlet pressure is fixed and known.

If the Hydro MPC has a fixed inlet pressure, it can be entered in this display so that the CU 351 can optimize the performance and control of the booster system.

Setting range

A fixed inlet pressure can be set, and the function can be activated/deactivated.

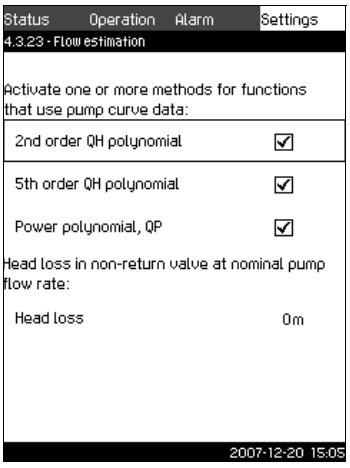
Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Secondary functions** with ⊙ or ⊙, and press ⊙.
3. Mark **Fixed inlet pressure** with ⊙ or ⊙, and press ⊙.
4. Set the inlet pressure with ⊙ or ⊙, and save with ⊙.
5. Mark **Activated** with ⊙ or ⊙, and press ⊙. The activation is indicated by a check mark in the box.

Factory setting

The function is deactivated.

9.7.40 Flow estimation (4.3.23)



TM03 8977 4807

Fig. 87 Flow estimation

Description

As described in section *9.7.37 Pump curve data (4.3.19)*, the CU 351 can optimize operation according to performance curves and motor data. In this display, curve types are selected which the CU 351 will use for the optimization if they are available.

At large flow rates, there may be a considerable head loss between the pump discharge flange and the pressure sensor.

The loss is caused by non-return valves and pipe bends. To improve the flow estimation of the system, it is necessary to compensate for the difference between the measured and the actual differential pressure across the pump. This is done by entering the head loss in non-return valves and pipe bends at the rated flow rate of one pump.

Setting range

- 2nd order QH polynomial
- 5th order QH polynomial
- Power polynomial, QP
- Head loss.

Note ***It is possible to select several curve types, as the CU 351 makes a priority based on the data available.***

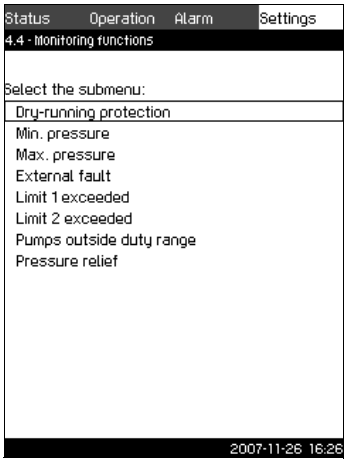
Setting via control panel

1. Mark the **Settings** menu with ⟩.
2. Mark **Secondary functions** with ⌄ or ⌃, and press ok.
3. Mark **Flow estimation** with ⌄ or ⌃, and press ok.
4. Select the curve type by marking one of the lines at the selection box with ⌄ or ⌃, and press ok.

Factory setting

All polynomials are selected.

9.7.41 Monitoring functions (4.4)



TM03 8978 4807

Fig. 88 Monitoring functions

Description

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

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

Setting range

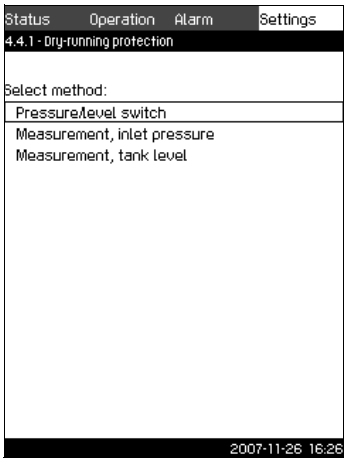
The following functions can be selected:

- *Dry-running protection (4.4.1)*
- *Min. pressure (4.4.2)*
- *Max. pressure (4.4.3)*
- *External fault (4.4.4)*
- *Limit 1 and 2 exceeded (4.4.5 and 4.4.6)*
- *Pumps outside duty range (4.4.7)*
- *Pressure relief (4.4.8)*.

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.

9.7.42 Dry-running protection (4.4.1)



TM03 2320 4807

Fig. 89 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 always recommends dry-running protection in connection with Hydro MPC booster systems.

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. See section *9.7.43 Dry-running protection with pressure/level switch (4.4.1.1)*.
- Measurement of inlet pressure in the suction manifold by means of an analog pressure transmitter. See section *9.7.44 Dry-running protection with pressure transmitter (4.4.1.2)*.
- Measurement of level in the supply tank by means of an analog level transmitter. See section *9.7.45 Dry-running protection with level transmitter (4.4.1.3)*.

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.

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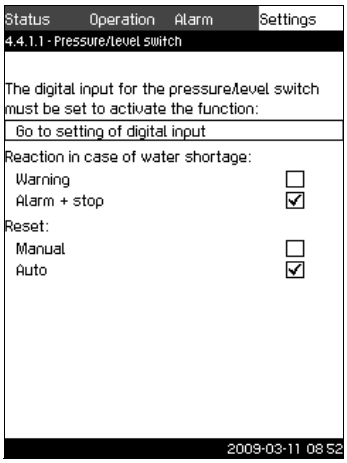
9.7.43 Dry-running protection with pressure/level switch (4.4.1.1)



TM03 2329 1109

Fig. 90 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 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

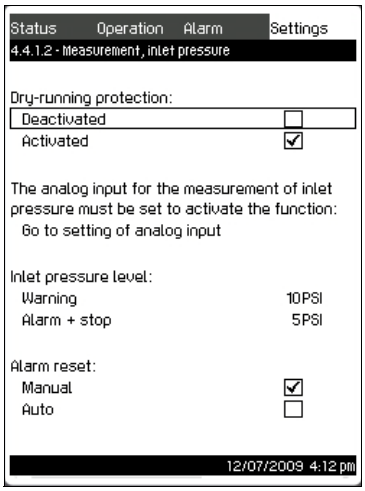
1. Mark the **Settings** menu with ›.
2. Mark **Monitoring functions** with ⌄ or ⌃, and press ok.
3. Mark **Dry-running protection** with ⌄ or ⌃, and press ok.
4. Mark **Pressure/level switch** with ⌄ or ⌃, and press ok.
5. Mark **Go to setting of digital input**, and press ok. Now the display *Digital 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 system is equipped with a pressure switch for dry-running protection, it is set to alarm + stop in case of water shortage.

Restart: Auto.

9.7.44 Dry-running protection with pressure transmitter (4.4.1.2)



TM04 6201 5009

Fig. 91 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 and alarm + stop.

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.
- Inlet pressure level for 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 **Measurement, inlet pressure** with ⌄ or ⌃, and press ok.
5. Mark **Go to setting of analog input**, and press ok. Now the display *Analog inputs (4.3.8)* appears. Set the input to **Inlet pressure, and save** with ok. Return with esc.
6. Mark **Activated** 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.***

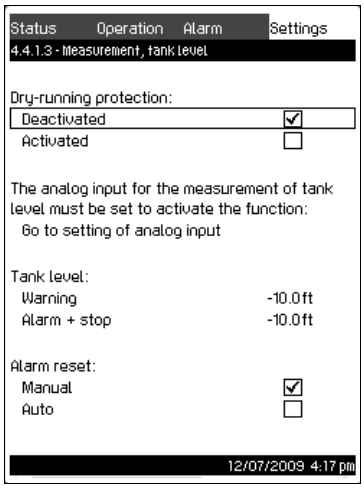
Factory setting

If the booster system is supplied with a pressure transmitter on the suction side, the transmitter has been set.

The warning level is 0.5 bar and the alarm level 0.2 bar. The function is activated.

Restart: Auto.

9.7.45 Dry-running protection with level transmitter (4.4.1.3)



TM04 6202 5009

Fig. 92 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 and alarm + stop.

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.
- Tank level for warning.
- Tank level for alarm + stop.
- Restart: Manual or automatic.

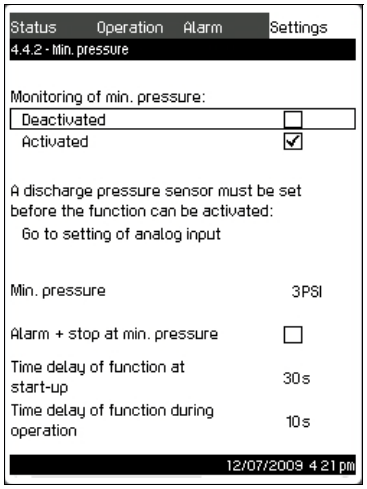
Setting via control panel

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 **Measurement, tank level** with ▽ or △, and press OK.
5. Mark **Go to setting of analog input**, and press OK. Now the display *Analog inputs (4.3.8)* appears. Set the input to **Tank level, suction side**. Return with ESC.
6. Mark **Activated** 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.

Factory setting

The function is deactivated.

9.7.46 Min. pressure (4.4.2)



TM04 6203 5009

Fig. 93 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 system stops and indicates alarm. This situation will require a manual reset of alarms.

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.

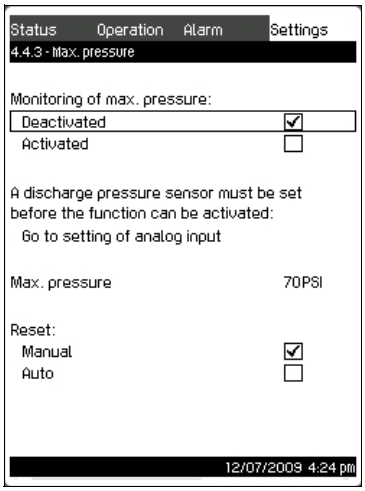
US

US

Factory setting

The function is deactivated.

9.7.47 Max. pressure (4.4.3)



TM04 6204 5009

Fig. 94 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 section *9.7.12 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.

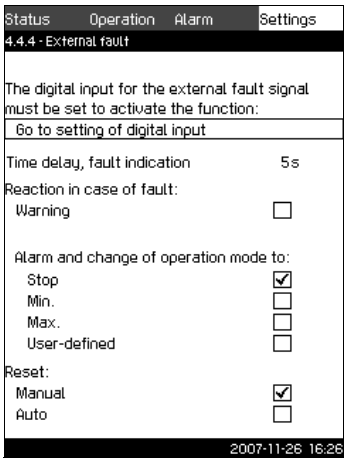
Setting via control panel

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 deactivated.

9.7.48 External fault (4.4.4)



TM03 2313 4807

Fig. 95 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 system 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

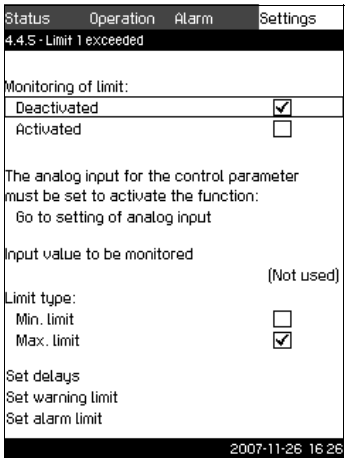
1. Mark the **Settings** menu with (›).
2. Mark **Monitoring functions** with (⌄) or (⌃), and press (ok).
3. Mark **External fault** with (⌄) or (⌃), and press (ok).
4. Mark **Go to setting of digital input** with (⌄) or (⌃), and press (ok). Now the display *Digital inputs (4.3.7)* appears. Set the input 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 system 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.

9.7.49 Limit 1 and 2 exceeded (4.4.5 and 4.4.6)



TM03 8983 4807

Fig. 96 Limit 1 exceeded

Description

With this function, the CU 351 can monitor set limits of analog values. It will react if the values exceed the limits. Each limit can be set as a maximum or minimum value. For each of the monitored values, a warning limit and an alarm limit must be defined.

The function makes it possible to monitor two different locations in a pump system at the same time. For instance the pressure at a consumer and the pump discharge pressure. This ensures that the discharge pressure does not reach a critical value.

If the value exceeds the warning limit, a warning is given. If the value exceeds the alarm limit, the pumps are stopped.

A delay can be set between the detection of an exceeded limit and the activation of a warning or an alarm. A delay can also be set for resetting a warning or an alarm.

A warning can be reset automatically or manually.

It is possible to set whether the system is to restart automatically after an alarm, or if the alarm must be reset manually. Restart can be delayed by an adjustable time. It is also possible to set a start-up delay ensuring that the system reaches a steady state before the function becomes active.

Setting range

- Activation of an analog input for the function.
- Selection of the measured value to be monitored.
- Setting of limit type (min./max.).
- Setting of warning limit.
- Setting of alarm limit.

Setting via control panel

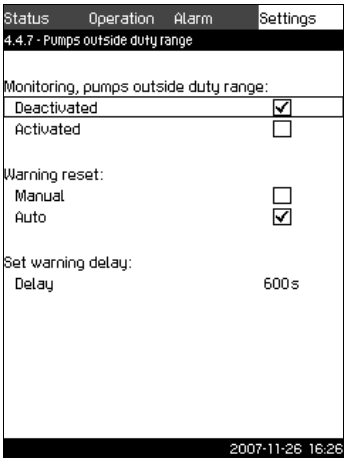
Note ***Analog inputs must be correctly set before the function is activated. See section 9.7.28 Analog inputs (4.3.8).***

1. Mark the **Settings** menu with ⊙
2. Mark **Monitoring functions** with ⊙ or ⊙, and press ok
3. Mark **Limit 1 exceeded** or **Limit 2 exceeded** with ⊙ or ⊙, and press ok.
4. Mark **Go to setting of analog input** with ⊙ or ⊙, and press ok.
5. Select the analog input with ⊙ or ⊙, and press ok.
6. 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.
7. Mark **Measured value** with ⊙ or ⊙, and press ok. Now the display 4.3.8.1.1 appears.
8. Select the input with ⊙ or ⊙, and press ok.
9. Press esc to return to display 4.3.8.1.
10. Set the minimum sensor value with ⊕ or ⊖, and save with ok.
11. Set the maximum sensor value with ⊕ or ⊖, and save with ok.
12. Return by pressing esc twice.
13. Mark **Measured value to be monitored** with ⊙ or ⊙ ., and press ok. Select the input with ⊙ or ⊙, and press ok.
14. Return with esc.
15. Mark **Min. limit** or **Max. limit** with ⊙ or ⊙ ., and press ok.
16. Mark **Set delays** with ⊙ or ⊙, and press ok
17. Mark **Time delay of function at start-up** with ⊙ or ⊙. Set the time with ⊕ or ⊖, and save with ok.
18. Mark **Time delay of function during operation** with ⊙ or ⊙. Set the time with ⊕ or ⊖, and save with ok.
19. Mark **Time delay of function at reset** with ⊙ or ⊙. Set the time with ⊕ or ⊖, and save with ok.
20. Return with esc.
21. Mark **Set warning limit** with ⊙ or ⊙, and press ok.
22. Mark **Activated** with ⊙ or ⊙, and press ok.
23. Mark **Warning limit** with ⊙ or ⊙. Set the value with ⊕ or ⊖, and save with ok.
24. Mark **Manual** or **Auto** with ⊙ or ⊙. Activate the function with ok.
25. Return with esc.
26. Mark **Set alarm limit** with ⊙ or ⊙, and press ok.
27. Mark **Activated** with ⊙ or ⊙, and press ok.
28. Mark **Alarm limit** with ⊙ or ⊙. Set the value with ⊕ or ⊖, and save with ok.
29. Mark **Manual** or **Auto** with ⊙ or ⊙. Activate the function with ok.
30. Return with esc.
31. Mark **Activated** with ⊙ or ⊙, and press ok to activate the function.

Factory setting

The function is deactivated.

9.7.50 Pumps outside duty range (4.4.7)



TM03 8984 4807

Fig. 97 Pumps outside duty range

US

US

Description

The function gives a warning if the duty point of the pumps moves outside the defined range. For instance, if the inlet pressure becomes lower than a minimum permissible value, thus causing a risk of cavitation for some pump types.

The warning is given with a set time delay. It is possible to set whether the warning is to be reset automatically or manually when the duty point comes within the defined duty range. It is also possible to set a relay output to be activated when the warning is given, and to be deactivated when the warning is reset.

This function requires that the discharge pressure and the inlet pressure (either measured or configured) or the differential pressure of the pumps is monitored, and that CU 351 contains valid pump data from either a GSC file or from manual input. See section *9.7.37 Pump curve data (4.3.19)*.

Setting range

- Activation of the function.
- Setting of manual or automatic reset.
- Setting of warning delay.

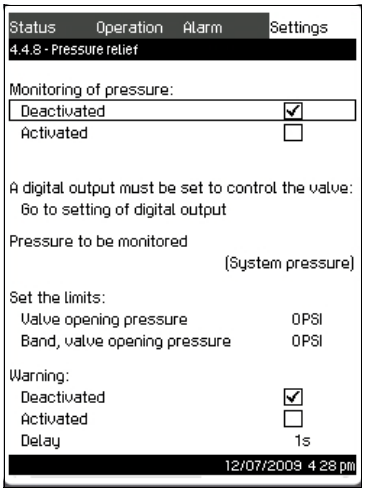
Setting via control panel

1. Mark the **Settings** menu with ▷
2. Mark **Monitoring functions** with ▽ or △, and press OK.
3. Mark **Pumps outside duty range** with ▽ or △, and press OK.
4. Mark **Manual** or **Auto** with ▽ or △, and activate the function with OK.
5. Mark **Warning delay** with ▽ or △. Set the time with ▽ or −, and save with OK.
6. Mark **Activated** with ▽ or △, and press OK to activate the function.

Factory setting

The function is deactivated.

9.7.51 Pressure relief (4.4.8)

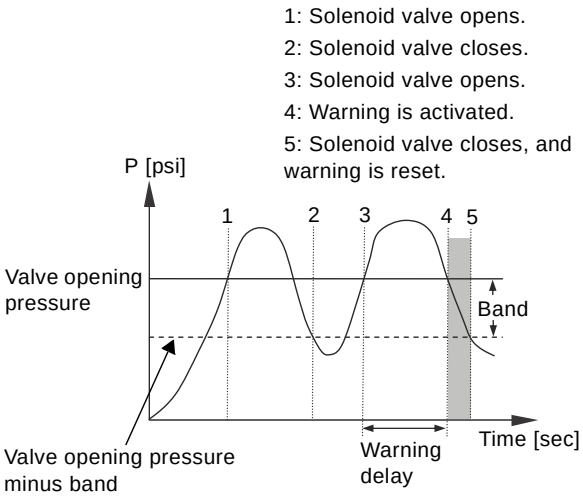


TM04 6205 5009

Fig. 98 Pressure relief

Description

The purpose of the function is to reduce the pressure in the pipework by opening a solenoid valve if it exceeds a set limit. If the pressure is not reduced within a given time, the solenoid valve will be closed, and a warning can be given.



TM03 9206 3607

Fig. 99 Pressure relief

Setting range

- Setting of digital output.
- Setting of pressure to be monitored.
- Setting of valve opening pressure.
- Setting of band for valve opening pressure.
- Setting of warning or alarm.
- Activation of the function.

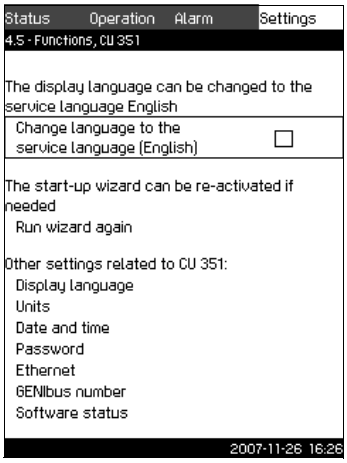
Setting via control panel

1. Mark the **Settings** menu with ▷
2. Mark **Monitoring functions** with ▽ or △, and press OK.
3. Mark **Pressure relief** with ▽ or △, and press OK.
4. Mark **Go to setting of digital output** with ▽ or △, and press OK.
5. Select a digital output with ▽ or △, and press OK.
6. Mark **Pressure relief** with ▽ or △, and save with OK.
7. Return by pressing ESC twice.
8. Mark **Pressure to be monitored** with ▽ or △, and press OK.
9. Mark **Discharge pressure**, **System pressure** or **External pressure** with ▽ or △, and save with OK.
10. Return with ESC.
11. Mark **Valve opening pressure** with ▽ or △. Set the pressure with + or −, and save with OK.
12. Mark **Band, valve opening pressure** with ▽ or △. Set the pressure with + or −, and save with OK.
13. Mark **Warning**, **Deactivated** or **Activated** with ▽ or △, and press OK.
14. Mark **Delay** with ▽ or △. Set the time with + or −, and save with OK. (Only to be set if warning has been activated.)
15. Mark **Activated** with ▽ or △, and press OK activate the function.

Factory setting

The function is deactivated.

9.7.52 Functions, CU 351 (4.5)



TM03 2295 4807

Fig. 100 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.

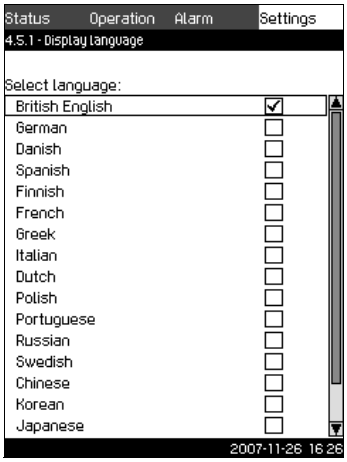
The service language, English, can be activated for service purposes. If no buttons are touched for 15 minutes, the display will return to the language selected at start-up or to the language set in section *9.7.53 Display language (4.5.1)*.

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 display units.
- 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.

9.7.53 Display language (4.5.1)



TM03 8987 4807

Fig. 101 Display language

Description

Here the language for the CU 351 display is selected.

Setting range

- British English
- German
- Danish
- Spanish
- Finnish
- French
- Greek
- Italian
- Dutch
- Polish
- Portuguese
- Russian
- Swedish
- Chinese
- Korean
- Japanese
- Czech
- Turkish.

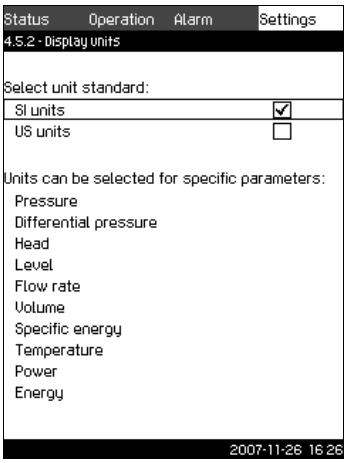
Setting via control panel

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.

9.7.54 Display units (4.5.2)



TM03 8988 4807

Fig. 102 Display units

Description

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

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

US

US

Setting range

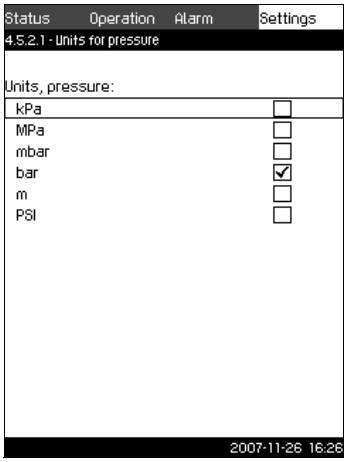
Parameter	Basic setting		Possible units
	SI	US	
Pressure	bar	psi	kPa, MPa, mbar, bar, m, psi
Differential pressure	m	psi	kPa, MPa, mbar, bar, m, psi
Head	m	ft	m, cm, ft, in
Level	m	ft	m, cm, ft, in
Flow rate	m^3/h	gpm	m^3/s, m^3/h, l/s, gpm, yd^3/s, yd^3/min, yd^3/h
Volume	m^3	gal	l, m^3, gal, yd^3
Specific energy	kWh/m^3	Wh/gal	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	kWh, MWh, BTU, HPh

Note

If units are changed from SI to US or vice versa, all individually set parameters will be 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 ⊙.
3. Mark **Units** with ⊙ or ⊙, and press ⊙.
4. Select the unit with ⊙ or ⊙, and save with ⊙.
   A check mark shows that the unit has been selected.
5. Select the measuring parameter with ⊙ or ⊙, and press ⊙ to open the display for the measuring parameter.
   See the example.



TM03 2310 4807

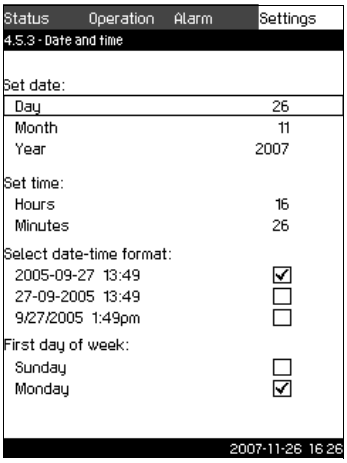
Fig. 103 Example of selection of display units

6. Select the unit with ⊙ or ⊙, and save with ⊙.
   A check mark shows that the unit has been selected.

Factory setting

CU 351 has been set to SI units from factory.

9.7.55 Date and time (4.5.3)



TM03 8989 4807

Fig. 104 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.

Examples of format
2005-09-27 13:49
27-09-2005 13:49
9/27/2005 1:49pm

It is also possible to select if Sunday or Monday is to be the first day of week.

Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Functions, CU 351** with ⊙ or ⊙, and press ⊙.
3. Mark **Date and time** with ⊙ or ⊙, and press ⊙.
4. Mark **Day**, **Month** and **Year** with ⊙ or ⊙, and set the date with ⊕ or ⊖. Save with ⊙.
5. Mark **Hours** and **Minutes** with ⊙ or ⊙, and set the time with ⊕ or ⊖. Save with ⊙.
6. Select the format with ⊙ or ⊙, and save with ⊙.
7. Mark **First day of week**, **Sunday** or **Monday** with ⊙ or ⊙, and save with ⊙

Factory setting

Local time.

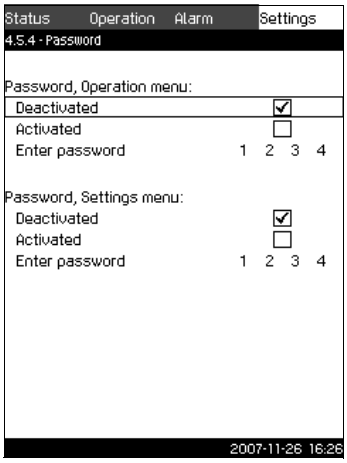
Note

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.

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

9.7.56 Passwords (4.5.4)



TM03 2899 4807

Fig. 105 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.***

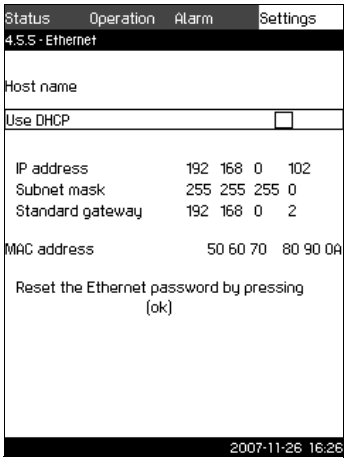
Setting via control panel

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 if it is necessary to activate the other password.

Factory setting

The **Operation** menu password is deactivated and the **Settings** menu password is activated. The password factory setting is "6814."

9.7.57 Ethernet (4.5.5)



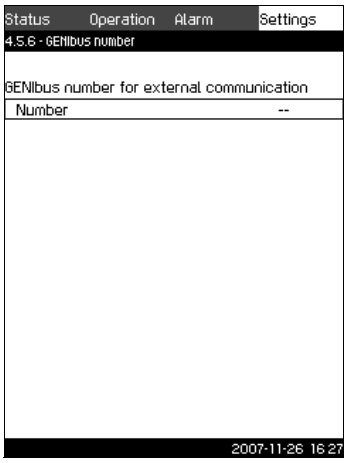
TM03 2298 4807

Fig. 106 Ethernet

Description

The CU 351 is equipped with an Ethernet connection for communication with a computer, either directly or via Internet. For further information, see section *9.8.1 Ethernet*.

9.7.58 GENIbus number (4.5.6)



TM03 2297 4807

Fig. 107 GENIbus number

Description

CU 351 can communicate with external units via an RS-485 interface (option). For further information, see fig. 109 and section *9.8.2 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

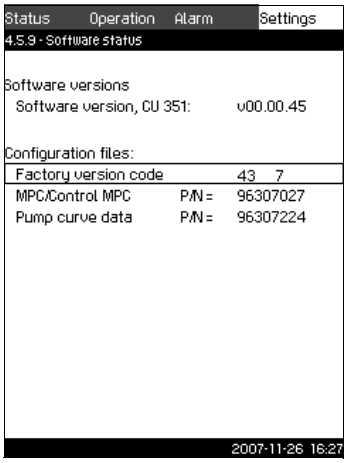
1. Mark the **Settings** menu with (›).
2. Mark **Functions, CU 351** with (⌄) or (⌃), and press (ok).
3. Mark **GENIbus number** with (⌄) or (⌃), and press (ok).
4. Select the number with (+) or (−), and save with (ok).

Factory setting

No number is set ("–").

US

9.7.59 Software status (4.5.9)



TM03 2296 4807

Fig. 108 Software status

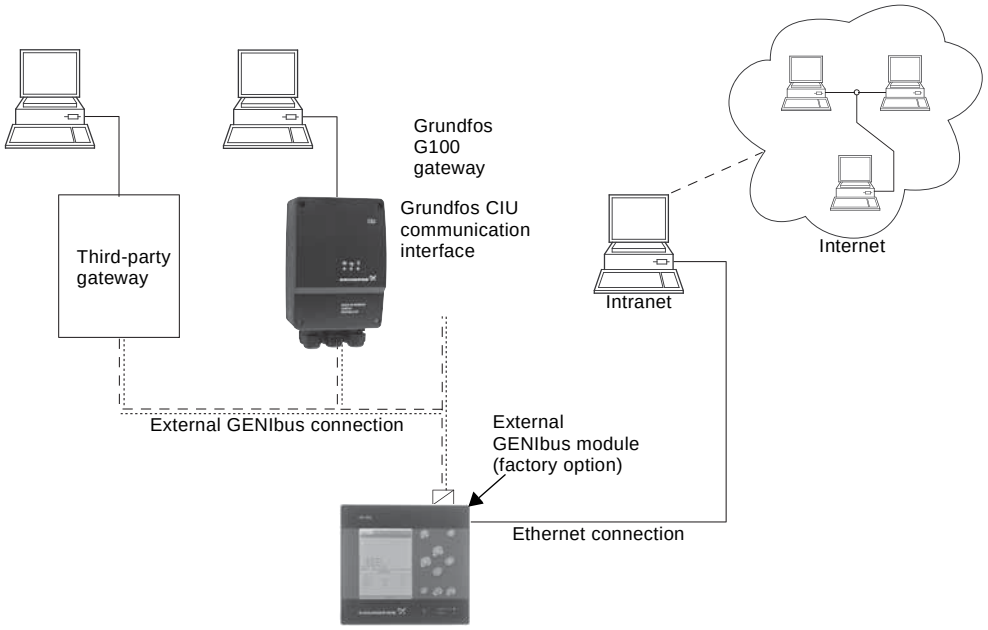
Description

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.

9.8 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.



TM03 2044 1009

Fig. 109 Data communication via external GENIbus and Ethernet connection

9.8.1 Ethernet

Ethernet is the most widely used standard for local networks (LAN). The standardisation of this technology has created some of the easiest and cheapest ways of creating communication between electrical units, for instance between computers or between computers and control units.

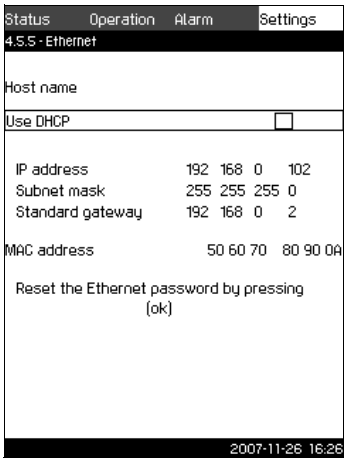
The web server of the CU 351 makes it possible to connect a computer to the CU 351 via an Ethernet connection. The user interface can thus be exported from the CU 351 to a computer so that the CU 351 and consequently the Hydro MPC booster system can be monitored and controlled externally.

Note

Grundfos recommends that you protect the connection to the CU 351 according to your safety requirements in consultation with the system administrator.

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 the 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. 110.



TM03 2298 4807

Fig. 110 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.

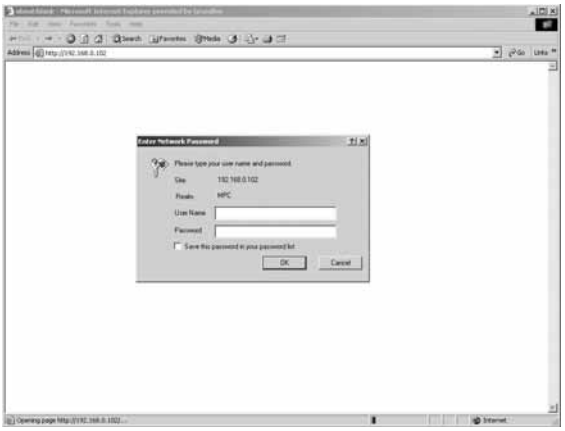
If you want to use the factory-set IP address, no changes are required in the display. Open the Internet browser and enter the IP address of the CU 351.

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 66.

US

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. 111 Connection to CU 351

Factory setting

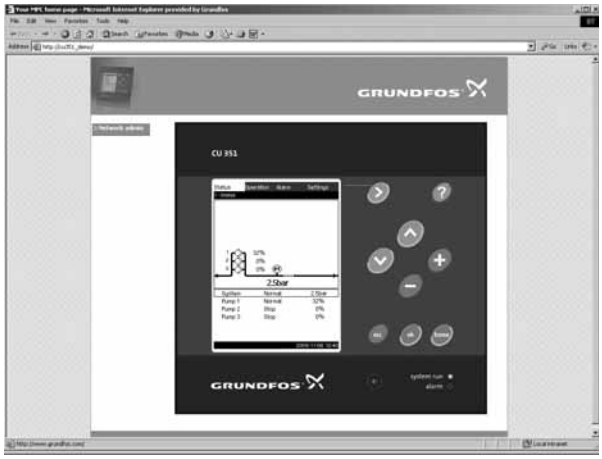
User name: admin
Password: admin

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. 112 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. 113 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. 114 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. 115 Change of password

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

9.8.2 GENIbus

By installing a GENIbus module in the CU 351 it is possible to connect the system to an external network. The connection can take place via a GENIbus-based network or a network based on another fieldbus protocol via a gateway. See examples in fig. 109. For further information, contact Grundfos.

The gateway may be a Grundfos CIU communication interface or a third-party gateway. For further information on the CIU, see WebCAPS or contact Grundfos.

US

10. External variable frequency drive

External variable frequency drives used in Hydro MPC booster system variants -F, -EF and -EDF come with the manufacturer's factory settings. See tables below.

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

In order not to affect the functions of the CU 351 at optimum operation, only the parameters shown should be adjusted. Other parameters should be as set from factory.

US

10.1 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 (if over 10 Hp then 0)
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	3
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.

All parameters are now factory-set, including the fault log.

10.2 VLT FC 202

Press [EXTEND MENU] to access all parameters.

Parameter	Function	Grundfos setting
		Value
001	Language	English
002	Motor Speed Unit	Hz
003	Regional Settings	North America
020	Display Line 1.1	Power [hp]
021	Display Line 1.2	Motor Voltage
022	Display Line 1.3	Motor Current
023	Display Line 2 Large	Frequency
024	Display Line 3 Large	Speed [rpm]
100	Configuration Mode	Open Loop
103	Torque Characteristics	Variable Torque
121	Motor Power [HP]	Nameplate
122	Motor Voltage	Nameplate
123	Motor Frequency	Nameplate
124	Motor Current	Nameplate
125	Motor Nominal Speed	Nameplate
190	Motor Thermal Protection	ETR trip 1
302	Minimum Reference	20.000 Hz
303	Maximum Reference	60.000 Hz
304	Reference Function	External Preset
310	Preset Reference	100.00%
313	Reference Site	Remote
341	Ramp 1 Ramp up Time	1.50 s
342	Ramp 1 Ramp down Time	3.00 s
412	Motor Speed Low Limit [Hz]	0.0 Hz
414	Motor Speed High Limit [Hz]	62.0 Hz
419	Max Output Frequency	65.0 Hz
510	Terminal 18 Digital Input	Star
513	Terminal 29 Digital Input	Preset reference on
540.0	Function Relay	Drive ready
542.0	Off Delay, Relay	2.00 s
610	Terminal 53 Low Voltage	0.00 V
611	Terminal 53 High Voltage	10.00 V
614	Terminal 53 Low Ref. / Feedb.	20.000 Hz
615	Terminal 53 High Ref. / Feedb.	60.000 Hz
1400	Switching Pattern	60 AVM
1401	Switching Frequency	5.0 kHz

Factory setting of VLT FC 200

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

1. Select parameter 14-22.
2. Press [OK].
3. Select “Initialisation” (for NLCP select “2”).
4. Press [OK].
5. Disconnect the power supply.
6. Reconnect the power supply.
7. All parameters are now factory-set, except RFI 1, protocol, address, baud rate, minimum response delay, maximum response delay, maximum inter-char delay, operating data, historic log and fault log.

or

1. Disconnect the power supply.
2. Press and hold [STATUS] + [MAIN MENU] + [OK] and reconnect the power supply.
3. All parameters are now factory-set, except operating hours, the number of power-ups and overtemp’s and overvolt’s.

US

US

10.3 Configuration of E-pump(s), if any

Before the Hydro MPC system is ready for test, the E-pumps have to be set.

- Turn on the power supply to the E-pumps by means of the automatic circuit breaker.
- Set with R100 the GENIbus number to the same number as that of the pump.
- (Number = 1 for pump No 1, etc.)

Note: The pumps are numbered from left to right, while facing the suction.

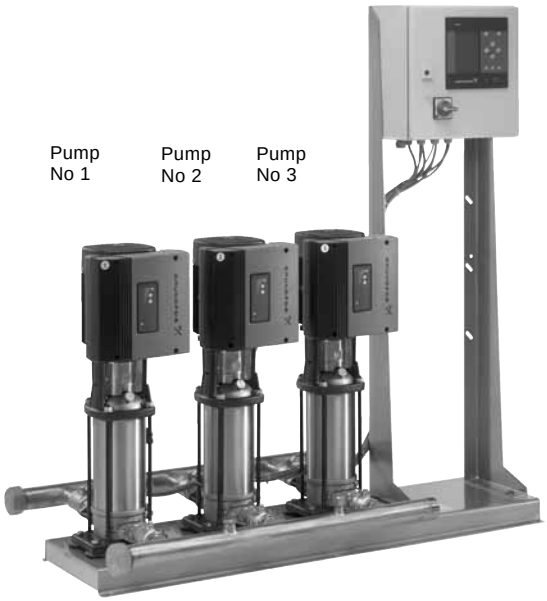


Fig. 116 Pumps numbered from left to right.

Configuration of the CUE(s), if any

The manufacturer's factory settings of the CUE used in Control MPC must be changed to the Control MPC settings before it is ready to test.

To configure the CUE:

1. Switch off the power supply to the CUE(s) by means of the automatic circuit breaker.
2. Connect the PC Tool to the GENIbus terminals of the CUE which you want to configure.
3. Turn on the power supply to the CUE.
4. Start the PC Tool E-products.
5. When communication has been established, the PC Tool "Network list" will display the icon for the CUE.
6. Select the CUE in "Network list".
7. Select the PC Tool function "Custom configuration".
8. Go to section "GENIbus", and set the "unit number" to the same number as that of the CUE.
   (Number = 1 for CUE No 1, etc.)
   Note: Steps 7 and 8 are not necessary for the CUE in Hydro MPC-F.
9. Go to section "General", select the "Pump Family" and enter motor data. See fig. 117.
   Note: Collect the motor data from the motor nameplate

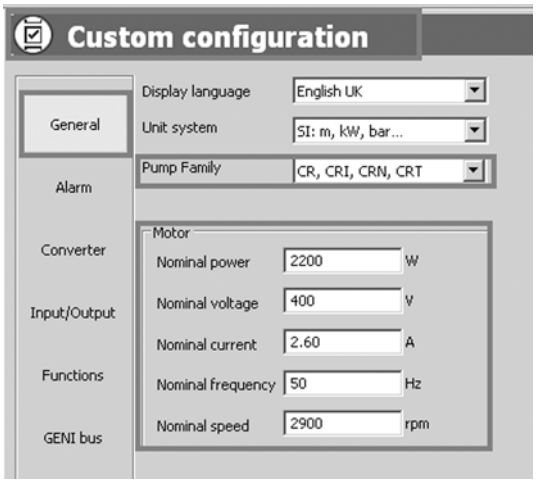


Fig. 117 "Custom configuration" (General)

10. Select the PC Tool function "Standard configuration".
11. Go to section "Search by" and select "Number".
12. Type the GCS file number "97685157" in the "Configuration No." field and click "Search Now".
13. Select the file from the "Configuration files" field and click "Send".
14. Switch on the power supply to the next CUE with the main switch, and repeat steps 6 to 13 for each CUE.

    Note: The bus termination dip switch on the last CUE drive should be switched to the "ON" position.

11. 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 the 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, strainer 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 system.
	Too many standby pumps selected.	Reduce the number of standby pumps.
	Pipe fracture or leakage in the system.	Check the system, and repair damages, if necessary.
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.

US

12. Maintenance

Warning

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

12.1 Pumps

Pump bearings and shaft seal are maintenance-free.

12.2 Motor bearings

Motors without grease nipples are maintenance-free.

Motors with grease nipples should be lubricated with motor manufacturer's approved type of grease.

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.

12.3 CU 351

The CU 351 is maintenance-free. It must be kept clean and dry. Protect it against direct sunlight. Furthermore, the CU 351 must not be outside the ambient temperature range. See section *15. Technical data*.

13. 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.

14. Taking out of operation

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

Warning

The conductors in front of the main switch are still energised. Lock the main 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-protective circuit breaker, automatic circuit breaker or fuse.

15. Technical data

15.1 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).

H_S = 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) of minimum "H" feet is required.

Maximum inlet pressure

Please refer to the CR, CRI, CRN, CRT installation and operating instructions (L-CR-TL-001) delivered togethr wtih this booster system.

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 232 psi [16 bar].

On request, Grundfos offers Hydro MPC booster systems with a maximum operating pressure higher than 232 psi [16 bar].

15.2 Temperature

Liquid temperature: 32 °F to +158 °F

Ambient temperature: 32 °F to +104 °F

15.3 Relative humidity

Max. relative humidity: 95 %

15.4 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) x 3

L_{max} = Maximum sound pressure level.

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

n = Number of pumps.

16. Electrical data

Supply voltage

See nameplate of the Hydro MPC.

Backup fuse

See the wiring diagram supplied with the Hydro MPC.

Control panel minimum short-circuit current rating (SCCR) is 5kA symetrical at rated voltage. Specify at time of order if higher SCCR rating is required.

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.***

17. Related documents

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

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

Title	Frequency	Publication number
Product Guide		
Grundfos Hydro MPC	60 Hz	L-BPQ-PG-01
Grundfos CR,CRI,CRN	60 Hz	L-CR-PG-001
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
Service documentation		
Service instructions	50/60 Hz	96646712
Service kit catalog	50/60 Hz	96488862
Other documentation		
Wiring diagram**	-	-

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

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

18. Disposal

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

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

Subject to alterations.

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