BoosterpaQ®-Hydro MPC

Installation and operating instructions
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1. Symbols used in this document

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

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.

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

Note
A diaphragm tank is required in most installations.

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](image)

<table>
<thead>
<tr>
<th>Pos.</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Control panel</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Nameplate</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Suction manifold (stainless steel)</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Isolating valve</td>
<td>2 per pump</td>
</tr>
<tr>
<td>5</td>
<td>Base frame (stainless steel)</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Non-return valve</td>
<td>1 per pump</td>
</tr>
<tr>
<td>7</td>
<td>Discharge manifold (stainless steel)</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Pressure transmitter/pressure gauge</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>Pump</td>
<td>2 - 6</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Control variant</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-E</td>
<td>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.</td>
</tr>
<tr>
<td>-F</td>
<td>Up to six CR pumps connected to an external Grundfos CUE variable frequency drive. The speed-controlled operation alternates between the pumps.</td>
</tr>
<tr>
<td>-S</td>
<td>Two to six constant speed CR pumps</td>
</tr>
</tbody>
</table>

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.

| Type: | 1 |
| Model: | 2 |
| Serial No.: | 3 |

Mains supply: 4 PSI T Medium: 5 °F
Q max.: 6 GPM H Min.: 8 ft.

<table>
<thead>
<tr>
<th>Number</th>
<th>P</th>
<th>H</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed speed pumps:</td>
<td>9</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>E-pumps:</td>
<td>12</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td>PkPump:</td>
<td>15</td>
<td>16</td>
<td>17</td>
</tr>
</tbody>
</table>

Order No.: 18
Options: 19
Panel PN: 20
NEMA Rating: 21
Weight: 22 lbs.

Assembled in US

C UL US LISTED

Fig. 2 Nameplate

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

<table>
<thead>
<tr>
<th>Pos.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Control MPC - GSC file number</td>
</tr>
<tr>
<td>2</td>
<td>Control MPC options - GSC file numbers</td>
</tr>
<tr>
<td>3</td>
<td>Hydro MPC - GSC file number</td>
</tr>
<tr>
<td>4</td>
<td>Hydro MPC options - GSC file numbers</td>
</tr>
<tr>
<td>5</td>
<td>Pump data - GSC file numbers</td>
</tr>
</tbody>
</table>

Note: A GSC (Grundfos Standard Configuration) file is a configuration data file.
6. Type key

<table>
<thead>
<tr>
<th>Example</th>
<th>Hydro MPC</th>
<th>-E 2 CRE 5-10 or 2 CR 5-10</th>
<th>3x460 V, 60Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type range</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subgroups:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-E Pumps with all integrated variable frequency drives or external Grundfos CUE variable frequency drives (one per pump)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-F Pumps with one Grundfos CUE external VFD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-S Constant speed pumps (start/stop)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of pumps with integrated variable frequency drive and pump type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of constant speed pumps and pump type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply voltage, frequency</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6.1 Examples of control variants

### Systems with speed-controlled pumps

**Hydro MPC-E**

Hydro MPC booster system with three CRE pumps shown below.

- One CRE pump in operation.
- Three CRE pumps in operation.

- 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.

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

- 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.
Hydro MPC-S

Hydro MPC booster system with three constant speed CR pumps.

- 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 \( H_{\text{set}} \) and \( H_{\text{stop}} \) (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.

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.

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.

---

<table>
<thead>
<tr>
<th>Pos.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Expansion joint</td>
</tr>
<tr>
<td>2</td>
<td>Pipe support and good location for system isolation valve (not shown)</td>
</tr>
<tr>
<td>3</td>
<td>Machine shoe</td>
</tr>
</tbody>
</table>

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

- Make sure that the booster 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 breaker is 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". Vented 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.

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.
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.

![Control panel diagram]

Fig. 6 Control panel

Key

<table>
<thead>
<tr>
<th>Pos.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Display</td>
</tr>
<tr>
<td>2</td>
<td>Arrow to the right</td>
</tr>
<tr>
<td>3</td>
<td>Help</td>
</tr>
<tr>
<td>4</td>
<td>Up</td>
</tr>
<tr>
<td>5</td>
<td>Down</td>
</tr>
<tr>
<td>6</td>
<td>Plus</td>
</tr>
<tr>
<td>7</td>
<td>Minus</td>
</tr>
<tr>
<td>8</td>
<td>Esc</td>
</tr>
<tr>
<td>9</td>
<td>Home</td>
</tr>
<tr>
<td>10</td>
<td>Ok</td>
</tr>
<tr>
<td>11</td>
<td>Indicator light, operation (green)</td>
</tr>
<tr>
<td>12</td>
<td>Indicator light, alarm (red)</td>
</tr>
<tr>
<td>13</td>
<td>Contrast</td>
</tr>
</tbody>
</table>

8.1 Display (pos. 1)

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.
9. Functions

9.1 Tree of functions

1. Status
   - 3.1 Current alarms
   - 1.2 System
     - 1.2.1 Operating mode
     - 1.2.2 Setpoint
     - 1.2.3 Setpoint influence
     - 1.2.4 Measured values
     - 1.2.5 Analog inputs
   - 1.3 Pump 1
   - 1.4 Pump 2
   - 1.5 Pump 3
   - 1.6 Pump 4
   - 1.7 Pump 5
   - 1.8 Pump 6

2. Operation
   - 2.1 Further settings
     - 2.1.1 System operating mode
     - 2.1.2 Control mode
     - 2.1.3 Setpoints
     - 2.1.4 Individual pump control

3. Alarm
   - 3.1 Current alarms
   - 3.2 Alarm log

Continued on page 17

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.
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
4.2.2 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

4.3.7.1 Function, D1..D3 (CU 351), [10, 12, 14]
4.3.7.2 Function, D1..D9 (IO 351-41), [10...46]
4.3.7.3 Function, D1..D9 (IO 351-42), [10...46]

Analog Inputs

4.3.8.1 Setting, analog input AI1..AI3 (CU 351), [51, 54, 57]
4.3.8.2 Setting, analog input AI1..AI3 (IO 351-41), [51, 54, 57]
4.3.8.3 Setting, analog input AI1..AI3 (IO 351-42), [51, 54, 57]

Function, AI1..AI3 (CU 351), [51, 54, 57]
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Function, AI1..AI2 (IO 351-42), [57, 60]
Function, AI1..AI2 (IO 351-42), [57, 60]
Function, AI1..AI2 (IO 351-42), [57, 60]

Digital outputs

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4.3.9.2 Function, DO1...DO7 (IO 351-41), [77...88]
4.3.9.3 Function, DO1...DO7 (IO 351-42), [77...88]

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

Pump curve data

4.3.19.1 Pump curve data
4.3.19.2 Flow estimation

4.3.20 Control source
4.3.22 Fixed inlet pressure
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4.4 Monitoring functions

4.4.1 Dry-running protection
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4.4.7 Pumps outside duty range
4.4.8 Pressure relief
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

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4.5.2.2 Units for differential pressure
4.5.2.3 Units for head
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4.5.2.9 Units for power
4.5.2.10 Units for energy

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4.5.6 GENIBus number
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## 9.2 Overview

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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.

![Status Display](image)

**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 \( \text{●} \) 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 \( \text{●} \) will also be shown in front of the status line (D) of the pump in question. At the same time, the symbol \( \text{●} \) will be flashing instead of the pump symbol (E). The symbol \( \text{●} \) 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 \( \text{●} \) or \( \text{●} \), and press \( \text{●} \).

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)

![Current alarms](image)

**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)

![System](image)

**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.
9.4.3 Operating mode (1.2.1)

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)

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)

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:

\[ \text{Setpoint}_{\text{current}} = \text{Setpoint}_{\text{selected}} \times \text{Infl.1} \times \text{Infl.2} \times \ldots \]

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)

![Fig. 14 Measured values](image)

**Description**

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

*The lines “Power consumption” and “Energy consumption” are only shown in Hydro MPC-E booster systems.*

9.4.7 Analog inputs (1.2.5)

![Fig. 15 Analog inputs](image)

**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)

![Fig. 16 Pump 1](image)

**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.
9.5.1 Operation (2)

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)

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)

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.

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.

Setting via control panel
1. Mark the Operation menu with .
2. Mark Further settings with or , and press .
3. Mark Control mode with or , and press .
4. Select Closed loop with or , and press .
5. Set the setpoint. See sections 9.5.4 Setpoints (2.1.3) and 9.5.1 Operation (2).
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 $\sqrt{\frac{1}{4}}$ = 50%
- Two pump operation from 50% to $\sqrt{\frac{2}{4}}$ = 70.7%
- Three pump operation from 70.7% to $\sqrt{\frac{3}{4}}$ = 86.6%
- Four pump operation from 86.6% to 100%

For staging pumps off the cut-out is 2% less than 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 . The check mark in the right box shows that the operation has been stopped.
3. Mark Further settings with or , and press .
4. Mark Control mode with or , and press .
5. Select Open loop with or , and press .
6. Return by pressing twice.
7. Mark Set setpoint 1, open loop with or .
8. Set the setpoint to 100 % with , and save with .
9. Mark the Settings menu with .
10. Mark Primary controller with or , and press .
11. Mark External setpoint influence with or , and press .
12. Mark Go to setting of analog input with or , and press .
13. Select the analog input with or , and press .
14. Select the range of the analog input with or , and press . The selection is indicated by a check mark.
15. Mark Measured input value with or , and press .

Now the display 4.3.8.1.1 appears.

16. Select 0-100 % signal with or , and press .
17. Press to return to display 4.3.8.1.
18. Set the minimum sensor value with or , and save with .
19. Set the maximum sensor value with or , and save with .
20. Return by pressing twice.
21. Mark Input value to be influenced by with or , and press .
22. Mark 0-100 % signal with or , and press .
23. Return with .
24. Mark Set the influence function with or , and press . 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 .
26. Select the required number of points with or , and save with .
27. Mark External input value (point 1) with or .
28. Set the value of the external input value with or , and save with .
29. Mark Reduce setpoint to (point 1) with or .
30. Set the value as a percentage with or , and save with .
31. Repeat 27 to 31 for all chosen points.
32. Return with .
33. Mark Filter time with or , set the time in seconds with or , and save with .
34. Mark Activated with or , and press . The check mark in the right box shows that the function has been activated.
35. Return by pressing twice.
36. Mark the Operation menu with .
37. Mark the operating mode Normal with or , and press . 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)**

**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 .
3. Mark Setpoints with or , and press .
4. Select the setpoint with or .
5. Set the setpoint with or , and press .

**Factory setting**
Setpoint 1 for closed-loop control is a value suitable for the Hydro MPC in question. The 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)**

**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 .
3. Mark Individual pump control with or , and press .
4. Select the pump with or , and press .
**9.5.6 Setting of individual operating mode (2.1.4.1 to 2.1.4.6)**

![Fig. 29 Setting of individual operating mode](image)

**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 .
3. Select the pump with or , and press .
4. Mark Auto or Manual with or , and press .
5. Manual: Select the operating mode with or , and press .
6. Normal: Mark Setpoint with or . Set the speed of the variable-speed pump with or , and press .

**Factory setting**
Auto.
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)

<table>
<thead>
<tr>
<th>Fault</th>
<th>Warning(✓)/alarm(✓)</th>
<th>Change of operating mode</th>
<th>Restart of alarm</th>
<th>Set in the Settings menu</th>
<th>Alarm code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water shortage</td>
<td>✗</td>
<td>Auto</td>
<td></td>
<td></td>
<td>206</td>
</tr>
<tr>
<td>Water shortage</td>
<td>✗</td>
<td>Stop</td>
<td>Man/auto</td>
<td>X</td>
<td>214</td>
</tr>
<tr>
<td>Pressure high</td>
<td>✗</td>
<td>Stop</td>
<td>Auto</td>
<td></td>
<td>210</td>
</tr>
<tr>
<td>Pressure low</td>
<td>✗</td>
<td>Auto</td>
<td>X</td>
<td></td>
<td>211</td>
</tr>
<tr>
<td>Pressure relief</td>
<td>✗</td>
<td>Auto</td>
<td>X</td>
<td></td>
<td>219</td>
</tr>
<tr>
<td>Alarm, all pumps</td>
<td>✗</td>
<td>Stop</td>
<td>Auto</td>
<td></td>
<td>203</td>
</tr>
<tr>
<td>External fault</td>
<td>✗</td>
<td>Stop</td>
<td>Man</td>
<td>X</td>
<td>3</td>
</tr>
<tr>
<td>Dissimilar sensor signals</td>
<td>✗</td>
<td>Auto</td>
<td></td>
<td></td>
<td>204</td>
</tr>
<tr>
<td>Fault, primary sensor</td>
<td>✗</td>
<td>Stop</td>
<td>Auto</td>
<td></td>
<td>89</td>
</tr>
<tr>
<td>Fault, sensor</td>
<td>✗</td>
<td>Auto</td>
<td></td>
<td></td>
<td>88</td>
</tr>
<tr>
<td>Communication fault</td>
<td>✗</td>
<td>Auto</td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Phase failure</td>
<td>✗</td>
<td>Auto</td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Undervoltage, pump</td>
<td>✗</td>
<td>Auto</td>
<td></td>
<td></td>
<td>7, 40, 42, 73</td>
</tr>
<tr>
<td>Overvoltage, pump</td>
<td>✗</td>
<td>Auto</td>
<td></td>
<td></td>
<td>32</td>
</tr>
<tr>
<td>Overload, pump</td>
<td>✗</td>
<td>Auto</td>
<td></td>
<td></td>
<td>48, 50, 51, 54</td>
</tr>
<tr>
<td>Motor temperature too high</td>
<td>✗</td>
<td>Auto</td>
<td></td>
<td></td>
<td>64, 65, 67, 70</td>
</tr>
<tr>
<td>Other fault, pump</td>
<td>✗</td>
<td>Auto</td>
<td></td>
<td></td>
<td>76, 83</td>
</tr>
<tr>
<td>Internal fault, CU 351</td>
<td>✗</td>
<td>Auto</td>
<td></td>
<td></td>
<td>72, 83, 157</td>
</tr>
<tr>
<td>Internal fault, IO 351</td>
<td>✗</td>
<td>Stop</td>
<td>Auto</td>
<td></td>
<td>83, 157</td>
</tr>
<tr>
<td>VFD not ready</td>
<td>✗</td>
<td>Auto</td>
<td></td>
<td></td>
<td>213</td>
</tr>
<tr>
<td>Fault, Ethernet</td>
<td>✗</td>
<td>Auto</td>
<td></td>
<td></td>
<td>231, 232</td>
</tr>
<tr>
<td>Limit 1 exceeded</td>
<td>✗</td>
<td>Man/auto</td>
<td>X</td>
<td></td>
<td>190</td>
</tr>
<tr>
<td>Limit 2 exceeded</td>
<td>✗</td>
<td>Man/auto</td>
<td>X</td>
<td></td>
<td>191</td>
</tr>
<tr>
<td>Pressure build-up fault</td>
<td>✗</td>
<td>Man/auto</td>
<td>X</td>
<td></td>
<td>215</td>
</tr>
<tr>
<td>Pumps outside duty range</td>
<td>✗</td>
<td>Man/auto</td>
<td>X</td>
<td></td>
<td>208</td>
</tr>
<tr>
<td>Pilot pump fault</td>
<td>✗</td>
<td>Auto</td>
<td></td>
<td></td>
<td>216</td>
</tr>
</tbody>
</table>

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).
### Alarm (3) continued

<table>
<thead>
<tr>
<th>Alarm code</th>
<th>Associated device and device no.</th>
<th>Description/cause</th>
<th>Remedy</th>
<th>Reset type</th>
<th>Alarm/warning Action type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Phase failure, pump</td>
<td></td>
<td>1. Check that all three power supply phases are within a 15 V window.</td>
<td>Auto</td>
<td>Warning,</td>
</tr>
<tr>
<td>2</td>
<td>Undervoltage</td>
<td></td>
<td>1. Restore power supply. 2. Replace terminal box.</td>
<td>Auto</td>
<td>Warning,</td>
</tr>
<tr>
<td>3</td>
<td>Undervoltage, pump</td>
<td></td>
<td>1. Bring voltage back to prescribed level.</td>
<td>Auto</td>
<td>Warning,</td>
</tr>
<tr>
<td>4</td>
<td>Undervoltage, pump</td>
<td></td>
<td>1. Restore proper power supply.</td>
<td>Auto</td>
<td>Warning,</td>
</tr>
<tr>
<td>5</td>
<td>Undervoltage, pump</td>
<td></td>
<td>1. Restore proper power supply.</td>
<td>Auto</td>
<td>Warning,</td>
</tr>
<tr>
<td>6</td>
<td>Overvoltage, pump</td>
<td></td>
<td>1. Bring voltage back to prescribed level.</td>
<td>Auto</td>
<td>Warning,</td>
</tr>
<tr>
<td>7</td>
<td>Overload, associated device</td>
<td></td>
<td>1. Check and possibly reduce load.</td>
<td>Auto</td>
<td>Warning,</td>
</tr>
<tr>
<td>8</td>
<td>Overload, associated device</td>
<td></td>
<td>1. Check and possibly reduce load/improve cooling</td>
<td>Auto</td>
<td>Warning,</td>
</tr>
<tr>
<td>9</td>
<td>Overload, associated device</td>
<td></td>
<td>1. Unblock the pump.</td>
<td>Auto</td>
<td>Warning,</td>
</tr>
<tr>
<td>10</td>
<td>Overload, associated device</td>
<td></td>
<td>1. Check and possibly reduce load/improve cooling</td>
<td>Auto</td>
<td>Warning,</td>
</tr>
<tr>
<td>11</td>
<td>Over temperature, pump</td>
<td></td>
<td>1. Check and possibly reduce load/improve cooling</td>
<td>Auto</td>
<td>Warning,</td>
</tr>
<tr>
<td>12</td>
<td>Over temperature, pump</td>
<td></td>
<td>1. Check and possibly reduce load/improve cooling. (Temperature during operation can be read via PC Tool E-products.)</td>
<td>Auto</td>
<td>Warning,</td>
</tr>
<tr>
<td>MPC alarm indication “Protocol description”</td>
<td>Alarm code</td>
<td>Associated device and device no.</td>
<td>Description/cause</td>
<td>Remedy</td>
<td>Reset type</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>------------</td>
<td>---------------------------------</td>
<td>-------------------</td>
<td>--------</td>
<td>------------</td>
</tr>
<tr>
<td>13. Other fault, associated device</td>
<td>76</td>
<td>Pump 1-6</td>
<td>a) Internal communication error has occurred in the pump.</td>
<td>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.</td>
<td>Auto</td>
</tr>
<tr>
<td>14. Limit 1 exceeded</td>
<td>190</td>
<td>Measured parameter</td>
<td>a) The measured parameter has exceeded the limit set.</td>
<td>1. Remove the cause of the fault.</td>
<td>Auto/ manual</td>
</tr>
<tr>
<td>15. Limit 2 exceeded</td>
<td>191</td>
<td>Measured parameter</td>
<td>a) The measured parameter has exceeded the limit set.</td>
<td>1. Remove the cause of the fault.</td>
<td>Auto/ manual</td>
</tr>
<tr>
<td>16. Pressure relief</td>
<td>219</td>
<td>System</td>
<td>a) The monitored pressure could not be reduced sufficiently.</td>
<td>1. Reduce the pressure to below the limit.</td>
<td>Auto</td>
</tr>
<tr>
<td>17. Pressure build-up fault</td>
<td>215</td>
<td>System</td>
<td>a) The pressure set cannot be reached within the configured time.</td>
<td>1. Check limit and pipes.</td>
<td>Auto/ manual</td>
</tr>
<tr>
<td>18. Pumps outside duty range</td>
<td>208</td>
<td>System</td>
<td>a) The pump is running outside the defined range.</td>
<td>1. Check the system.</td>
<td>Auto/ manual</td>
</tr>
<tr>
<td>19. Pilot pump fault</td>
<td>216</td>
<td>Pilot pump</td>
<td>a) Pilot pump fault</td>
<td>1. Check wires. 2. Check the pump.</td>
<td>Auto</td>
</tr>
<tr>
<td>Alarm code</td>
<td>Type</td>
<td>Description/cause</td>
<td>Remedy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>------</td>
<td>-------------------</td>
<td>--------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>206</td>
<td></td>
<td>a) The inlet pressure (or the level in the feed tank) is below its programmable warning limit.</td>
<td>Auto Warning Unchanged</td>
<td></td>
<td></td>
</tr>
<tr>
<td>214</td>
<td></td>
<td>a) The inlet pressure (or the level in the feed tank) is below its programmable warning limit.</td>
<td>Auto/Stop</td>
<td></td>
<td></td>
</tr>
<tr>
<td>210</td>
<td></td>
<td>a) The system pressure is above the programmable high-pressure alarm limit.</td>
<td>Auto/Fast stop (over rule min. seq. time)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>211</td>
<td></td>
<td>a) The system pressure is below the programmable low-pressure alarm limit.</td>
<td>Auto/Stop/Unchanged</td>
<td></td>
<td></td>
</tr>
<tr>
<td>203</td>
<td></td>
<td>a) All pumps, set to Auto, are stopped on account of pump alarm</td>
<td>Auto/Stop</td>
<td></td>
<td></td>
</tr>
<tr>
<td>003</td>
<td></td>
<td>a) External fault digital input activated.</td>
<td>Auto/Alarm/Warning Stop/Unchanged</td>
<td></td>
<td></td>
</tr>
<tr>
<td>204</td>
<td></td>
<td>a) Primary feedback sensor value (pressure) is inconsistent with redundant feedback sensor value.</td>
<td>Auto Warning Unchanged</td>
<td></td>
<td></td>
</tr>
<tr>
<td>089</td>
<td></td>
<td>a) A fault in the sensor assigned to the feedback control is detected.</td>
<td>Alarm Stop</td>
<td></td>
<td></td>
</tr>
<tr>
<td>088</td>
<td></td>
<td>a) The signal (ex. 4-20 mA) from one of the analog sensors is outside the selected signal range.</td>
<td>Warning Unchanged</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MPC alarm indication</td>
<td>Alarm code</td>
<td>Associated device and device no.</td>
<td>Description/cause</td>
<td>Remedy</td>
<td>Reset type</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------</td>
<td>----------------------------------</td>
<td>------------------</td>
<td>--------</td>
<td>------------</td>
</tr>
<tr>
<td>29. CU 351 internal fault</td>
<td>157</td>
<td></td>
<td>a) The real-time clock in CU 351 is out of order</td>
<td>Replace the CU 351</td>
<td></td>
</tr>
<tr>
<td>30. Ethernet fault</td>
<td>231</td>
<td>CU 351</td>
<td>a) No address from DHCP server</td>
<td>1. Communication error. 2. Please contact the system integrator or network administrator.</td>
<td></td>
</tr>
<tr>
<td>31. Ethernet fault</td>
<td>232</td>
<td></td>
<td>a) Auto-disabled due to misuse</td>
<td></td>
<td></td>
</tr>
<tr>
<td>32. FLASH parameter verification error</td>
<td>083</td>
<td></td>
<td>a) Verification error in CU 351 FLASH memory</td>
<td>Replace the CU 351</td>
<td></td>
</tr>
<tr>
<td>33. IO 351 internal fault</td>
<td>080</td>
<td>IO 351</td>
<td>a) IO 351 pump module hardware fault</td>
<td>See current alarms and identify the faulty IO 351 module from the alarm message and replace the module.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>b) IO 351 I/O module hardware fault</td>
<td></td>
<td></td>
</tr>
<tr>
<td>34. VFD not ready</td>
<td>213</td>
<td>Pump 1-6 CU 351</td>
<td>a) The VFD signal relay does not release the VFD for operation</td>
<td>1. Check for VFD alarm 2. Check the wiring and input according to the wiring diagram.</td>
<td>Auto</td>
</tr>
<tr>
<td>35. Communication fault</td>
<td>010</td>
<td>Pump 1-6 IO 351</td>
<td>a) No GeniBus communication with a device connected to CU 351</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>36. Device alarms</td>
<td>From device</td>
<td>Pump 1-6</td>
<td>a) The device is in alarm</td>
<td>See actual alarms and identify the faulty device from the alarm message. 1. Fault find according to the service instruction for the device.</td>
<td></td>
</tr>
</tbody>
</table>

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)
9.6.2 Current alarms (3.1)

Description
This submenu shows the following:
- Warnings \( \wedge \) caused by faults that still exist.
- Warnings \( \wedge \) caused by faults that have disappeared, but the warning requires manual reset.
- Alarms \( \Delta \) caused by faults that still exist.
- Alarms \( \Delta \) 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 \( \wedge \). An alarm cannot be reset until the fault has disappeared.

For every warning or alarm, the following is shown:
- Whether it is a warning \( \wedge \) or an alarm \( \Delta \).
- 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.

For every warning or alarm, the following is shown:
- Whether it is a warning \( \wedge \) or an alarm \( \Delta \).
- 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)

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)

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)

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 or , and press .
3. Mark PI controller with or , and press .
4. Select the gain (\( K_p \)) with or , Set the value with or , and save with .
  
  Note: Usually it is not necessary to adjust \( K_p \).
5. Select the integral time (\( T_i \)) with or . Set the time with or , and press .

Factory setting
- \( K_p \): 0.5
- \( T_i \): 1 second

9.7.3 Alternative setpoints (4.1.2)

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.
9.7.4 Alternative setpoints 2 to 7 (4.1.2.1 to 4.1.2.7)

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)

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:

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

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 .
   Now a list of available parameters appear.
4. Mark the parameter which is to influence the setpoint with or , and press .
5. Mark the menu line for number of points 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 , and save with .
11. Set the value of the external input value with or , and save with .
12. Mark Reduce setpoint to (point 1) with or , and save with .
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 ·. 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)**

<table>
<thead>
<tr>
<th>Status</th>
<th>Operation</th>
<th>Alarm</th>
<th>Settings</th>
</tr>
</thead>
</table>

**Set the influence function**

<table>
<thead>
<tr>
<th>Select the number of points (2 to 8)</th>
<th>On the influence curve:</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Setpoint influence [%]" /></td>
<td><img src="image" alt="Q [gpm]" /></td>
</tr>
</tbody>
</table>

**Example with four points:**

1. Mark the menu line for number of points with ✓ or ☑, and press ·.
2. Select the required number of points with ✓ or ☑, and save with ✓.
3. Mark External input value (point 1) with ✓ or ☑.
4. Set the value of the external input value with ✓ or ☑, and save with ✓.
5. Mark the menu line for number of points with ✓ or ☑, and press ·.
6. Select the required number of points with ✓ or ☑, and save with ✓.
7. Mark External input value (point 1) with ✓ or ☑.
8. Set the value of the external input value with ✓ or ☑, and save with ✓.
9. Mark Reduce setpoint to (point 1) with ✓ or ☑.
10. Set the value as a percentage with ✓ or ☑, and save with ✓.
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)**

- **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

**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 Set the influence function with ✓ or ☑, and press ·.
5. Select the control parameter. Discharge pressure ✓
6. Select the sensor that measures the value.
   - Series 2000, flow rate ✓
   - Flow pipe temperature ✓
   - Return pipe temperature ✓
   - Differential pressure, external ✓
   - Ambient temperature ✓
   - 0-100 % signal ✓
   - Not used.
Setting via control panel

1. Mark the Settings menu with \( \mathbf{\downarrow} \).
2. Mark Primary controller with \( \mathbf{\uparrow} \) or \( \mathbf{\downarrow} \), and press \( \mathbf{\rightarrow} \).
3. Mark Primary sensor with \( \mathbf{\uparrow} \) or \( \mathbf{\downarrow} \), and press \( \mathbf{\rightarrow} \).
4. Mark Go to setting of analog input with \( \mathbf{\uparrow} \) or \( \mathbf{\downarrow} \), and press \( \mathbf{\rightarrow} \).
   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 \( \mathbf{\rightarrow} \).
5. Select the control parameter for the primary sensor with \( \mathbf{\uparrow} \) or \( \mathbf{\downarrow} \), and press \( \mathbf{\rightarrow} \).

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)

Setting range

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

Setting via control panel

1. Mark the Settings menu with \( \mathbf{\downarrow} \).
2. Mark Primary controller with \( \mathbf{\uparrow} \) or \( \mathbf{\downarrow} \), and press \( \mathbf{\rightarrow} \).
3. Mark Clock program with \( \mathbf{\uparrow} \) or \( \mathbf{\downarrow} \), and press \( \mathbf{\rightarrow} \).
4. Mark Event 1 with \( \mathbf{\uparrow} \) or \( \mathbf{\downarrow} \), and press \( \mathbf{\rightarrow} \).

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.

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.

Fig. 43 Event 1

5. Mark operating mode Normal or Stop with \( \mathbf{\uparrow} \) or \( \mathbf{\downarrow} \), and press \( \mathbf{\rightarrow} \). (If Stop is selected, Step 6 is skipped.)
6. Mark Setpoint, closed loop with \( \mathbf{\uparrow} \) or \( \mathbf{\downarrow} \). Set the pressure with \( \mathbf{\uparrow} \) or \( \mathbf{\downarrow} \), and save with \( \mathbf{\rightarrow} \).
7. Mark Time (hours, minutes) with \( \mathbf{\uparrow} \) or \( \mathbf{\downarrow} \).
8. Set the time with \( \mathbf{\uparrow} \) or \( \mathbf{\downarrow} \), and save with \( \mathbf{\rightarrow} \).
9. Mark day of week on which the settings are to be activated with \( \mathbf{\uparrow} \) or \( \mathbf{\downarrow} \), and press \( \mathbf{\rightarrow} \).
10. Mark Activated with \( \mathbf{\uparrow} \) or \( \mathbf{\downarrow} \), and press \( \mathbf{\rightarrow} \).
11. Repeat Steps 4 to 10 if several events are to be activated.

Note: Up to ten events can be set.
12. Return with \( \mathbf{\rightarrow} \).
13. Mark Activated with \( \mathbf{\uparrow} \) or \( \mathbf{\downarrow} \), and press \( \mathbf{\rightarrow} \). 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)

Setting range

• Proportional pressure: \( \mathbf{\uparrow} \) or \( \mathbf{\downarrow} \).
• Proportional pressure: \( \mathbf{\uparrow} \) or \( \mathbf{\downarrow} \).

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.
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 .
3. Mark Proportional pressure with  or  , and press .
4. Mark Activated with  or  , and press . The check mark in the right box shows that the function has been activated.
5. Mark Adaptation, linear or square with  or  , and press .
6. Mark Influence at 0 flow with  or  . Set the value with  or  , and save with .

Factory setting
The function is deactivated.

S-system configuration (4.1.8)

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 \( H_{set} + \text{start/stop band} \). 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 \( H_{set} + \text{start/stop band} \). And a pump is stopped when the current value becomes lower than \( H_{set} \). See fig. 47.

Normal control

**H [psi]**

**Pump stops**

\[ H_{set} \]

**Start/stop band**

**Pump starts**

**Time [sec]**

**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 .
3. Mark S-system configuration with  or  , and press .
4. Mark Inverse with  or  , and press .
5. Mark Start/stop band with  or  . Set the value with  or  , and save with .

Factory setting
Normal.

Pump cascade control (4.2)

**Status**

**Operation**

**Alarm**

**Settings**

Select the fixed-speed control type:

**Normal**

**Inverse**

Select the start/stop delay:

**Min. time between start/stop**

**Max. number of start/stop**

**Standby pumps**

**Fault pump changeover**

**Pump fast run**

**Pilot pump**

**Pump stop attempt**

**Pump start and stop speed**

**Win. performance**

Compensation for pump start-up time

**Fig. 48** Pump cascade control
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)

**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)

**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 whether the next pump is allowed to start/stop in order not to exceed the permissible number of starts per hour. The function always allows pump starts 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)

**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 .
3. Mark Standby pumps with or , and press .
4. Select the number of standby pumps with or , and save with .

**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)

**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 .
3. Mark Forced pump changeover with or , and press .
4. Mark Activated with or , and press . The check mark in the right box shows that the function has been activated.
5. Mark Time for changeover with , and press .
6. Set the time with or , and save with .

**Factory setting**
The function is activated. The time is set to 03:00.

9.7.16 Pump test run (4.2.5)

**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.
Setting range
• Not used.
• Once every 24 hours.
• Once every 48 hours.
• Once a week.

Setting via control panel
1. Mark the Settings menu with .
2. Mark Pump cascade control with or , and press .
3. Mark Pump test run with or , and press .
4. Select the interval with or .
5. Activate the function with .

Factory setting
Test runs are set to Not Used.

9.7.17 Pilot pump (4.2.6)

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.

Set the setpoint of the pilot pump to this value:

\[ H_{\text{set}} + \frac{1}{8} \text{ on/off band} + 10 \text{ psi} \]

If the setpoint of the main pumps is changed, the setpoint of the pilot pump must be changed too.

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

Factory setting
The function is deactivated.

9.7.18 Pump stop attempt (4.2.7)

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 .
3. Mark Pump stop attempt with or , and press .
4. Mark Self learning or Fixed interval with or , and press .
5. If Fixed interval is selected:
6. Mark Interval between stop attempts with or .
7. Set the interval with or .
8. Mark Activated with or , and save with .

Factory setting
The function is activated.

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.

Note
Set the setpoint of the pilot pump to this value:

\[ H_{\text{set}} + \frac{1}{8} \text{ on/off band} + 10 \text{ psi} \]
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

<table>
<thead>
<tr>
<th>Status</th>
<th>Operation</th>
<th>Alarm</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2.8: Pump start and stop speed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Select how to start and stop a pump:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use calculated speed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use fixed speed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start next pump at this speed:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-&gt;2</td>
<td>75%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-&gt;3</td>
<td>75%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-&gt;4</td>
<td>75%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-&gt;5</td>
<td>90%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-&gt;5</td>
<td>98%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 fixed speed with ○ or ◐, and press ◐.

2. Use fixed speed

<table>
<thead>
<tr>
<th>Status</th>
<th>Operation</th>
<th>Alarm</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2.8: Pump start and stop speed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Select how to start and stop a pump:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use calculated speed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use fixed speed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start next pump at this speed:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-&gt;0</td>
<td>40%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-&gt;1</td>
<td>40%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-&gt;2</td>
<td>40%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-&gt;3</td>
<td>40%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-&gt;4</td>
<td>40%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-&gt;5</td>
<td>40%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 57  Fixed pump start and stop speed

9.7.20 Min. performance (4.2.9)

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 press ◐.
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%.

Fig. 58  Min. performance
9.7.21 Compensation for pump start-up time (4.2.10)

![Fig. 59](image1)

**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 .
3. Mark Compensation for pump start-up time with or , and press .
4. Set the start-up time with or , and save with .

**Factory setting**
The start-up time is set to 0 seconds.

9.7.22 Secondary functions (4.3)

![Fig. 60](image2)

**Secondary functions**
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.

9.7.23 Stop function (4.3.1)

![Fig. 61](image3)

**Stop function**
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.

![Fig. 62](image4)

**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 \( (Q < Q_{\text{min}}) \), 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 \( H_{\text{set}} + 0.5 \times \text{on/off band} \). The pump is restarted when the pressure is \( H_{\text{set}} - 0.5 \times \text{on/off band} \). See fig. 63.

**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 system with an isolation valve, then a drain valve, and then connected to the diaphragm tank.

### 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 \( Q_{\text{min}} \), the pump will run on/off. If the flow rate is increased to above \( Q_{\text{min}} \), the pump returns to normal operation, \( H_{\text{set}} \). \( H_{\text{set}} \) is equal to the current setpoint. See section 9.4.4 *Setpoint* (1.2.2).

### Setting range

**System without flow switch or flowmeter**

1. Mark the **Settings** menu with 
2. Mark **Secondary functions** with or , and press .
3. Mark **Stop function** with or , and press .
4. Mark **Activated** with or , and press .
5. Mark **On/off band** with or .
6. Set the on/off band with or , and save with .
7. Mark **Go to setting of flow stop parameters** with or , and press .

Now the display below is shown.

---

**Precharge pressure**

Hydro MPC-E and -F: \( 0.7 \times \text{setpoint} \).

Hydro MPC-S: \( 0.9 \times \text{setpoint} \).

During each flow estimation (every 2 minutes), the estimating function will disturb the discharge pressure by \( \pm 10 \% \) 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 via control panel**

1. Mark the **Settings** menu with .
2. Mark **Secondary functions** with or , and press .
3. Mark **Stop function** with or , and press .
4. Mark **Activated** with or , and press .
5. Mark **On/off band** with or .
6. Set the on/off band with or , and save with .
7. Mark **Go to setting of flow stop parameters** with or , and press .

Now the display below is shown.

---

**Recommended diaphragm tank size [gallons]**

<table>
<thead>
<tr>
<th>Pump type</th>
<th>-E</th>
<th>-F</th>
<th>-S</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR(E) 3</td>
<td>4.4</td>
<td>4.4</td>
<td>20</td>
</tr>
<tr>
<td>CR(E) 5</td>
<td>4.4</td>
<td>4.4</td>
<td>34</td>
</tr>
<tr>
<td>CR(E) 10</td>
<td>10.2</td>
<td>10.2</td>
<td>62</td>
</tr>
<tr>
<td>CR(E) 15</td>
<td>34</td>
<td>34</td>
<td>211</td>
</tr>
<tr>
<td>CR(E) 20</td>
<td>34</td>
<td>34</td>
<td>211</td>
</tr>
<tr>
<td>CR(E) 32</td>
<td>44</td>
<td>44</td>
<td>317</td>
</tr>
<tr>
<td>CR(E) 45</td>
<td>86</td>
<td>86</td>
<td>528</td>
</tr>
<tr>
<td>CR(E) 64</td>
<td>132</td>
<td>132</td>
<td>1056</td>
</tr>
<tr>
<td>CR(E) 90</td>
<td>132</td>
<td>132</td>
<td>1056</td>
</tr>
</tbody>
</table>

**On/off band**: 5 to 30 %

**Min. flow rate**: 2 to 50 % of the nominal flow rate \( (Q_{\text{nom}}) \) of one of the pumps. (Can only be set if direct flow measurement by means of flowmeter has been selected.)
8. Select one of the stop parameters with \( \checkmark \) or \( \circ \), and save with \( \checkmark \). If Customised settings are selected, the parameters shown in fig. 65 must be set. See examples below.

### Example 1: Increasing the stop limit, \( Q_{\text{min}} \) (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.

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

### Example of increased stop limit

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delta pressure for gradient</td>
<td>6 %</td>
</tr>
<tr>
<td>Delta time for gradient (pump stopped)</td>
<td>1.5 sec</td>
</tr>
<tr>
<td>Delta time for gradient (pump running)</td>
<td>2.0 sec</td>
</tr>
<tr>
<td>Speed reduction</td>
<td>10 %</td>
</tr>
</tbody>
</table>

### Example 2: Reducing the stop limit, \( Q_{\text{min}} \) (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.

---

### System with flow switch

Make the following additional settings:
1. Mark Go to setting of digital input with \( \checkmark \) or \( \circ \), and press \( \checkmark \). Now the display Digital inputs (4.3.7) appears.
2. Select the digital input where the flow switch is connected with \( \checkmark \) or \( \circ \), and press \( \checkmark \).
3. Mark Flow switch with \( \checkmark \) or \( \circ \), press \( \checkmark \) and return with \( \checkmark \).

### Note

An open contact indicates low flow.

### System with flowmeter

Make the following additional settings:
1. Mark Go to setting of analog input with \( \checkmark \) or \( \circ \), and press \( \checkmark \). 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 \( \checkmark \) twice.
4. Mark Stop limit with \( \checkmark \) or \( \circ \).
5. Set the value with \( \checkmark \) or \( \circ \), and save with \( \checkmark \).

### 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)

#### 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)

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).
9.7.26 Digital inputs (4.3.7)

**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]:

<table>
<thead>
<tr>
<th>DI1: Digital input No 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>(IO 351-41): IO 351, GENibus number 41</td>
</tr>
<tr>
<td>[10]: Terminal No 10</td>
</tr>
</tbody>
</table>

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

9.7.27 Functions of digital inputs (4.3.7.1)

**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:

<table>
<thead>
<tr>
<th>Function</th>
<th>Contact activated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>Min. duty</td>
<td>= Operating mode Min.</td>
</tr>
<tr>
<td>Max. duty</td>
<td>= Operating mode Max.</td>
</tr>
<tr>
<td>User-defined duty</td>
<td>= Operating mode User-defined</td>
</tr>
<tr>
<td>External fault</td>
<td>= External fault</td>
</tr>
<tr>
<td>Dry-running protection</td>
<td>= Water shortage</td>
</tr>
<tr>
<td>Flow switch</td>
<td>= Flow rate &gt; Set switch value</td>
</tr>
<tr>
<td>Reset of alarm</td>
<td>= Reset alarms</td>
</tr>
<tr>
<td>Emergency run</td>
<td>= Operating mode Emergency run</td>
</tr>
<tr>
<td>Pilot pump fault</td>
<td>= Pilot pump fault</td>
</tr>
<tr>
<td>Alternative setpoint 2</td>
<td>= Setpoint 2 selected</td>
</tr>
<tr>
<td>Alternative setpoint 3</td>
<td>= Setpoint 3 selected</td>
</tr>
<tr>
<td>Alternative setpoint 4</td>
<td>= Setpoint 4 selected</td>
</tr>
<tr>
<td>Alternative setpoint 5</td>
<td>= Setpoint 5 selected</td>
</tr>
<tr>
<td>Alternative setpoint 6</td>
<td>= Setpoint 6 selected</td>
</tr>
<tr>
<td>Alternative setpoint 7</td>
<td>= Setpoint 7 selected</td>
</tr>
</tbody>
</table>

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

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

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

9.7.28 Analog inputs (4.3.8)

<table>
<thead>
<tr>
<th>Status</th>
<th>Operation</th>
<th>Alarm</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog inputs and measured value:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AI1 (CU 351) [51]</td>
<td>Flow rate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AI2 (CU 351) [52]</td>
<td>Flow rate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AI3 (CU 351) [53]</td>
<td>Flow rate</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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
<table>
<thead>
<tr>
<th>AI1 (CU 351) [51]:</th>
<th>Analog input No 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>AI1: (CU 351):</td>
<td>CU 351</td>
</tr>
<tr>
<td>[51]:</td>
<td>Terminal No 51</td>
</tr>
</tbody>
</table>

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 .
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.

9.7.29 Analog inputs (4.3.8.1 to 4.3.8.7)

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.

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.
Factory setting

<table>
<thead>
<tr>
<th>Analog input</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>AI1 (CU 351)</td>
<td>Discharge pressure</td>
</tr>
<tr>
<td>AI2 (CU 351)</td>
<td>Tank precharge pressure</td>
</tr>
<tr>
<td>AI3 (CU 351)</td>
<td>Redundant primary sensor</td>
</tr>
</tbody>
</table>

### 9.7.30 Analog inputs and measured value (4.3.8.1.1 to 4.3.8.7.1)

#### 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 .
3. Mark Analog inputs with  or , and press .
4. Select the analog input with  or , and press .
5. Set the range of the analog input with  or , and press .
   The activation is indicated by a check mark.
6. Mark Measured input value with  or , and press .
   Now the display 4.3.8.1.1 appears.
7. Select the input with  or , and press .
8. Press  to return to display 4.3.8.1.
9. Set the minimum sensor value with  or , and save with .
10. Set the maximum sensor value with  or , and save with .

### 9.7.31 Digital outputs (4.3.9)

#### 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]:**

<table>
<thead>
<tr>
<th>DO1</th>
<th>Digital output No 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>(IO 351-41)</td>
<td>IO 351B, GENIbus number 41</td>
</tr>
<tr>
<td>[71]</td>
<td>Terminal No 71</td>
</tr>
</tbody>
</table>

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)

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 .
3. Mark Digital outputs with or , and press .
4. Select the digital output with or , and press .
5. Mark the desired function with or , and activate it with .

The activation is indicated by a check mark in the box.

Factory setting

<table>
<thead>
<tr>
<th>Digital output</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>DO1 (CU 351) [71]</td>
<td>Alarm, system</td>
</tr>
<tr>
<td>DO2 (CU 351) [74]</td>
<td>Operation, system</td>
</tr>
</tbody>
</table>

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

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).

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)

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.
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)

<table>
<thead>
<tr>
<th>Setting via control panel</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mark the Settings menu with .</td>
<td></td>
</tr>
<tr>
<td>2. Mark Secondary functions with or , and press .</td>
<td></td>
</tr>
<tr>
<td>3. Mark Min., max. and user-defined duty with or , and press .</td>
<td></td>
</tr>
<tr>
<td>4. Mark Max. duty with or , and press .</td>
<td></td>
</tr>
<tr>
<td>5. Mark Number of pumps in operation at 100 % speed, max. duty with or .</td>
<td></td>
</tr>
<tr>
<td>6. Set the number with or , and save with .</td>
<td></td>
</tr>
</tbody>
</table>

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)

<table>
<thead>
<tr>
<th>Setting via control panel</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mark the Settings menu with .</td>
<td></td>
</tr>
<tr>
<td>2. Mark Secondary functions with or , and press .</td>
<td></td>
</tr>
<tr>
<td>3. Mark Min., max. and user-defined duty with or , and press .</td>
<td></td>
</tr>
<tr>
<td>4. Mark User-defined duty with or , and press .</td>
<td></td>
</tr>
<tr>
<td>5. Mark Number of pumps in operation, user-defined duty with or .</td>
<td></td>
</tr>
<tr>
<td>6. Set the number with or , and save with .</td>
<td></td>
</tr>
<tr>
<td>7. Mark Speed with or .</td>
<td></td>
</tr>
<tr>
<td>8. Set the value with or , and save with .</td>
<td></td>
</tr>
</tbody>
</table>

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

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

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)

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)

Description
The CU 351 has a number of functions using these pump data:
• Nominal flow rate, \( Q_{\text{nom}} \), in gpm
• Nominal head, \( H_{\text{nom}} \), in feet
• Max. head, \( H_{\text{max}} \), in feet
• Max. flow rate, \( Q_{\text{max}} \), in gpm
• Power, \( Q_0 \), 100 % speed, in kW
• Power, \( Q_0 \), 50 % speed, in kW
• Nominal power, \( P_{\text{nom}} \), in kW.

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, \( Q_0 \), 100 % speed, Power, \( Q_0 \), 50 % speed, and Nominal power, \( P_{\text{nom}} \). 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).

Fig. 80 Pump curve data

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

The electrical data, "Power, \( Q_0 \), 100 % speed" and "Power, \( Q_0 \), 50 % speed" must be entered manually.

For Grundfos E-pumps, the data of input power (\( P_1 \)) must be entered.
Note: \( Q_{\text{nom}} \) and \( H_{\text{nom}} \) 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 \( \circ \).
2. Mark **Secondary functions** with \( \checkmark \) or \( \times \), and press \( \circ \).
3. Mark **Pump curve data** with \( \checkmark \) or \( \times \), and press \( \circ \).
4. Mark **Nominal flow rate** \( Q_{\text{nom}} \) with \( \checkmark \) or \( \times \).
5. Set the value with \( \circ \) or \( \times \), and save with \( \circ \).
6. Mark **Nominal head** \( H_{\text{nom}} \) with \( \checkmark \) or \( \times \).
7. Set the value with \( \circ \) or \( \times \), and save with \( \circ \).
8. Mark **Max. head** \( H_{\text{max}} \) with \( \checkmark \) or \( \times \).
9. Set the value with \( \circ \) or \( \times \), and save with \( \circ \).
10. Mark **Max. flow rate** \( Q_{\text{max}} \) with \( \checkmark \) or \( \times \).
11. Set the value with \( \circ \) or \( \times \), and save with \( \circ \).
12. Mark **Power, \( Q_0 \), 100 % speed** with \( \checkmark \) or \( \times \).
13. Set the value with \( \circ \) or \( \times \), and save with \( \circ \).
14. Mark **Power, \( Q_0 \), 50 % speed** with \( \checkmark \) or \( \times \).
15. Set the value with \( \circ \) or \( \times \), and save with \( \circ \).
16. Mark **Nominal power** \( P_{\text{nom}} \) with \( \checkmark \) or \( \times \).
17. Set the value with \( \circ \) or \( \times \), and save with \( \circ \).

### 9.7.38 Control source (4.3.20)

#### Fig. 85 Control source

**Description**
Hydro MPC can be remote-controlled via an external bus connection (option). See section 9.8.2 GENbus. 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 \( \circ \).
2. Mark **Secondary functions** with \( \checkmark \) or \( \times \), and press \( \circ \).
3. Mark **Control source** with \( \checkmark \) or \( \times \), and press \( \circ \).
4. Select the desired control source with \( \checkmark \) or \( \times \), and save with \( \circ \).

**Factory setting**
The control source is CU 351.

### 9.7.39 Fixed inlet pressure (4.3.22)

#### 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 \( \circ \).
2. Mark **Secondary functions** with \( \checkmark \) or \( \times \), and press \( \circ \).
3. Mark **Fixed inlet pressure** with \( \checkmark \) or \( \times \), and press \( \circ \).
4. Set the inlet pressure with \( \circ \) or \( \times \), and save with \( \circ \).
5. Mark **Activated** with \( \checkmark \) or \( \times \), and press \( \circ \). 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)

#### 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.

*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 🔄.
3. Mark **Flow estimation** with 🔄 or 🔄, and press 🔄.
4. Select the curve type by marking one of the lines at the selection box with 🔄 or 🔄, and press 🔄.

**Factory setting**
All polynomials are selected.

### 9.7.41 Monitoring functions (4.4)

**Setting via control panel**
1. Mark the **Settings** menu with 🔄.
2. Mark **Monitoring functions** with 🔄 or 🔄, and press 🔄.
3. Select the function with 🔄 or 🔄, and press 🔄.

**Factory setting**
All functions are selected.

#### 9.7.42 Dry-running protection (4.4.1)

**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 🔄.
3. Mark **Dry-running protection** with 🔄 or 🔄, and press 🔄.
4. Select the method with 🔄 or 🔄, and press 🔄.
9.7.43 Dry-running protection with pressure/level switch (4.4.1.1)

**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 .
3. Mark **Dry-running protection** with or , and press .
4. Mark **Pressure/level switch** with or , and press .
5. Mark **Go to setting of digital input**, and press . Now the display **Digital inputs** (4.3.7) appears. Set the input to dry-running protection. Return with .
6. Mark **Warning** or **Alarm + stop** with or , and save with .
7. Mark **Manual** or **Auto** with or , and save with .

**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.

**Table**

<table>
<thead>
<tr>
<th>Status</th>
<th>Operation</th>
<th>Alarm</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.4.1.1 Pressure/level switch</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The digital input for the pressure/level switch must be set to activate the function:</td>
<td>Go to setting of digital input</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reaction in case of water shortage:</td>
<td>Warning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restart:</td>
<td>Manual</td>
<td>Auto</td>
<td></td>
</tr>
</tbody>
</table>

**Fig. 90** Dry-running protection with pressure/level switch

9.7.44 Dry-running protection with pressure transmitter (4.4.1.2)

**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 .
3. Mark **Dry-running protection** with or , and press .
4. Mark **Measurement, inlet pressure** with or , and press .
5. Mark **Go to setting of analog input**, and press . Now the display **Analog inputs** (4.3.8) appears. Set the input to Inlet pressure, and save with . Return with .
6. Mark **Activated** with or , and press .
7. Mark **Warning** with or . Set the level with or , and save with .
8. Mark **Alarm + stop** with or . Set the level with or , and save with .
9. Mark **Manual** or **Auto** with or , and save with .

**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)

**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 .
3. Mark **Dry-running protection** with or , and press .
4. Mark **Measurement, tank level** with or , and press .
5. Mark **Go to setting of analog input**, and press . Now the display **Analog inputs (4.3.8)** appears. Set the input to **Tank level, suction side**. Return with .
6. Mark **Activated** with or , and press .
7. Mark **Warning** with or . Set the level with or , and save with .
8. Mark **Alarm + stop** with or . Set the level with or , and save with .
9. Mark **Manual** or **Auto** with or , and save with .

**Factory setting**

The function is deactivated.

9.7.46 Min. pressure (4.4.2)

**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 .
3. Mark **Min. pressure** with or , and press .
4. Mark **Activated** with or , and press to activate/deactivate the function.
5. Mark **Min. pressure** with or , and set the pressure with or , and save with .
6. Mark **Stop at min. pressure** with or , and press to activate/deactivate the function.
7. Mark **Time delay of function at start-up** with or . Set the time with or , and save with .
8. Mark **Time delay of function during operation** with or . Set the time with or , and save with .
9.7.47 Max. pressure (4.4.3)

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 .
3. Mark Max. pressure with or , and press .
4. Mark Activated with or , and press .
5. Mark Max. pressure with or , and set the pressure with or , and save with .
6. Mark Manual or Auto with or . Activate the function with .

Factory setting
The function is deactivated.

9.7.48 External fault (4.4.4)

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 .
3. Mark External fault with or , and press .
4. Mark Go to setting of digital input with or , and press . Now the display Digital inputs (4.3.7) appears. Set the input to External fault. Return with .
5. Mark Time delay, fault indication with or . Set the time with or , and save with .
6. Mark Warning with or if only a warning is required in case of external fault. Activate the function with .
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 .
8. Mark Manual or Auto with or . Activate the function with .

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.
9.7.49 Limit 1 and 2 exceeded (4.4.5 and 4.4.6)

#### 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

**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 and press .
2. Mark **Monitoring functions** with or , and press .
3. Mark **Limit 1 exceeded** or **Limit 2 exceeded** with or , and press .
4. Mark **Go to setting of analog input** with or , and press .
5. Select the analog input with or , and press .
6. Mark the setting of the analog input with or , and activate it with .

The activation is indicated by a check mark in the box.

7. Mark **Measured value** with or , and press . Now the display 4.3.8.1.1 appears.
8. Select the input with or , and press .
9. Press to return to display 4.3.8.1.
10. Set the minimum sensor value with or , and save with .
11. Set the maximum sensor value with or , and save with .
12. Return by pressing twice.
13. Mark **Measured value to be monitored** with or , and press . Select the input with or , and press .
15. Mark **Min. limit or Max. limit** with or , and press .
16. Mark **Set delays** with or , and press .
17. Mark **Time delay of function at start-up** with or . Set the time with or , and save with .
18. Mark **Time delay of function during operation** with or . Set the time with or , and save with .
19. Mark **Time delay of function at reset** with or . Set the time with or , and save with .
20. Return with .
21. Mark **Set warning limit** with or , and press .
22. Mark **Activated** with or , and press .
23. Mark **Warning limit** with or , and save with .
24. Mark **Manual** or **Auto** with or . Activate the function with .
25. Return with .
26. Mark **Set alarm limit** with or , and press .
27. Mark **Activated** with or , and press .
28. Mark **Alarm limit** with or , and save with .
29. Mark **Manual** or **Auto** with or . Activate the function with .
30. Return with .
31. Mark **Activated** with or , and press to activate the function.

#### Factory setting
The function is deactivated.

9.7.50 Pumps outside duty range (4.4.7)

#### Setting range
- Monitoring, pumps outside duty range.
- **Activated**
- **Warning reset:**
  - Manual
  - Auto
- **Set warning delay:**
  - Delay: 600s

**Fig. 97** Pumps outside duty range

---

**Note:**
Analog inputs must be correctly set before the function is activated. See section 9.7.28 Analog inputs (4.3.8).
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 .
3. Mark Pumps outside duty range with or , and press .
4. Mark Manual or Auto with or , and activate the function with .
5. Mark Warning delay with or . Set the time with or , and save with .
6. Mark Activated with or , and press to activate the function.

Factory setting
The function is deactivated.

9.7.51 Pressure relief (4.4.8)

Fig. 98 Pressure relief

Fig. 99 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.

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

Factory setting
The function is deactivated.
9.7.52 Functions, CU 351 (4.5)

**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).

**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)

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

**Setting via control panel**
1. Mark the Settings menu with .
2. Mark Functions, CU 351 with or , and press .
3. Mark Display language with or , and press .
4. Select language with or , and save with .

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

9.7.54 Display units (4.5.2)

**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.
Setting range

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Basic setting</th>
<th>Possible units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure</td>
<td>SI US</td>
<td>bar psi kPa MPa mbar bar m psi</td>
</tr>
<tr>
<td>Differential pressure</td>
<td>SI US</td>
<td>m psi kPa MPa mbar bar m psi</td>
</tr>
<tr>
<td>Head</td>
<td>SI US</td>
<td>m ft m cm ft in</td>
</tr>
<tr>
<td>Level</td>
<td>SI US</td>
<td>m ft m cm ft in</td>
</tr>
<tr>
<td>Flow rate</td>
<td>SI US</td>
<td>m³/h gpm m³/s m³/h l/s gpm yd³/yd³/yd³/min yd³/h</td>
</tr>
<tr>
<td>Volume</td>
<td>SI US</td>
<td>m³ gal l m³ gal l</td>
</tr>
<tr>
<td>Specific energy</td>
<td>SI US</td>
<td>kWh/m³ Wh/gal kWh/m³ Wh/gal Wh/kgal BTU/gal HPh/gal</td>
</tr>
<tr>
<td>Temperature</td>
<td>SI US</td>
<td>°C °F K °C °F</td>
</tr>
<tr>
<td>Differential temperature</td>
<td>SI US</td>
<td>K K</td>
</tr>
<tr>
<td>Power</td>
<td>SI US</td>
<td>kW HP W kW MW HP</td>
</tr>
<tr>
<td>Energy</td>
<td>SI US</td>
<td>kWh kWh kWh MWh BTU HPh</td>
</tr>
</tbody>
</table>

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 .
5. Select the measuring parameter with or , and press to open the display for the measuring parameter. See the example.
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)

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. Select the unit with or , and save with .
5. Select the format with or , and 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.

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)

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.

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 .
3. Mark Password with or , and press .
4. Mark the password to be activated, and press .
5. Mark Enter password, and press .
   Now the first digit of the password is flashing.
6. Select the digit with or , and save with .
   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)

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)

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 .
3. Mark GENIbus number with or , and press .
4. Select the number with or , and save with .

Factory setting
No number is set (“-“).
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.

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.

**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.

**Note**

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 **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.

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

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

![Fig. 111 Connection to CU 351](image1)

**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.

![Fig. 112 Display with link to the JavaScript® program](image2)

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.

![Fig. 113 Network setting](image3)

**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.

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

![Fig. 114 Change of network setting](image4)
Change of password

![Image of a GRUNDFOS interface showing a window titled 'Change password' with fields for username, current password, and new password]

**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.
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.

10.1 VLT 2800

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Factory setting</th>
<th>Grundfos setting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Function</td>
<td>Value or number in the display of VLT</td>
</tr>
<tr>
<td>2</td>
<td>Local/remote operation</td>
<td>Local/remote operation</td>
</tr>
<tr>
<td>3</td>
<td>Local reference</td>
<td>Local reference</td>
</tr>
<tr>
<td>101</td>
<td>Torque characteristics</td>
<td>Torque characteristics</td>
</tr>
<tr>
<td>102</td>
<td>Motor power</td>
<td>Motor power</td>
</tr>
<tr>
<td>103</td>
<td>Motor voltage</td>
<td>Motor voltage</td>
</tr>
<tr>
<td>104</td>
<td>Motor frequency</td>
<td>Motor frequency</td>
</tr>
<tr>
<td>105</td>
<td>Motor current</td>
<td>Motor current</td>
</tr>
<tr>
<td>106</td>
<td>Rated motor speed</td>
<td>Rated motor speed</td>
</tr>
<tr>
<td>107</td>
<td>Automatic motor adaptation</td>
<td>Automatic motor adaptation</td>
</tr>
<tr>
<td>128</td>
<td>Thermal motor protection</td>
<td>Thermal motor protection</td>
</tr>
<tr>
<td>204</td>
<td>Minimum reference</td>
<td>Minimum reference</td>
</tr>
<tr>
<td>205</td>
<td>Maximum reference</td>
<td>Maximum reference</td>
</tr>
<tr>
<td>206</td>
<td>Ramp type</td>
<td>Ramp type</td>
</tr>
<tr>
<td>207</td>
<td>Ramp up time</td>
<td>Ramp up time</td>
</tr>
<tr>
<td>208</td>
<td>Ramp down time</td>
<td>Ramp down time</td>
</tr>
<tr>
<td>214</td>
<td>Reference function</td>
<td>Reference function</td>
</tr>
<tr>
<td>215</td>
<td>Preset reference</td>
<td>Preset reference</td>
</tr>
<tr>
<td>302</td>
<td>Digital input</td>
<td>Digital input</td>
</tr>
<tr>
<td>304</td>
<td>Digital input</td>
<td>Digital input</td>
</tr>
<tr>
<td>305</td>
<td>Digital input6</td>
<td>Digital input6</td>
</tr>
<tr>
<td>323</td>
<td>Relay output</td>
<td>Relay output</td>
</tr>
<tr>
<td>406</td>
<td>Automatic restart time</td>
<td>Automatic restart time</td>
</tr>
<tr>
<td>411</td>
<td>Switching frequency</td>
<td>Switching frequency</td>
</tr>
</tbody>
</table>

* 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.

---

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
<th>Grundfos setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>Language</td>
<td>English</td>
</tr>
<tr>
<td>002</td>
<td>Motor Speed Unit</td>
<td>Hz</td>
</tr>
<tr>
<td>003</td>
<td>Regional Settings</td>
<td>North America</td>
</tr>
<tr>
<td>020</td>
<td>Display Line 1.1</td>
<td>Power [hp]</td>
</tr>
<tr>
<td>021</td>
<td>Display Line 1.2</td>
<td>Motor Voltage</td>
</tr>
<tr>
<td>022</td>
<td>Display Line 1.3</td>
<td>Motor Current</td>
</tr>
<tr>
<td>023</td>
<td>Display Line 2 Large</td>
<td>Frequency</td>
</tr>
<tr>
<td>024</td>
<td>Display Line 3 Large</td>
<td>Speed [rpm]</td>
</tr>
<tr>
<td>100</td>
<td>Configuration Mode</td>
<td>Open Loop</td>
</tr>
<tr>
<td>103</td>
<td>Torque Characteristics</td>
<td>Variable Torque</td>
</tr>
<tr>
<td>121</td>
<td>Motor Power [HP]</td>
<td>Nameplate</td>
</tr>
<tr>
<td>122</td>
<td>Motor Voltage</td>
<td>Nameplate</td>
</tr>
<tr>
<td>123</td>
<td>Motor Frequency</td>
<td>Nameplate</td>
</tr>
<tr>
<td>124</td>
<td>Motor Current</td>
<td>Nameplate</td>
</tr>
<tr>
<td>125</td>
<td>Motor Nominal Speed</td>
<td>Nameplate</td>
</tr>
<tr>
<td>190</td>
<td>Motor Thermal Protection</td>
<td>ETR trip 1</td>
</tr>
<tr>
<td>302</td>
<td>Minimum Reference</td>
<td>20,000 Hz</td>
</tr>
<tr>
<td>303</td>
<td>Maximum Reference</td>
<td>60,000 Hz</td>
</tr>
<tr>
<td>304</td>
<td>Reference Function</td>
<td>External Preset</td>
</tr>
<tr>
<td>310</td>
<td>Preset Reference</td>
<td>100.00%</td>
</tr>
<tr>
<td>313</td>
<td>Reference Site</td>
<td>Remote</td>
</tr>
<tr>
<td>341</td>
<td>Ramp 1 Ramp up Time</td>
<td>1.50 s</td>
</tr>
<tr>
<td>342</td>
<td>Ramp 1 Ramp down Time</td>
<td>3.00 s</td>
</tr>
<tr>
<td>412</td>
<td>Motor Speed Low Limit [Hz]</td>
<td>0.0 Hz</td>
</tr>
<tr>
<td>414</td>
<td>Motor Speed High Limit [Hz]</td>
<td>62.0 Hz</td>
</tr>
<tr>
<td>419</td>
<td>Max Output Frequency</td>
<td>65.0 Hz</td>
</tr>
<tr>
<td>510</td>
<td>Terminal 18 Digital Input</td>
<td>Star</td>
</tr>
<tr>
<td>513</td>
<td>Terminal 29 Digital Input</td>
<td>Preset reference on</td>
</tr>
<tr>
<td>540.0</td>
<td>Function Relay</td>
<td>Drive ready</td>
</tr>
<tr>
<td>542.0</td>
<td>Off Delay, Relay</td>
<td>2.00 s</td>
</tr>
<tr>
<td>610</td>
<td>Terminal 53 Low Voltage</td>
<td>0.00 V</td>
</tr>
<tr>
<td>611</td>
<td>Terminal 53 High Voltage</td>
<td>10.00 V</td>
</tr>
<tr>
<td>614</td>
<td>Terminal 53 Low Ref. / Feedb.</td>
<td>20,000 Hz</td>
</tr>
<tr>
<td>615</td>
<td>Terminal 53 High Ref. / Feedb.</td>
<td>60,000 Hz</td>
</tr>
<tr>
<td>1400</td>
<td>Switching Pattern</td>
<td>60 AVM</td>
</tr>
<tr>
<td>1401</td>
<td>Switching Frequency</td>
<td>5.0 kHz</td>
</tr>
</tbody>
</table>

---

**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 operating hours, the number of power-ups and overtemp’s and overvolt’s.

---

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.

---

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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.

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.

- Convertor
  - Nominal power: 2200 W
- Input/Output
  - Nominal voltage: 400 V
  - Nominal current: 2.60 A
- Functions
  - Nominal frequency: 50 Hz
  - Nominal speed: 2900 rpm

Fig. 116 Pumps numbered from left to right.

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.
### 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.*

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

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.
- \( NPSH = \text{Net Positive Suction Head} \) in feet.

\( NPSH \) can be read from the NPSH curve at the maximum capacity at which the pump will run.
(See installation and operating instructions for CR, CRI, CRN).

\( H_s = \text{Safety margin} = \text{minimum 2 feet.} \)

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

Maximum inlet pressure
Please refer to the CR, CRI, CRN, CRT installation and operating instructions (L-CR-TL-001) delivered together with this booster system.

The maximum inlet pressure is determined by the construction of the pump, such as bearing pressure.

**Note**
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:
\[ L_{\text{max}} = L_{\text{pump}} + (n - 1) \times 3 \]
\[ L_{\text{max}} = \text{Maximum sound pressure level.} \]
\[ L_{\text{pump}} = \text{Sound pressure level for one pump.} \]
\[ n = \text{Number of pumps.} \]

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 symmetrical 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

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

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.

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.

<table>
<thead>
<tr>
<th>Title</th>
<th>Frequency</th>
<th>Publication number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Guide</td>
<td>60 Hz</td>
<td>L-BPQ-PG-01</td>
</tr>
<tr>
<td>Grundfos Hydro MPC</td>
<td>60 Hz</td>
<td>L-CR-PG-001</td>
</tr>
<tr>
<td>Installation and operating instructions</td>
<td>60 Hz</td>
<td>L-CP-TL-003</td>
</tr>
<tr>
<td>Service documentation</td>
<td>50/60 Hz</td>
<td>96646712</td>
</tr>
<tr>
<td>Service kit catalog</td>
<td>50/60 Hz</td>
<td>96488862</td>
</tr>
<tr>
<td>Other documentation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wiring diagram**</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* 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.
U.S.A.
GRUNDFOS Pumps Corporation
17100 West 118th Terrace
Olathe, Kansas 66061
Phone: +1-913-227-3400
Telefax: +1-913-227-3500

Canada
GRUNDFOS Canada Inc.
2941 Brighton Road
Oakville, Ontario
L6H 6C9
Phone: +1-905 829 9533
Telefax: +1-905 829 9512

México
Bombas GRUNDFOS de México S.A. de C.V.
Boulevard TLC No. 15
Parque Industrial Itiva
Aeropuerto
Apodaca, N.L.C.P. 66600
Phone: +52-81-8144 4000
Telefax: +52-81-8144 4010

Addresses revised 22.09.2005