Control MPC

(GB) **Installation and operating instructions**

(GB) Declaration of Conformity

We **Grundfos** declare under our sole responsibility that the products **Control MPC**, to which this declaration relates, are in conformity with these Council Directives on the approximation of the laws of the EC Member States:

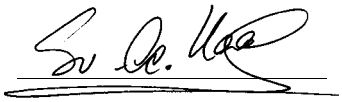
— Machinery Directive (98/37/EC)
Standard used: EN 60204-1:2006.

— EMC Directive (2004/108/EC)
Attestation of conformity: Certificate Control MPC 1:2007.

— Low Voltage Directive (2006/95/EC)
Standard used: EN 60439-1:2002.

These products must not be put into service until the system into which they are to be incorporated has been declared in conformity with the provisions of the Machinery Directive (98/37/EC).

Bjerringbro, 15th May 2009



Svend Aage Kaae
Technical Director

CONTENTS

Warning

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

1. Symbols used in this document

Warning

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

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

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

2. Scope of these instructions

These installation and operating instructions apply to Grundfos Control MPC.

Grundfos Control MPC is a complete solution for control and monitoring of up to six identical pumps.

3. Product description

TM04 0210 0208 - GrA5728

Fig. 1 Control MPC

Grundfos Control MPC is used for control and monitoring of booster systems and circulation systems.

Control MPC consists of a control cabinet with a built-in controller, the CU 351. The control cabinet contains all necessary components such as main switch, contactors, IO modules and cabling. In systems with external frequency converters, the frequency converters can be installed in the cabinet.

The control cabinet is for wall or floor mounting.

4. Applications

Control MPC is used for control and monitoring of pumps in these applications:

- booster systems
- circulation systems for heating, cooling and air-conditioning.

4.1 Pumps

Control MPC is designed for systems with these pumps:

- CR(E), CRI(E), CRN(E), CRIE
- NB(E), NBG(E)
- NK(E), NKG(E)
- TP
- TPE Series 1000
- TPE Series 2000
- HS
- SP
- MAGNA, UPE Series 2000.

Note ***The main pumps of the system must be of the same type and size.***

4.2 Control variant

Control MPC is divided into four groups based on control variant:

Control variant	Description
-E	Two to six electronically speed-controlled pumps. From 0,37 to 22 kW, Control MPC-E is equipped with Grundfos pumps with integrated frequency converter. As from 30 kW, Control MPC-E is equipped with mains-operated pumps connected to external Grundfos CUE frequency converters (one per pump).
Series 2000	Two to six MAGNA, UPE or TPE Series 2000 pumps
-F	Two to six pumps connected to an external Grundfos CUE frequency converter. The speed-controlled operation alternates between the pumps.
-S	Two to six mains-operated pumps

See also section *8. Overview of control variants*.

The Control MPC includes software for booster, heating and cooling.

5. Nameplate

The nameplate of the Control MPC is fitted on the base frame. See position 2 in fig. 2.

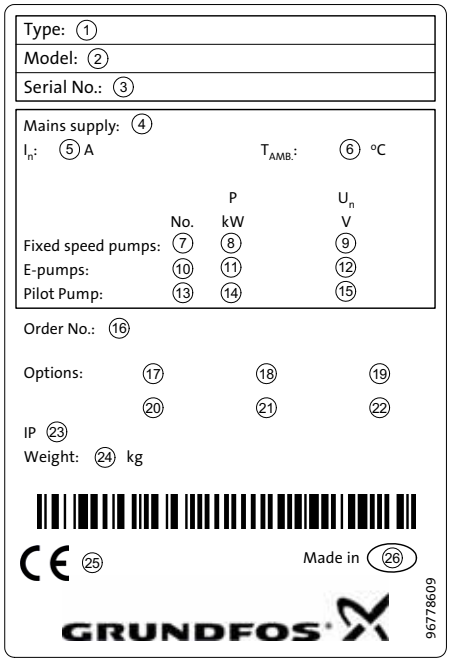


Fig. 2 Nameplate

Pos.	Description
1	Type designation
2	Model
3	Serial number
4	Supply voltage
5	Nominal current [A]
6	Maximum ambient temperature in °C
7	Number of mains-operated pumps
8	Motor power in kW for mains-operated pumps
9	Nominal voltage in volts for mains-operated pumps
10	Number of pumps with frequency converter
11	Motor power in kW for pumps with frequency converter
12	Nominal voltage in volts for pumps with frequency converter
13	Number of pilot pumps
14	Motor power in kW for pilot pump
15	Nominal voltage in volts for pilot pump
16	Order number
17-22	Options
23	Enclosure class
24	Weight [kg]
25	CE-mark
26	Country of origin

6. Software label

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

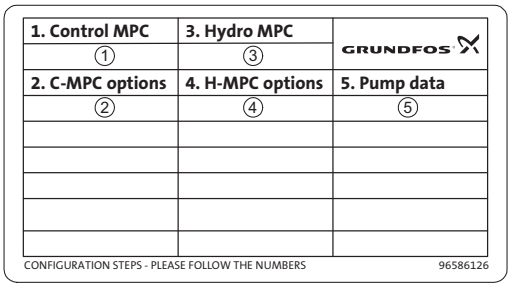


Fig. 3 Software label

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

* Applies only to booster systems.

** Applies only to CR, CRI, CRE and CRIE pumps.

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

7. Type key

Example	Control MPC	-E	2 x	4	E	(*	(*	(*	3 x 380-415 V, 50/60 Hz, PE

Type range

Subgroups:
E: Pumps with integrated frequency converter (0.37 - 22 kW) - one per pump
E: Pumps with external Grundfos CUE frequency converter (30 kW and above) - one per pump
F: Pumps with external Grundfos CUE frequency converter
S: Mains-operated pumps (start/stop)

Number of pumps with frequency converter

Power [kW]

Starting method:
E: Electronic soft starter (pumps with integrated frequency converter)
ESS: Electronic soft starter (pumps with external Grundfos CUE frequency converter)

Number of mains-operated pumps

Power [kW]

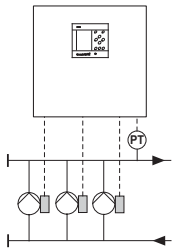
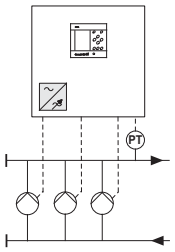
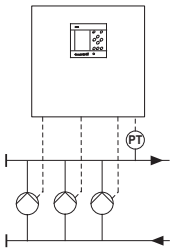
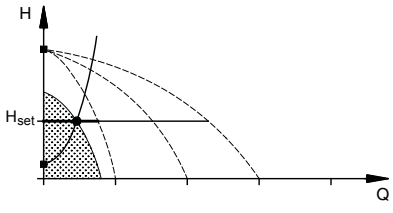
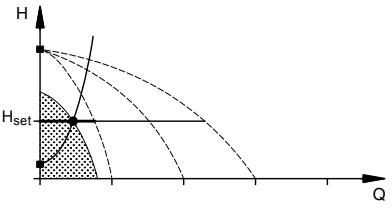
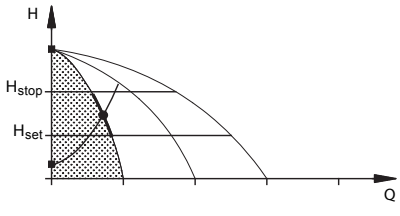
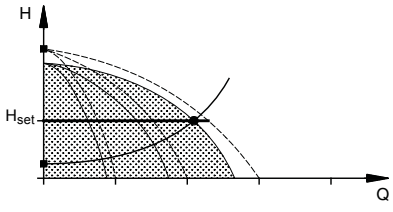
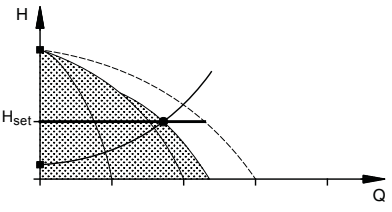
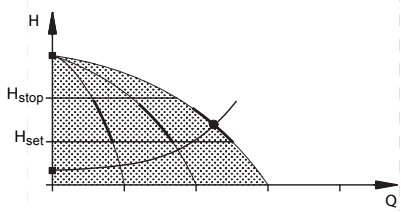
Starting method:
DOL: Direct-on-line starting
SD: Star-delta starting

Supply voltage, frequency

(* Code for custom-built solution.

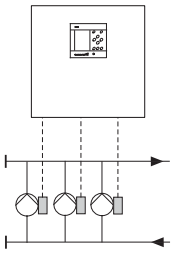
8. Overview of control variants

The examples below are based on booster systems.

Systems with speed-controlled pumps	Systems with pumps connected to one CUE frequency converter	Systems with mains-operated pumps
Control MPC-E	**Control MPC-F**	**Control MPC-S**
Control MPC with three E-pumps.	Control MPC with three pumps connected to an external Grundfos CUE frequency converter in the control cabinet. The speed-controlled operation alternates between the pumps.	Control MPC with three mains-operated pumps.
 TM03 0993 0905	 TM03 1265 1505	 TM03 0999 0905
One E-pump in operation.	One pump connected to an external Grundfos CUE frequency converter in operation.	One mains-operated pump in operation.
 TM00 7995 2296	 TM00 7995 2296	 TM03 9204 3607
Three E-pumps in operation.	One pump connected to an external Grundfos CUE frequency converter and two mains-operated pumps in operation.	Three mains-operated pumps in operation.
 TM00 7996 2296	 TM00 7998 2296	 TM03 9203 3607
• Control MPC-E maintains a constant pressure through continuous adjustment of the speed of the pumps. • The system performance is adjusted to the demand through cutting in/out the required number of pumps and through parallel control of the pumps in operation. • Pump changeover is automatic and depends on load, operating hours and fault. • All pumps in operation will run at equal speed. • The number of pumps in operation also depends on the energy consumption of the pumps. If only one pump is required, two pumps will be running at a lower speed if this results in a lower energy consumption. This requires that the differential pressure of the pump is measured.	• Control MPC-F maintains a constant pressure through continuous adjustment of the speed of the pump connected to the external Grundfos CUE frequency converter. The speed-controlled operation alternates between the pumps. • One pump connected to the external Grundfos CUE frequency converter always starts first. If the pressure cannot be maintained by the pump, one or two mains-operated pumps will be cut in. • Pump changeover is automatic and depends on load, operating hours and fault.	• Control MPC-S maintains an almost constant pressure through cutting in/out the required number of pumps. • The operating range of the pumps will lie between H_{set} and H_{stop} (cut-out pressure). • Pump changeover is automatic and depends on load, operating hours and fault.

The example below is based on a circulation system.

Control MPC Series 2000
Control MPC with three E-pumps.



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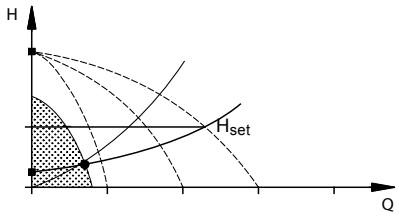
One E-pump in operation.



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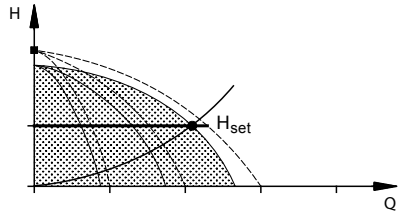
Three E-pumps in operation.



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- Control MPC Series 2000 maintains a constant pressure through adjustment of the speed of the pumps connected.
- The 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.
- The number of pumps in operation is also depending on the energy consumption of the pumps. If only one pump is required, the Control MPC will run with two pumps in operation at a lower speed if this results in a lower energy consumption. This requires that the differential pressure of the pump is measured.

9. Installation

Warning

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

Before installation check that

- the Control MPC corresponds to the one ordered
- no visible parts have been damaged.

9.1 Mechanical installation

The Control MPC must be installed in a well ventilated room to ensure sufficient cooling of the control cabinet.

Install the pumps according to the installation and operating instructions supplied with the pumps.

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

9.2 Electrical installation

Warning

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

- The electrical installation of the Control MPC must comply with enclosure class, IP54.
- Make sure that the Control MPC 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.

9.3 Start-up

The start-up description presupposes that the selected pumps have been installed correctly according to the installation and operating instructions supplied with the pumps.

After having carried out the installation of the Control MPC as described in section *9. Installation*, proceed as follows:

1. Turn on the electricity supply.
2. Wait for the first display to appear.
3. The first time the CU 351 is switched on, a start-up wizard will guide the user through the basic settings.
4. Follow the instructions in each display.
5. When the wizard is completed, check that all pumps are set to *Auto* in the **Status** menu.
6. Go to the **Operation** menu (2), select operating mode *Normal*, and press (ok).
7. Control MPC is now ready for operation.

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

All other pump types require manual entering of both hydraulic and electrical pump data. See section 11.7.37 Pump curve data (4.3.19).

8. The system is now ready for operation.

10. 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 system.

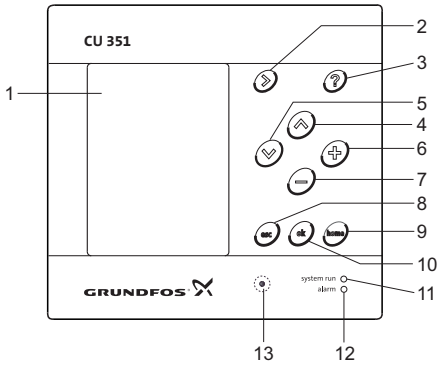

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Fig. 4 Control panel

Key

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

10.1 Display (pos. 1)

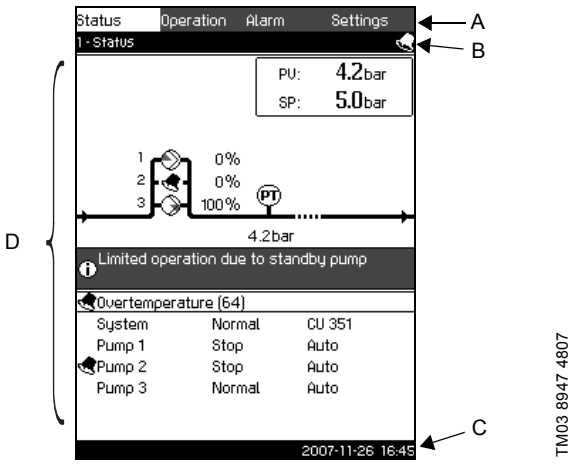


Fig. 5 Display design

10.1.1 Menu line

The menu line (A) is illustrated in fig. 5.

The display has four main menus:

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

10.1.2 Top line

The top line (B) is illustrated in fig. 5.

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).

10.1.3 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.

10.1.4 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.

10.1.5 Bottom line

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

10.2 Buttons and indicator lights

The buttons (pos. 2 to 10 in fig. 4) on the CU 351 are active when they are illuminated.

10.2.1 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.

10.2.2 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.

10.2.3 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.

10.2.4 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.

10.2.5 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 *10.2.7 Ok (pos. 10)*.

If the button is pressed before the button, the new value will be saved. For further information, see section *10.2.7 Ok (pos. 10)*.

10.2.6 Home (pos. 9)

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

10.2.7 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.

10.2.8 Indicator lights (pos. 11 and 12)

The control panel incorporates a green and red indicator light.

The green indicator light is on when the Control MPC is in operation.
The green indicator light is flashing if the Control 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.

10.2.9 Contrast (pos. 13)

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

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

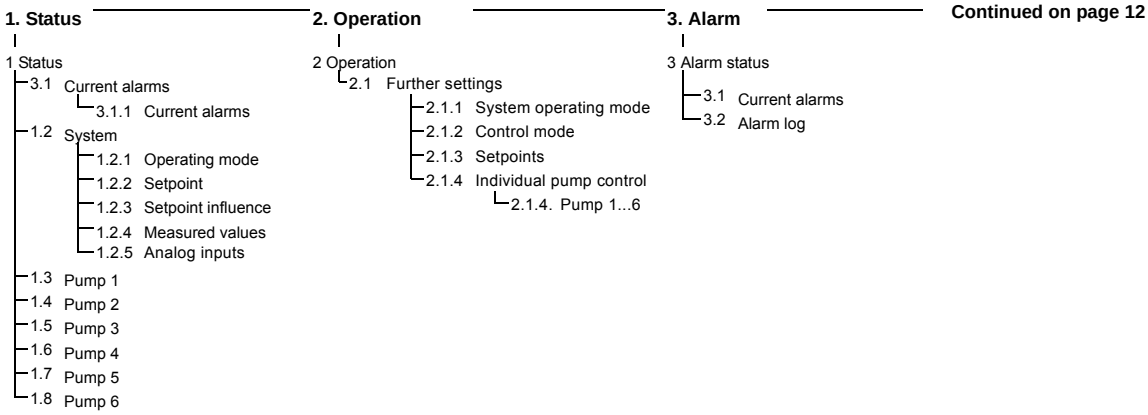
10.2.10 Back light

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.

11. Functions

11.1 Tree of functions



Continued on page 12

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

Status
The **Status** menu shows alarms and the status of system and pumps. **Note:** No settings can be made in this menu.
Operation
In the **Operation** menu, the most basic parameters can be set, such as setpoint, operating mode, control mode and individual pump control.
Alarm
The **Alarm** menu gives an overview of alarms and warnings. Alarms and warnings can be reset in this menu.
Settings
In the **Settings** menu, it is possible to set various functions: • Primary controller Setting of alternative setpoints, external setpoint influence, primary sensor, clock program, proportional pressure and S-system configuration. • Pump cascade control Setting of min. time between start/stop, max. number of starts/hour, number of standby pumps, forced pump changeover, pump test run, pilot pump, pump stop attempt, pump start and stop speed, min. performance and compensation for pump start-up time. • Secondary functions Setting of stop function, soft pressure build-up, digital and analog inputs, digital outputs, emergency run, min., max. and user-defined duty, pump curve data, flow estimation, control source and fixed inlet pressure. • Monitoring functions Setting of dry-running protection, min. and max. pressure, external fault, limit 1 and 2 exceeded, pumps outside duty range and pressure relief. • Functions, CU 351 Selection of service language, main language and units. Setting of date and time, passwords, Ethernet connection, GENIbus number and software status.

Continued from page 11

4. Settings

- 4.1 Primary controller
  - 4.1.1 PI controller
  - 4.1.2 Alternative setpoints
    - 4.1.2.1 Alternative setpoints 2...7
  - 4.1.3 External setpoint influence
    - 4.1.3.1 Input value to be influenced by
      - 4.1.3.2 Setting of influence function
  - 4.1.4 Primary sensor
  - 4.1.6 Clock program
  - 4.1.7 Proportional pressure
  - 4.1.8 S-system configuration
- 4.2 Pump cascade control
  - 4.2.1 Min. time between start/stop
    Max. number of starts/hour
  - 4.2.3 Standby pumps
  - 4.2.4 Forced pump changeover
  - 4.2.5 Pump test run
  - 4.2.6 Pilot pump
  - 4.2.7 Pump stop attempt
  - 4.2.8 Pump start and stop speed
  - 4.2.9 Min. performance
  - 4.2.10 Compensation for pump start-up time
- 4.3 Secondary functions
  - 4.3.1 Stop function
    - 4.3.1.1 Stop parameters
  - 4.3.3 Soft pressure build-up
  - 4.3.5 Emergency run
  - 4.3.7 Digital inputs
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    - Function, DI1..DI9 (IO 351-41), [10...46]
    - Function, DI1..DI9 (IO 351-42), [10...46]
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      - Function, AI1...AI3 (CU 351), [51, 54, 57]
    - Setting, AI1..AI2 (IO 351-41), [57, 60]
      - Function, AI1..AI2 (IO 351-41), [57, 60]
    - Setting, AI1..AI2 (IO 351-42), [57, 60]
      - Function, AI1..A2 (IO 351-42), [57, 60]
  - 4.3.9 Digital outputs
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    - Function, DO1...DO7 (IO 351-41), [77...88]
    - Function, DO1...DO7 (IO 351-42), [77...88]
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    - 4.3.14.2 Max. duty
    - 4.3.14.3 User-defined duty
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  - 4.3.20 Control source
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  - 4.4.1 Dry-running protection
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    - 4.4.1.2 Measurement, inlet pressure
    - 4.4.1.3 Measurement, tank level
  - 4.4.2 Min. pressure
  - 4.4.3 Max. pressure
  - 4.4.4 External fault
  - 4.4.5 Limit 1 exceeded
  - 4.4.6 Limit 2 exceeded
  - 4.4.7 Pumps outside duty range
  - 4.4.8 Pressure relief
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  - Change language to service language (GB)
  - Run wizard again
  - 4.5.1 Display language
  - 4.5.2 Display units
    - 4.5.2.1 Units for pressure
    - 4.5.2.2 Units for differential pressure
    - 4.5.2.3 Units for head
    - 4.5.2.4 Units for level
    - 4.5.2.5 Units for flow rate
    - 4.5.2.6 Units for volume
    - 4.5.2.7 Units for specific energy
    - 4.5.2.8 Units for temperature
    - 4.5.2.9 Units for power
    - 4.5.2.10 Units for energy
  - 4.5.3 Date and time
  - 4.5.4 Password
  - 4.5.5 Ethernet
  - 4.5.6 GENIbus number
  - 4.5.9 Software status

11.2 Overview

11.3 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.

11.4 Status (1)

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

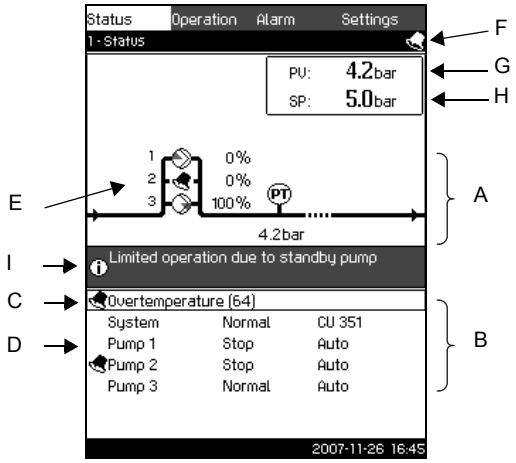

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Fig. 6 Status

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 pump system. The selected measuring parameters are shown with sensor symbol and current value.

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

- limited operation due to standby pump
- proportional pressure influence active
- external setpoint influence active
- alternative setpoint active
- clock program active
- remote-controlled via Ethernet
- remote-controlled via GENI (RS-485).

The lower display half (B) shows

- the latest current alarm, if any, and the fault cause together with the fault code in brackets
- system status with current operating mode and control source
- pump status with current operating mode and manual/auto.

Note

If a fault has occurred, the symbol will be shown in the alarm line (C) together with the cause and fault code, for instance Overtemperature (64).

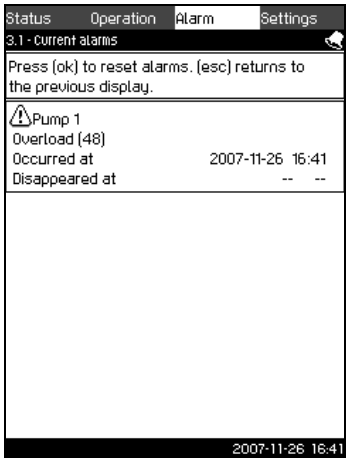
If the fault is related to one of the pumps, the symbol will also be shown in front of the status line (D) of the pump in question. At the same time, the symbol will be flashing instead of the pump symbol (E). The symbol will be shown to the right in the top line of the display (F). As long as a fault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

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

The display makes it possible to open status displays showing

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

11.4.1 Current alarms (3.1)



TM03 2293 4807

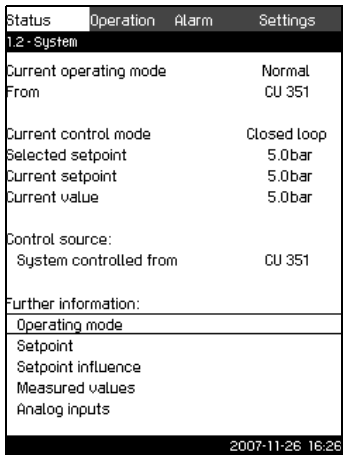
Fig. 7 Current alarms

Description

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

For further information, see sections *11.6.2 Current alarms (3.1)* and *11.6.3 Alarm log (3.2)*.

11.4.2 System (1.2)



TM03 8946 4807

Fig. 8 System

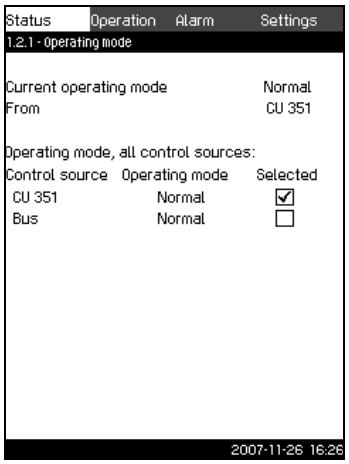
Description

This display shows the current operational state of the 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.

11.4.3 Operating mode (1.2.1)



TM03 2273 4807

Fig. 9 Operating mode

Description

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

Operating modes

Control MPC has six operating modes:

1. *Normal*
   The pumps adapt their 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 *11.7.33 Min., max. and user-defined duty (4.3.14)* and *11.7.25 Emergency run (4.3.5)*.

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

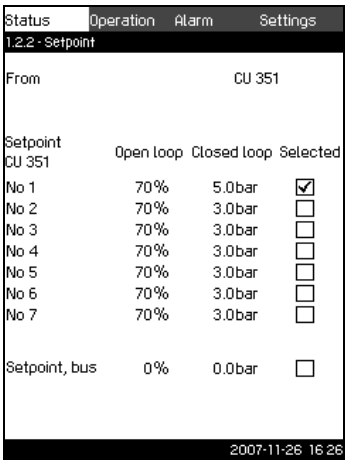
Control source

Control 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**.

11.4.4 Setpoint (1.2.2)



TM03 2272 4807

Fig. 10 Setpoint

Description

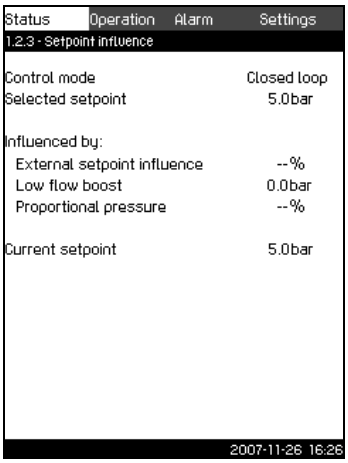
This display shows the selected setpoint and whether it comes from the CU 351 or an external bus.

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

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

Setpoints can be changed in the **Operation** or **Settings** menu. See section *11.7.3 Alternative setpoints (4.1.2)*.

11.4.5 Setpoint influence (1.2.3)



TM03 8948 4807

Fig. 11 Setpoint influence

Description

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

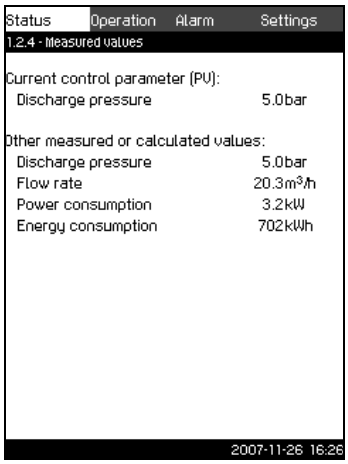
$$\text{Setpoint}_{\text{current(SP)}} = \text{Setpoint}_{\text{selected}} \times \text{Infl.}(1) \times \text{Infl.}(2) \times \ldots$$

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

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

Finally the resulting current setpoint (SP) is shown.

11.4.6 Measured values (1.2.4)



TM03 2270 4807

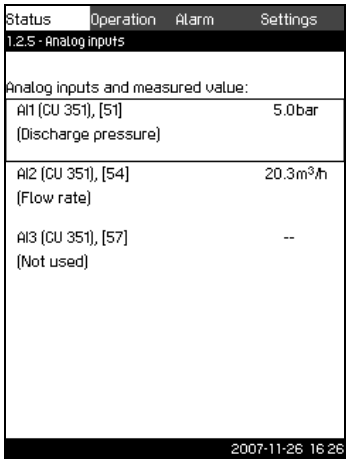
Fig. 12 Measured values

Description

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

Note ***The lines "Power consumption" and "Energy consumption" are only shown in Control MPC-E systems.***

11.4.7 Analog inputs (1.2.5)



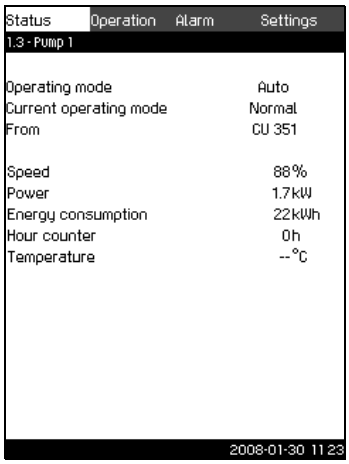
TM03 8949 4807

Fig. 13 Analog inputs

Description

The display shows an overview of the analog inputs and the current measured values of each input. See sections *11.7.28 Analog inputs (4.3.8)*, *11.7.29 Analog inputs (4.3.8.1 to 4.3.8.7)* and *11.7.30 Analog inputs and measured value (4.3.8.1.1 to 4.3.8.7.1)*.

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



TM03 2268 4807

Fig. 14 Pump 1

Description

This display shows the operational state of the individual pumps.

The pumps may have different operating modes:

- *Auto*
  Together with the other pumps in automatic operation, the pump is controlled by the PI controller which ensures that the system delivers the required performance.
- *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 (only Control MPC-E)
- energy consumption (only Control MPC-E)
- operating hours.

11.5 Operation (2)

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

11.5.1 Operation (2)

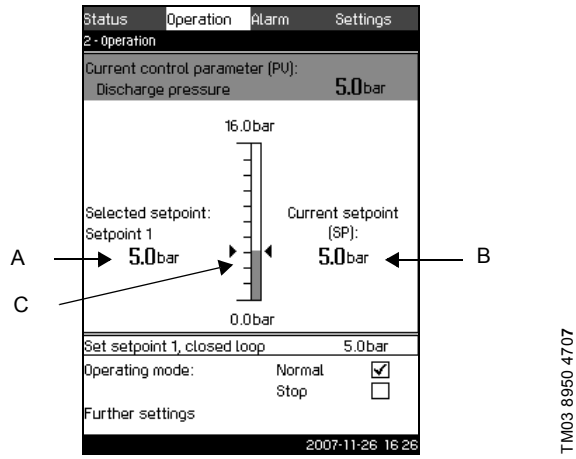


Fig. 15 Operation

Description

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

At the left hand of the column, the 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 *11.7.5 External setpoint influence (4.1.3)* and *11.7.6 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 OK.

Operating mode:

1. Mark the **Operation** menu with ▷.
2. Mark operating mode **Normal** or **Stop** with ▽ or △. Save with OK.

Further settings:

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

- System operating mode (see section *11.5.2*).
- Control mode (see section *11.5.3*).
- Setpoints (see section *11.5.4*).
- Individual pump control (see section *11.5.6*).

Factory setting

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

11.5.2 System operating mode (2.1.1)

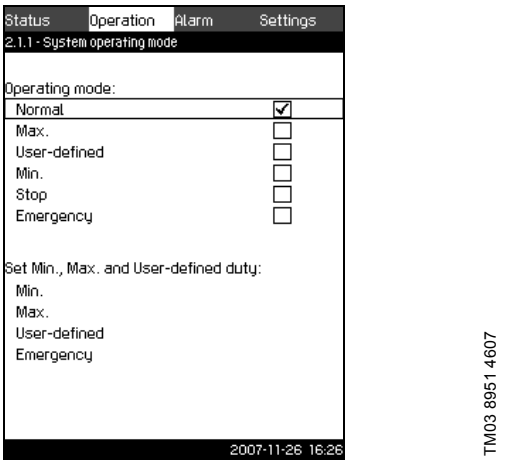


Fig. 16 System operating mode

Description

Control MPC can be set to six different operating modes. *Normal* is the typical setting. See section *11.4.3 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*.

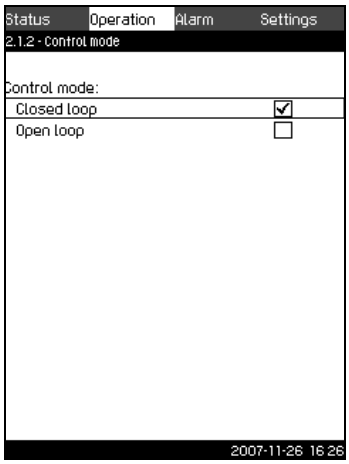
Setting via control panel

1. Mark the **Operation** menu with ▷.
2. Mark **Further settings** with ▽ or △, and press OK.
3. Mark **System operating mode** with ▽ or △, and press OK.
4. Select the desired operating mode by marking one of the lines with check boxes with ▽ or △, and press OK.
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 OK.
   See sections *11.7.33 Min., max. and user-defined duty (4.3.14)* and *11.7.25 Emergency run (4.3.5)*.

Factory setting

Normal.

11.5.3 Control mode (2.1.2)



TM03 2283 4807

Fig. 17 Control mode

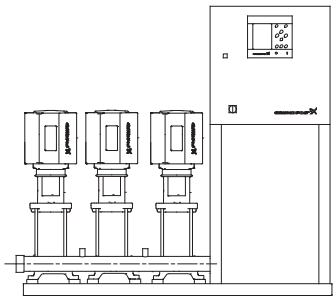
Description

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

Examples:

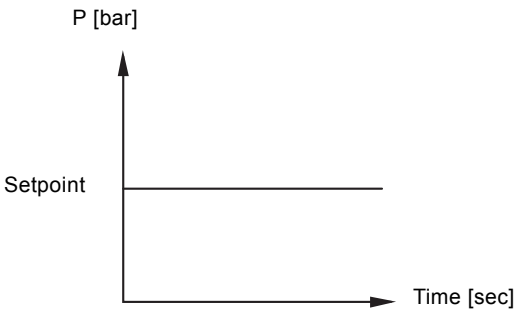
Closed loop

The typical control mode is closed loop where the built-in PI controller ensures that the system reaches and maintains the selected setpoint. The performance is based on the setpoint set for closed loop. See figs 18 and 19.



TM03 2231 3905

Fig. 18 Booster system controlled by built-in PI controller (closed loop)



TM03 2390 4105

Fig. 19 Regulation curve for closed loop

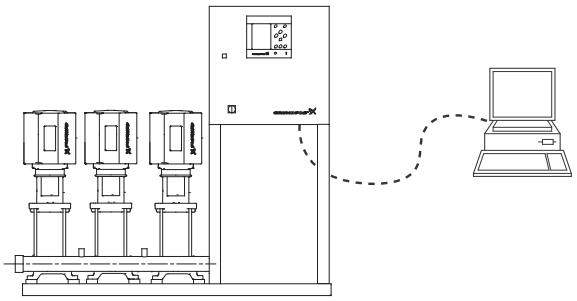
Setting via control panel

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 *11.5.4 Setpoints (2.1.3)* and *11.5.1 Operation (2)*.

Open loop

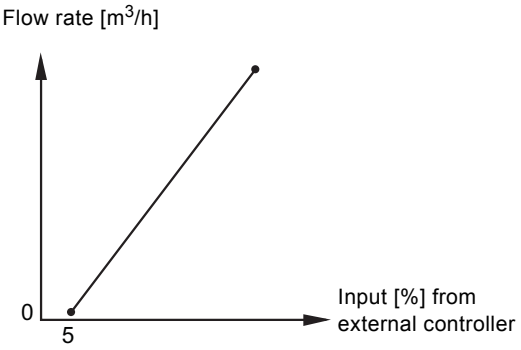
In open-loop control, the pumps run at a fixed speed.
The pump speed is calculated from the performance set by the user (0-100 %). The pump performance in percentage is proportional with the flow rate.

Open-loop control is usually used when the 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 Control MPC.
In such cases the Control MPC is like an actuator.
See figs 20 and 21.



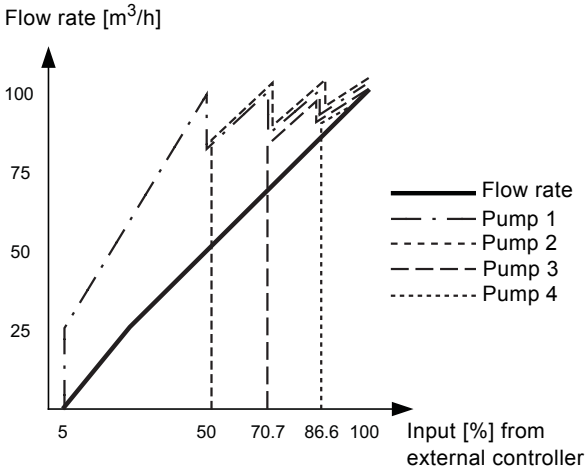
TM03 2232 3905

Fig. 20 Booster system with external controller (open loop)



TM03 2391 3607

Fig. 21 Regulation curve for open loop



TM03 9977 4807

Fig. 22 Regulation curve for Control MPC-E in open loop

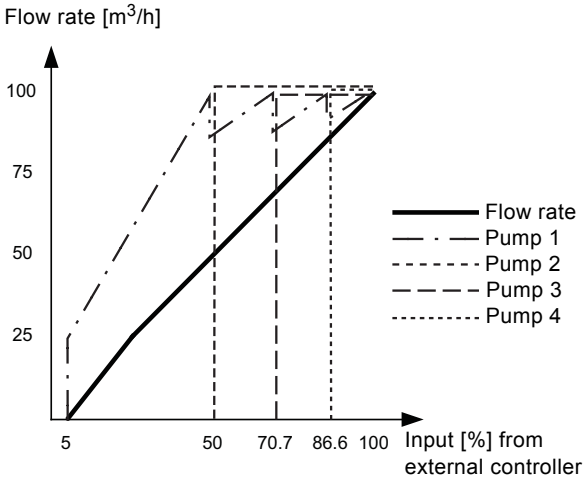


Fig. 23 Regulation curve for Control MPC-F in open loop

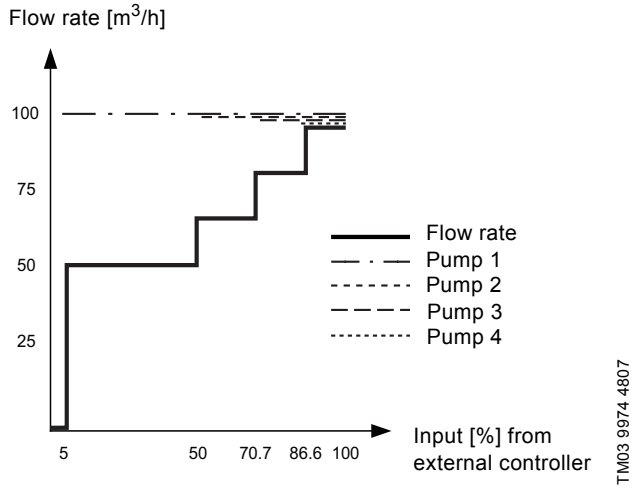


Fig. 24 Regulation curve for Control MPC-S in open loop

Setting range

These settings must be made in connection with open loop:

- Stop of system.
- 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

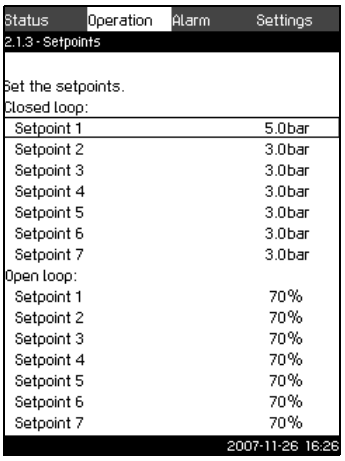
To set an external control source to control the system, proceed as follows:

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 the **0-100 % signal** with ⊙ or ⊙, and press ⊙.
23. Return with ⊙.
24. Mark **Set the influence function** with ⊙ or ⊙, and press ⊙. For details, see section *11.7.6 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 steps 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.

11.5.4 Setpoints (2.1.3)



TM03 8952 4807

Fig. 25 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 *11.7.3 Alternative setpoints (4.1.2)* and *11.7.4 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 *11.7.7 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 ⊙.

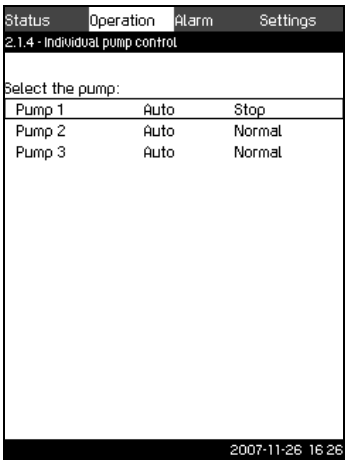
Factory setting

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

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

All setpoints for open-loop control are 70 %.

11.5.5 Individual pump control (2.1.4)



TM03 8953 4807

Fig. 26 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 system delivers the required performance.

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 operation of Control MPC.

If one or more pumps are in manual operation, the system 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.

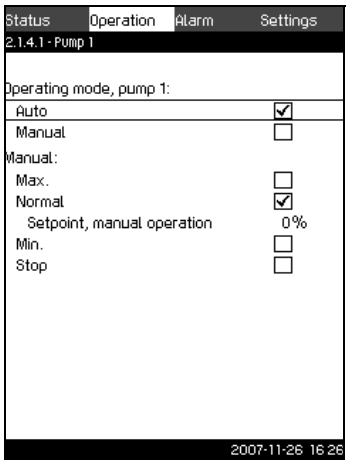
Setting range

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 ⊙.

11.5.6 Setting of individual operating mode (2.1.4.1 to 2.1.4.6)



TM03 8954 4807

Fig. 27 Setting of individual operating mode

Description

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

Setting range

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

Setting via control panel

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

Factory setting

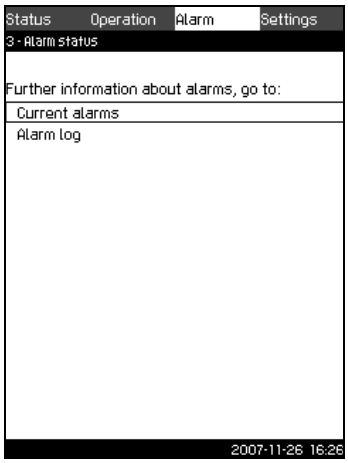
Auto.

11.6 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.

11.6.1 Alarm status (3)



TM03 2291 4607

Fig. 28 Alarm status

Description

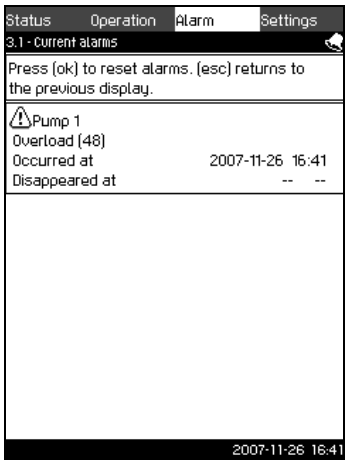
A fault in the system or one of the components monitored can cause an alarm ⊗ or a warning ⚠. Besides the fault signal via the alarm/warning signal relay and the red indicator light on the CU 351, an alarm can also cause a change of operating mode, for instance from *Normal* to *Stop*. A warning only 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 system changes in case of alarm, and whether restart of the 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 *11.7.24 Soft pressure build-up (4.3.3)* and *11.7.41 Monitoring functions (4.4)* to *11.7.51 Pressure relief (4.4.8)*.

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

11.6.2 Current alarms (3.1)



TM03 2293 4607

Fig. 29 Current alarms

Description

This submenu shows the following:

- Warnings ⚠ caused by faults that still exist.
- Warnings ⚠ caused by faults that have disappeared, but the warning requires manual reset.
- Alarms ⊗ caused by faults that still exist.
- Alarms ⊗ caused by faults that have disappeared, but the alarm requires manual reset.

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

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

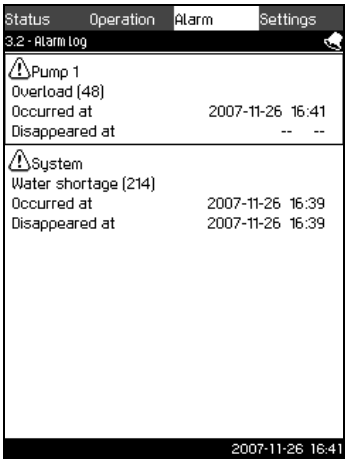
For every warning or alarm, the following will be shown:

- Whether it is a warning ⚠ or an alarm ⊗.
- Where the fault occurred: System, Pump 1, Pump 2, etc.
- In case of input-related faults, the input will be 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.

11.6.3 Alarm log (3.2)

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



TM03 2292 4807

Fig. 30 Alarm log

Description

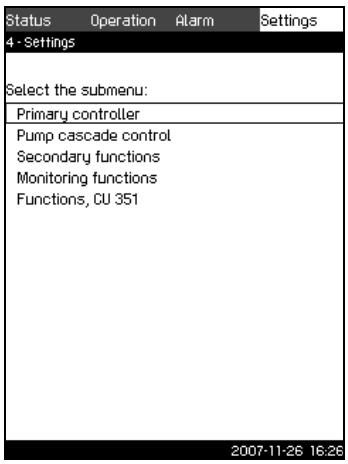
Here warnings and alarms are shown.

For every warning or alarm, the following will be shown:

- Whether it is a warning ⚠ or an alarm ⊗.
- Where the fault occurred. System, Pump 1, Pump 2, etc.
- In case of input-related faults, the input will be 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.

11.7 Settings (4)



TM03 2294 4607

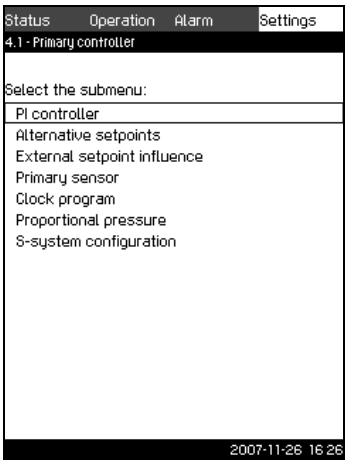
Fig. 31 Settings

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

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

Usually, all these functions are set correctly when the Control 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.

11.7.1 Primary controller (4.1)



TM03 8955 4807

Fig. 32 Primary controller

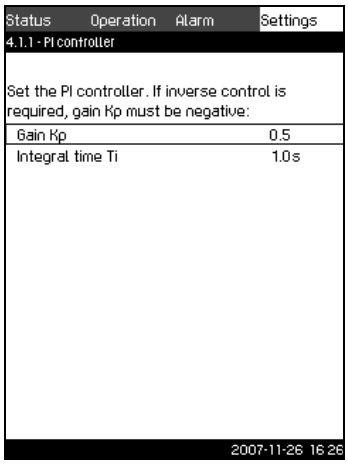
Description

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

The following menus can be selected:

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

11.7.2 PI controller (4.1.1)



TM03 2387 4607

Fig. 33 PI controller

Description

Control 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

The setting of K_p and T_i depends on the system and application.

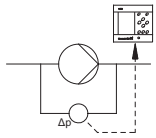
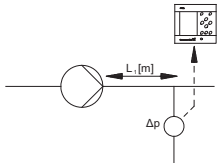
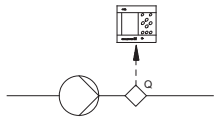
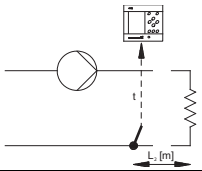
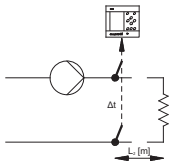
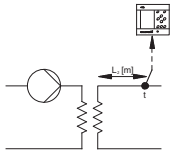
PI controller settings for pressure boosting

If the application has been set to pressure boosting in the start-up wizard, the following values of K_p and T_i will be set automatically:

- K_p: 0.5
- T_i: 1 second.

PI controller settings for heating and cooling

If another application than pressure boosting has been selected in the start-up wizard, the values of K_p and T_i will be set automatically according to the table below. As Control MPC does not know the pipe length, the default parameters will be set according to the table to a pipe length (L_1 or L_2) of 5 metres.

System/application	K_p		T_i [Seconds]
	Heating system[1)]	Cooling system[2)]	
	**0.5**		**1**
	**0.5**		L_1 < 5 m: **1** L_1 > 5 m: **3** L_1 > 10 m: **5**
	**0.5**		**1**
	**0.5**	**-0.5**	**10 + 5L_2**
	**0.5**		**10 + 5L_2**
	**0.5**	**-0.5**	**30 + 5L_2**

[1)] Heating systems are systems in which an increase in pump performance will result in a temperature rise at the sensor.

[2)] Cooling systems are systems in which an increase in pump performance will result in a temperature drop at the sensor.

L_1: Distance [m] between pump and sensor.

L_2: Distance [m] between heat exchanger and sensor.

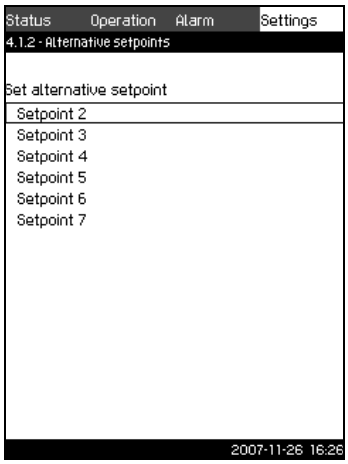
ΔP: Measurement of differential pressure.

Q: Measurement of flow rate.

t: Measurement of temperature.

Δt: Measurement of differential temperature.

11.7.3 Alternative setpoints (4.1.2)



TM03 2383 4607

Fig. 34 Alternative setpoints

Description

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

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

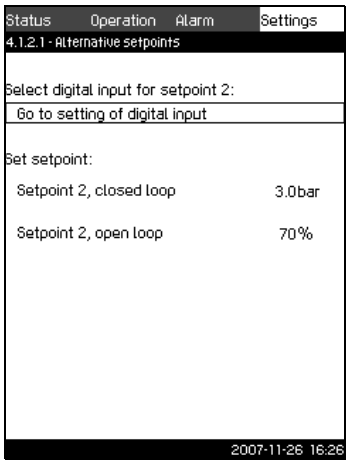
Setting range

- Six setpoints, No 2 to 7.

Factory setting

No alternative setpoints have been selected.

11.7.4 Alternative setpoints 2 to 7 (4.1.2.1 to 4.1.2.7)



TM03 2384 4607

Fig. 35 Alternative setpoints 2 to 7

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

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

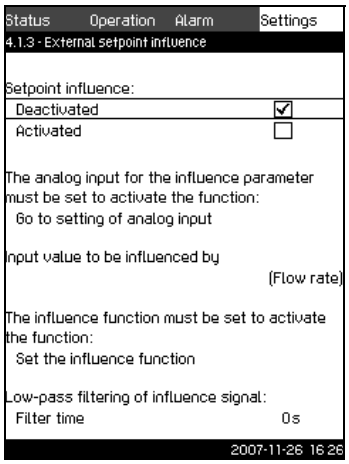
Setting via control panel

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

Factory setting

No alternative setpoints have been set.

11.7.5 External setpoint influence (4.1.3)



TM03 8956 4807

Fig. 36 External setpoint influence

Description

This function makes it possible to adapt the setpoint by letting measuring parameters influence the setpoint. Typically an analog signal from a flow or temperature transmitter, or a similar transmitter. Section *12. Measuring parameters* shows an overview of transmitter types and possible positions.

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 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:

$$Setpoint_{current(SP)} = Setpoint_{selected} \times Infl.(1) \times Infl.(2) \times ...$$

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.

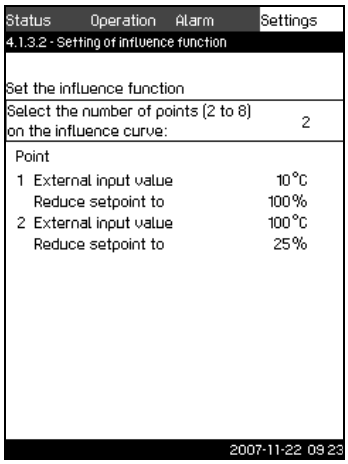
Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Primary controller** with ⊙ or ⊙, and press ok.
3. Mark **External setpoint influence** with ⊙ or ⊙, and press ok.
4. Mark **Input value to be influenced by** with ⊙ or ⊙, and press ok.
   Now a list of available parameters appear.
5. Mark the parameter which is to influence the setpoint with ⊙ or ⊙, and press ok.
6. Return with esc.
7. Mark **Set the influence function** with ⊙ or ⊙, and press ok. For details, see section *11.7.6 Setting of influence function (4.1.3.2)*.
8. Mark the menu line for number of points with ⊙ or ⊙, and press ok.
9. Select the required number of points with ⊕ or ⊖, and save with ok.
10. Mark **External input value** (point 1) with ⊙ or ⊙.
11. Set the value of the external input value with ⊕ or ⊖, and save with ok.
12. Mark **Reduce setpoint to** (point 1) with ⊙ or ⊙.
13. Set the value as a percentage with ⊕ or ⊖, and save with ok.
14. Repeat steps 8 to 13 for all desired parameters.
15. Return with esc.
16. Mark **Filter time** with ⊙ or ⊙, set the time in seconds with ⊕ or ⊖, and save with ok.
17. Mark **Activated** with ⊙ or ⊙, and press ok. The check mark in the right box shows that the function has been activated.

Factory setting

Setpoint influence is not activated.

11.7.6 Setting of influence function (4.1.3.2)



TM03 9963 4707

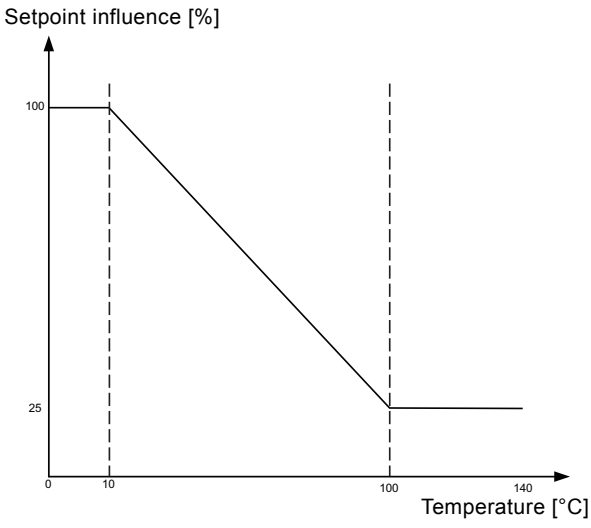
Fig. 37 Setting of influence function

Description

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

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

Example:



TM03 9978 4707

Fig. 38 Relation between setpoint influence and flow rate

The control unit draws straight lines between the points. A horizontal line is drawn from the minimum value of the relevant sensor (0 m^3/h in the example) to the first point. This is also the case from the last point to the sensor's maximum value (example 50 m^3/h).

Setting range

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

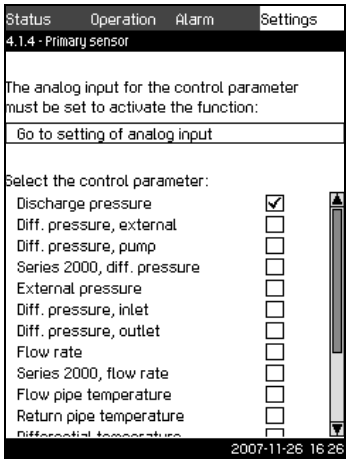
Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Primary controller** with ⊙ or ⊙, and press ⊙.
3. Mark **External setpoint influence** with ⊙ or ⊙, and press ⊙.
4. Mark **Set the influence function** with ⊙ or ⊙, and press ⊙.
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 steps 7 to 10 for all desired parameters.

Factory setting

External setpoint influence is not activated.

11.7.7 Primary sensor (4.1.4)



TM03 8958 4807

Fig. 39 Primary sensor

Description

In this display, select the control parameter of the system and set the sensor to measure the value.

For booster systems, the control parameter is usually the discharge pressure which is measured by a sensor fitted on the discharge manifold. In heating and cooling systems, the control parameter is typically a differential pressure or a temperature.

See section *12. Measuring parameters*.

Setting range

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

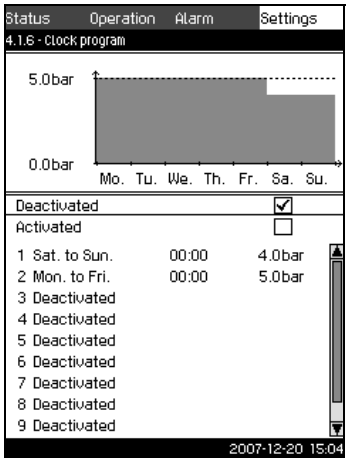
Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Primary controller** with ⊙ or ⊙, and press ⊙.
3. Mark **Primary sensor** with ⊙ or ⊙, and press ⊙.
4. Mark **Go to setting of analog input** with ⊙ or ⊙, and press ⊙.
   Now the display *Analog inputs (4.3.8)* appears. Select the analog input (AI) for the primary sensor, and set the parameters for this sensor. Return to display *Primary sensor (4.1.4)* with ⊙.
5. Select the control parameter for the primary sensor with ⊙ or ⊙, and press ⊙.

Factory setting

The primary parameter is discharge pressure. The sensor is connected to AI1 (CU 351). Other primary parameters can be selected in the start-up wizard.

11.7.8 Clock program (4.1.6)



TM03 8990 4807

Fig. 40 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 system.

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

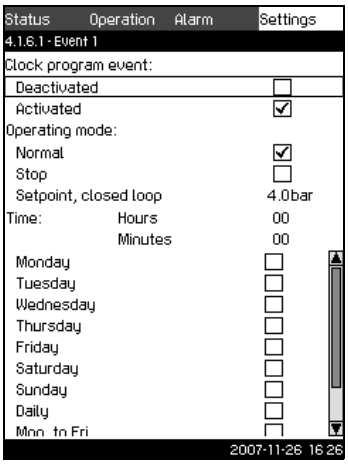
Note ***Minimum 2 events are required when activating the clock program; one to start the system and one to stop the system.***

Setting range

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

Setting via control panel

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



TM03 8959 4807

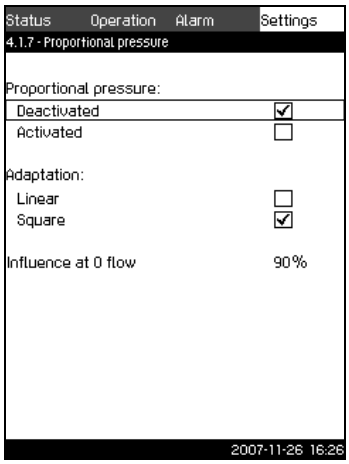
Fig. 41 Event 1

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

Factory setting

The function is deactivated.

11.7.9 Proportional pressure (4.1.7)

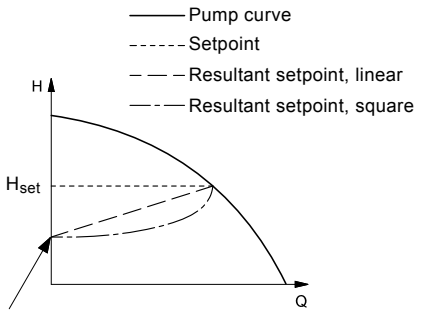


TM03 8960 4807

Fig. 42 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. 43.



TM03 8524 1807

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

Fig. 43 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.

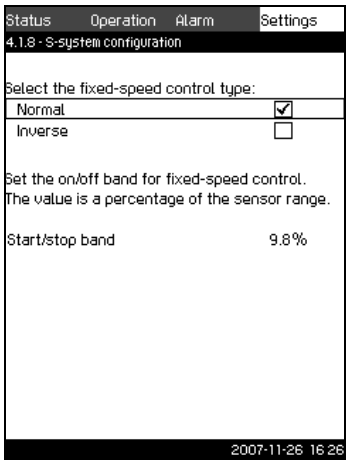
Setting via control panel

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.

11.7.10 S-system configuration (4.1.8)



TM03 8961 4807

Fig. 44 S-system configuration

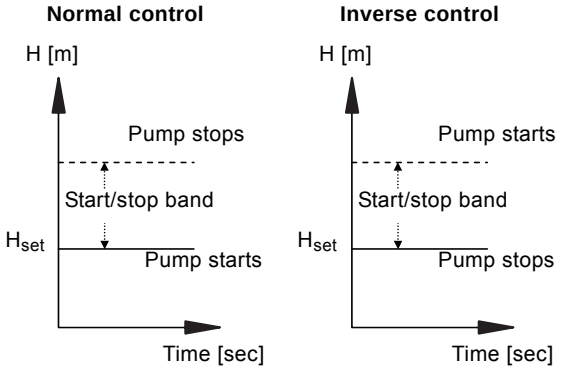
Description

The function makes it possible to invert the control of mains-operated pumps (Control 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. 45.

Normal control: A pump is stopped when the current value becomes higher than H_{set} + start/stop band. And a pump is started when the current value becomes lower than H_{set}. See fig. 45.

Inverse control: A pump is started when the current value becomes higher than H_{set} + start/stop band. And a pump is stopped when the current value becomes lower than H_{set}. See fig. 45.



TM03 9205 3607 - TM03 9205 3607

Fig. 45 Normal and inverse control

Setting range

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

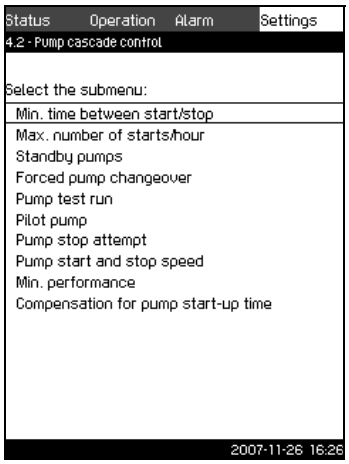
Setting via control panel

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.

11.7.11 Pump cascade control (4.2)



TM03 8962 4807

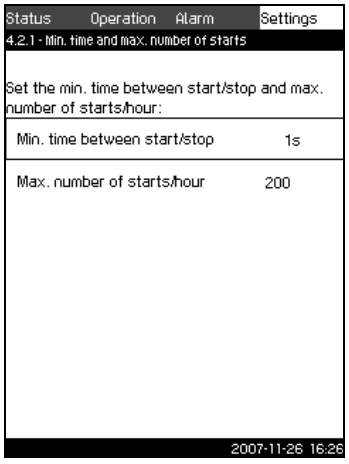
Fig. 46 Pump cascade control

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.

11.7.12 Min. time between start/stop (4.2.1)



TM03 2367 4607

Fig. 47 Min. time between start/stop

Description

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

The purpose is to prevent hunting when pumps start and stop continuously.

Setting range

From 1 to 3600 seconds.

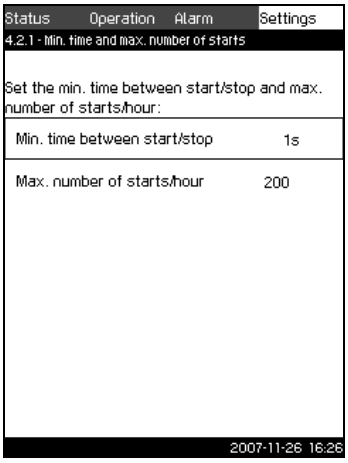
Setting via control panel

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

Factory setting

The setting is done in the start-up wizard and depends on the application.

11.7.13 Max. number of starts/hour (4.2.1)



TM03 2367 4607

Fig. 48 Max. number of starts/hour

Description

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

Each time a pump starts or stops, the CU 351 calculates when the next pump is allowed to start/stop in order not to exceed the permissible number of starts per hour.

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

The time between pump starts must be between the minimum time between start/stop, see section *11.7.12*, and 3600/n, n being the set number of starts per hour.

Setting range

1 to 1000 starts per hour.

Setting via control panel

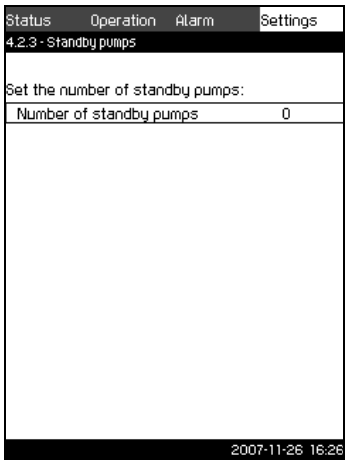
1. Mark the **Settings** menu with ⊙.
2. Mark **Pump cascade control** with ⊙ or ⊙, and press ⊙.
3. Mark **Max. number of starts/hour** with ⊙ or ⊙, and press ⊙.
4. Set the permissible number of starts per hour with ⊙ or ⊙, and save with ⊙.

Factory setting

Control MPC-E:	200 starts per hour
Other variants:	100 starts per hour

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

11.7.14 Standby pumps (4.2.3)



TM03 2366 4607

Fig. 49 Standby pumps

Description

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

If a three-pump system has one standby pump, maximum two pumps are allowed to 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 system is thus not reduced.

The status as standby pump alternates between all pumps.

Setting range

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

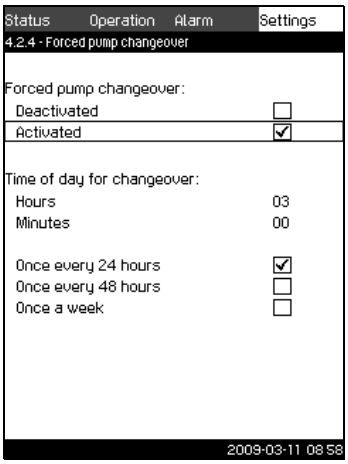
Setting via control panel

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.

11.7.15 Forced pump changeover (4.2.4)



TM03 2365 1109

Fig. 50 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.

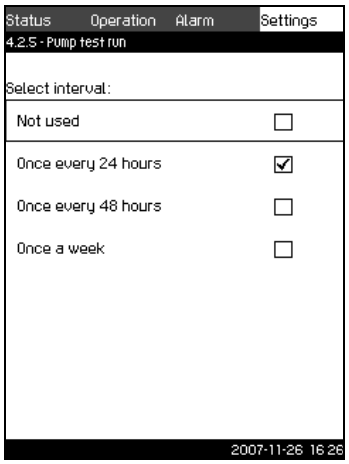
Setting via control panel

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.

11.7.16 Pump test run (4.2.5)



TM03 2364 4607

Fig. 51 Pump test run

Description

This function is primarily used in situations where the forced pump changeover is deactivated, and/or if the Control 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.

Note

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

Pilot pumps are included in the pump test run.

Setting range

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

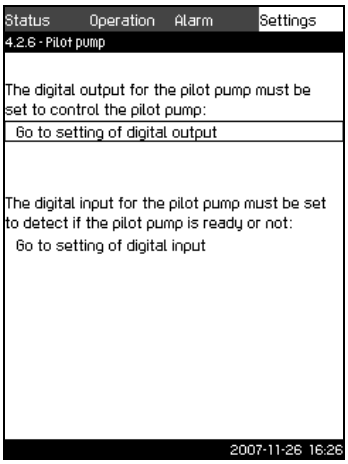
Setting via control panel

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

Factory setting

The setting is done in the start-up wizard and depends on the application.

11.7.17 Pilot pump (4.2.6)



TM03 8963 4807

Fig. 52 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 *11.7.23 Stop function (4.3.1)*.

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

The purpose is to

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

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

Note

Set the setpoint of the pilot pump to this value: H_{set} + 1/2 on/off band + 8 metres.

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

Setting range

- See section *11.7.31 Digital outputs (4.3.9)*.
- See section *11.7.26 Digital inputs (4.3.7)*.

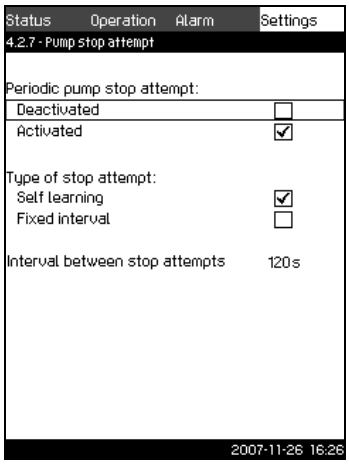
Setting via control panel

1. Mark the **Settings** menu with .
2. Mark **Pump cascade control** with or , and press .
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.

11.7.18 Pump stop attempt (4.2.7)



TM03 8964 4807

Fig. 53 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. See *11.7.19 Pump start and stop speed (4.2.8)*. 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 , and save with .
8. Mark **Activated** with or , and press . The check mark in the right box shows that the function has been activated.

Factory setting

The function is activated, and self learning is selected.

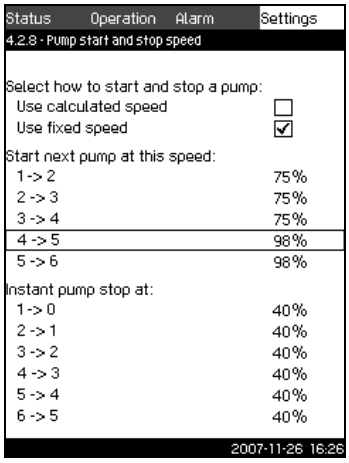
11.7.19 Pump start and stop speed (4.2.8)

Description

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

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

1. Use calculated speed



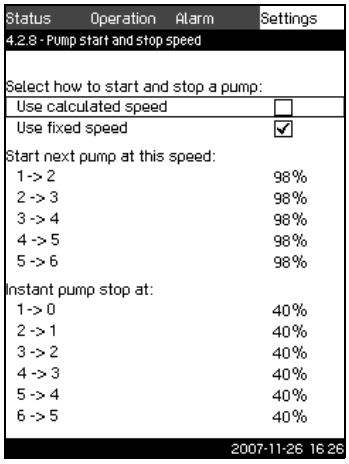
TM03 8966 4807

Fig. 54 Calculated pump start and stop speed

Setting via control panel

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

2. Use fixed speed



TM03 8965 4807

Fig. 55 Fixed pump start and stop speed

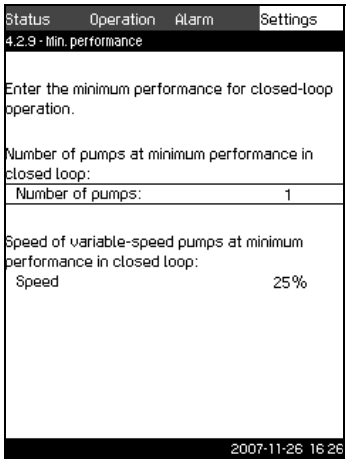
Setting via control panel

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

Factory setting

The function is set to calculated speed.

11.7.20 Min. performance (4.2.9)



TM03 8967 4807

Fig. 56 Min. performance

Description

This function ensures circulation in a system. Note that the stop function, if activated, can influence this function. See section *11.7.23 Stop function (4.3.1)*. Examples:

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

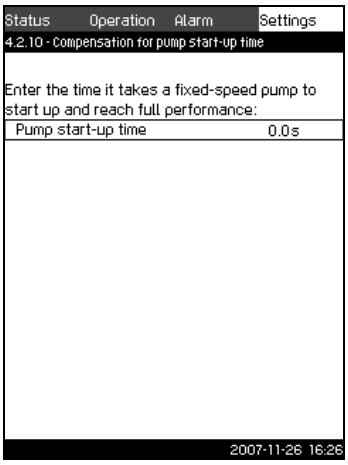
Setting via control panel

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

Factory setting

The number of pumps is set to 0. The speed in closed loop is set to 25 %.

11.7.21 Compensation for pump start-up time (4.2.10)



TM03 8968 4807

Fig. 57 Compensation for pump start-up time

Description

The function is used for Control MPC-F systems only.

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

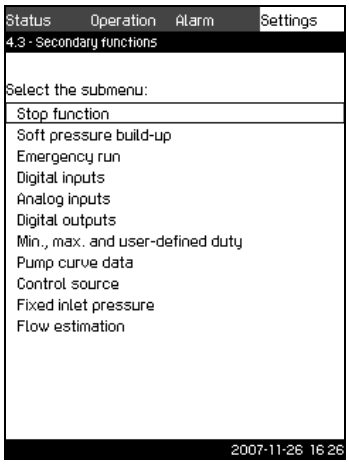
Setting via control panel

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.

11.7.22 Secondary functions (4.3)



TM03 8969 4807

Fig. 58 Secondary functions

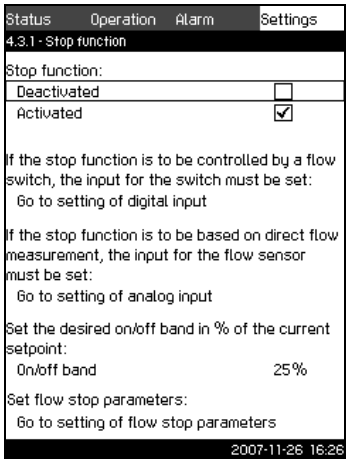
Description

Functions that are secondary in relation to the normal operation of the system can be set in this display. Secondary functions are functions that offer additional functionality.

The display makes it possible to open these specific displays:

- *Stop function (4.3.1)*
- *Soft pressure build-up (4.3.3)*
- *Digital inputs (4.3.7)*
- *Analog inputs (4.3.8)*
- *Digital outputs (4.3.9)*
- *Emergency run (4.3.5)*
- *Min., max. and user-defined duty (4.3.14)*
- *Pump curve data (4.3.19)*
- *Flow estimation (4.3.23)*
- *Control source (4.3.20)*
- *Fixed inlet pressure (4.3.22)*.

11.7.23 Stop function (4.3.1)



TM03 2355 4607

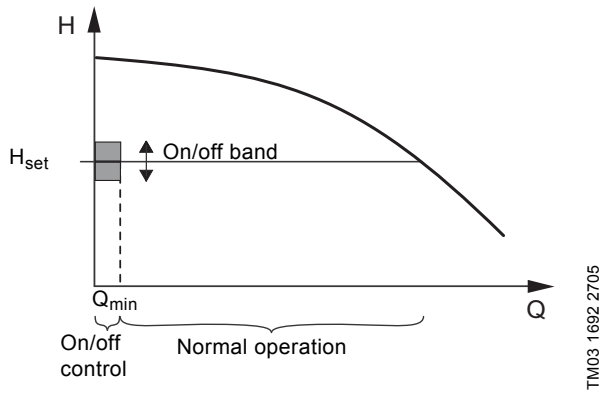
Fig. 59 Stop function

Description

This function is typically used in constant pressure applications and 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 booster systems with variable-speed pumps. Control MPC-S will have on/off control of all pumps as described in section *8. Overview of control variants*.

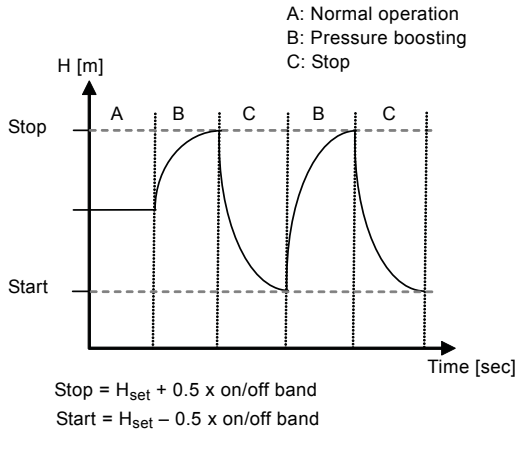


TM03 1692 2705

Fig. 60 On/off band

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

Before stopping, the pump increases the pressure to a value corresponding to H_{set} + 0.5 x on/off band. The pump is restarted when the pressure is H_{set} – 0.5 x on/off band. See fig. 61.



TM03 9292 4807

Fig. 61 On/off operation

The flow rate is estimated by the CU 351 when the pump is in the stop period. As long as the flow rate is lower than Q_{min}, the pump will run on/off. If the flow rate is increased to above Q_{min}, the pump returns to normal operation, H_{set}. H_{set} is equal to the current setpoint. See section *11.4.4 Setpoint (1.2.2)*.

Detection of low flow rate

Low flow rate can be detected by means of

- direct flow measurement with a flowmeter or flow switch
- estimation of flow rate by measurement of 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

Pump type	Recommended diaphragm tank size [litres]		
	-E	-F	-S
CRI(E) 3	8	8	80
CRI(E) 5	12	12	120
CRI(E) 10	18	18	180
CRI(E) 15	80	80	300
CRI(E) 20	80	80	400
CR(E) 32	80	80	600
CR(E) 45	120	120	800
CR(E) 64	120	120	1000
CR(E) 90	180	180	1500
CR(E) 120	180	180	1500
CR(E) 150	180	180	1500

Precharge pressure

Hydro MPC-E and -F: 0.7 x setpoint.

Hydro MPC-S: 0.9 x setpoint.

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

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

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

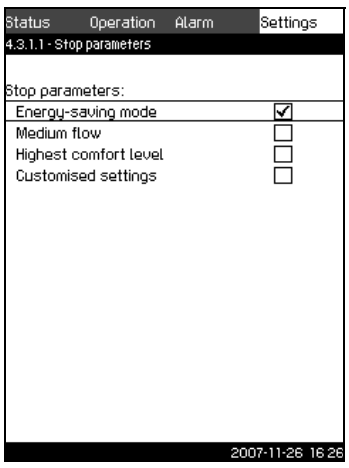
Setting range

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

Setting via control panel

System without flow switch or flowmeter

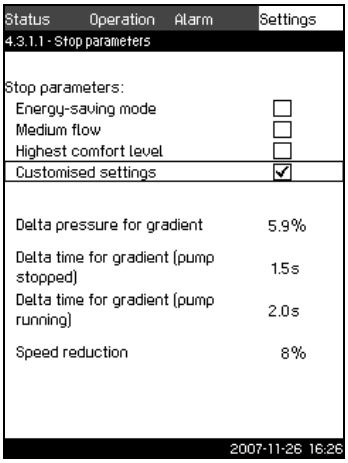
1. Mark the **Settings** menu with ⊙.
2. Mark **Secondary functions** with ⊙ or ⊙, and press ⊙.
3. Mark **Stop function** with ⊙ or ⊙, and press ⊙.
4. Mark **Activated** with ⊙ or ⊙, and press ⊙.
   The activation is indicated by a check mark in the box.
5. Mark **On/off band** with ⊙ or ⊙.
6. Set the on/off band with ⊙ or ⊙, and save with ⊙.
7. Mark **Go to setting of flow stop parameters** with ⊙ or ⊙, and press ⊙.
   Now the display below is shown.



TM03 9966 4807

Fig. 62 Stop parameters

8. Select one of the stop parameters with ⊙ or ⊙, and save with ⊙. If **Customised settings** are selected, the parameters shown in fig. 63 must be set. See examples below.



TM03 8957 4807

Fig. 63 Customised settings

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

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

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

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

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

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

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

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

Note ***An open contact indicates low flow.***

System with flowmeter

Make the following additional settings:

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

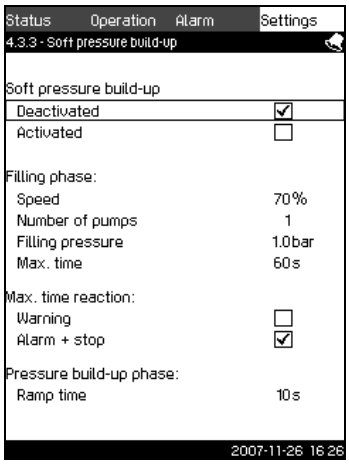
Factory setting

The function is activated in booster applications with the settings in the table.

On/off band:	25 %
Min. flow rate:	30 % of the nominal flow rate of one pump

The function is deactivated in all other applications.

11.7.24 Soft pressure build-up (4.3.3)



TM03 8970 4807

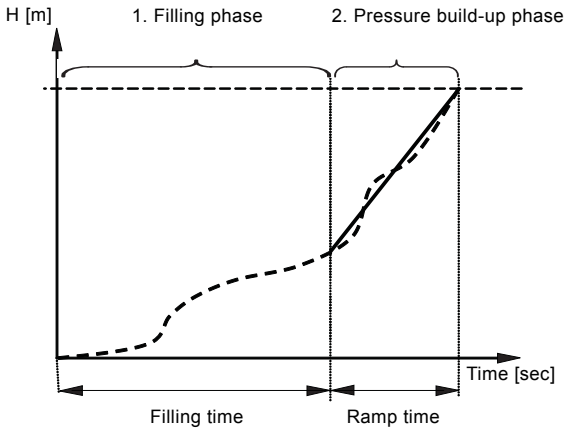
Fig. 64 Soft pressure build-up

Description

This function is typically used in booster applications and ensures a smooth start-up of systems with for instance empty pipes.

Start-up takes place in two phases. See fig. 65.

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.



TM03 9037 3207

Fig. 65 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.

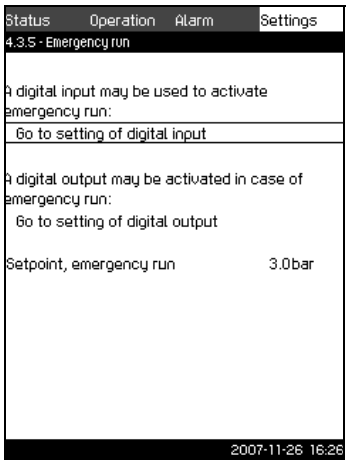
Setting via control panel

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

Factory setting

The function is deactivated.

11.7.25 Emergency run (4.3.5)



TM03 8971 4807

Fig. 66 Emergency run

Description

This function is used in booster applications. 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

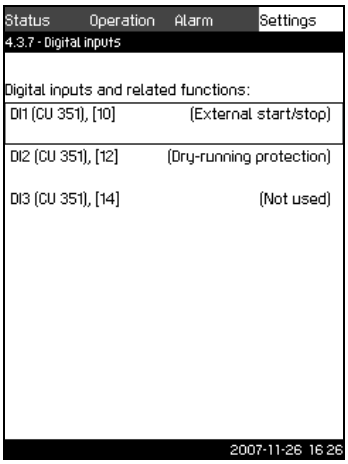
- Setting of digital input (*11.7.26 Digital inputs (4.3.7)*).
- Setting of digital output (*11.7.31 Digital outputs (4.3.9)*).
- Setting of setpoint for emergency run.

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).***

11.7.26 Digital inputs (4.3.7)



TM03 2359 4607

Fig. 67 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 Control MPC has three digital inputs. If the Control 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 Control MPC can be identified.

Example

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

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

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

Setting range

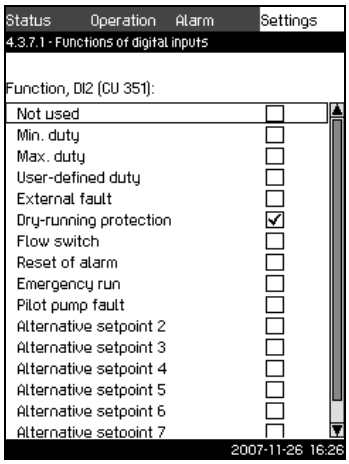
The digital input to be set is selected in the display *Digital inputs (4.3.7)*.

Note ***DI1 (CU 351) cannot be selected.***

Setting via control panel

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

11.7.27 Functions of digital inputs (4.3.7.1)



TM03 8972 4807

Fig. 68 Functions of digital inputs

Description

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

Setting range

It is possible to select one function in each display:

Function	Contact activated
Not used	
Min. duty	= Operating mode *Min.*
Max. duty	= Operating mode *Max.*
User-defined duty	= Operating mode *User-defined*
External fault	= External fault
Dry-running protection	= Water shortage
Flow switch	= Flow rate
Reset of alarm	= Reset alarms
Emergency run	= Operating mode *Emergency run*
Pilot pump fault	= Pilot pump fault
Alternative setpoint 2	= Setpoint 2 selected
Alternative setpoint 3	= Setpoint 3selected
Alternative setpoint 4	= Setpoint 4 selected
Alternative setpoint 5	= Setpoint 5 selected
Alternative setpoint 6	= Setpoint 6 selected
Alternative setpoint 7	= Setpoint 7 selected

See the relevant sections for further information about the functions.

Generally, a closed contact activates the function selected.

Setting via control panel

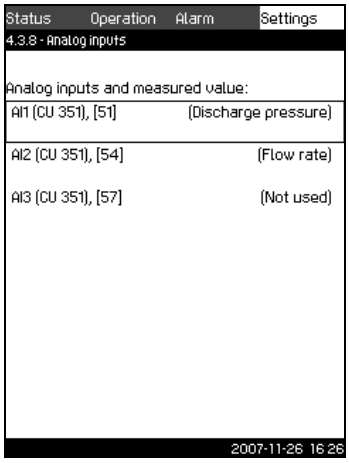
1. Mark the **Settings** menu with ▷.
2. Mark **Secondary functions** with ▽ or △, and press OK.
3. Mark **Digital inputs** with ▽ or △, and press OK.
4. Select the digital input with ▽ or △, and press OK.
5. Select the desired function with ▽ or △, and activate it with OK.
   The activation is indicated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

Factory setting

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

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

11.7.28 Analog inputs (4.3.8)



TM03 2356 4607

Fig. 69 Analog inputs

Description

In this display, the analog inputs of the Control MPC can be set.

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

As standard, the Control MPC has three analog inputs. If the Control 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 Control MPC can be identified.
A redundant primary sensor can be fitted as back-up for the primary sensor in order to increase reliability and prevent stop of operation.

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

Example

AI1 (CU 351) [51]:

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

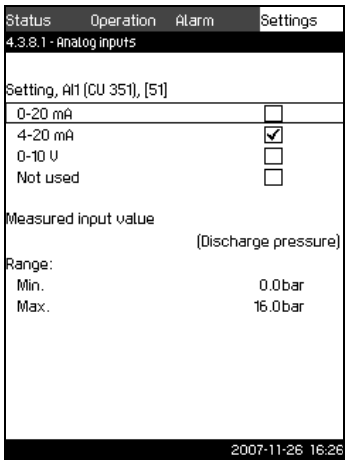
Setting range

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

Setting via control panel

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

11.7.29 Analog inputs (4.3.8.1 to 4.3.8.7)



TM03 2357 4607

Fig. 70 Analog inputs

Description

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

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

Setting range

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

- 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 ok.
3. Mark **Analog inputs** with ⊙ or ⊙, and press ok.
4. Select the analog input with ⊙ or ⊙, and press ok.
5. Mark the setting of the analog input with ⊙ or ⊙, and activate it with ok.
   The activation is indicated by a check mark in the box.

Note

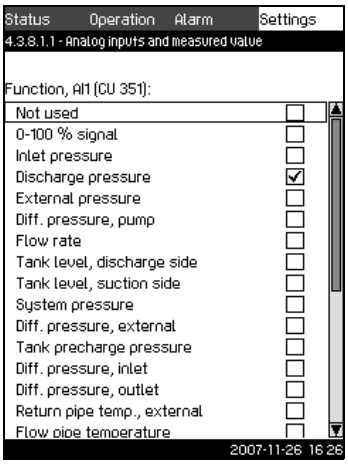
If an analog input is deactivated, the display will only show the top part, i.e. the setting of the analog input.
If the input is activated, the middle part, "Measured input value", will be shown. This makes it possible to relate a function to the analog input in another display. When the analog input has been related to a function, CU 351 will return to the display for setting of analog inputs.

Factory setting

Pressure boosting	
Analog input	**Function**
AI1 (CU 351) [51]	Discharge pressure

Heating and cooling	
Analog input	**Function**
AI1 (CU 351) [51]	These are selected in the start-up wizard

11.7.30 Analog inputs and measured value (4.3.8.1.1 to 4.3.8.7.1)



TM03 8973 4807

Fig. 71 Analog inputs and measured value

Description

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

Setting range

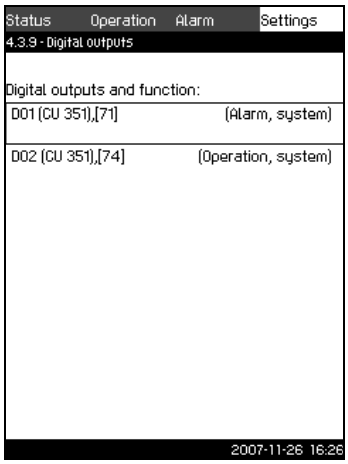
It is possible to select one function per analog input. For further details, see section *12. Measuring parameters*.

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

Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Secondary functions** with ⊙ or ⊙, and press ok.
3. Mark **Analog inputs** with ⊙ or ⊙, and press ok.
4. Select the analog input with ⊙ or ⊙, and press ok.
5. Set the range of the analog input with ⊙ or ⊙, and press ok.
   The activation is indicated by a check mark.
6. Mark **Measured input value** with ⊙ or ⊙, and press ok.
   Now the display 4.3.8.1.1 appears.
7. Select the input with ⊙ or ⊙, and press ok.
8. Press esc to return to display 4.3.8.1.
9. Set the minimum sensor value with ⊕ or ⊖, and save with ok.
10. Set the maximum sensor value with ⊕ or ⊖, and save with ok.

11.7.31 Digital outputs (4.3.9)



TM03 2333 4607

Fig. 72 Digital outputs

Description

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

As standard, the Control MPC has two digital outputs.

If the Control 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 Control MPC can be identified.

Example

DO1 (IO 351-41) [71]:

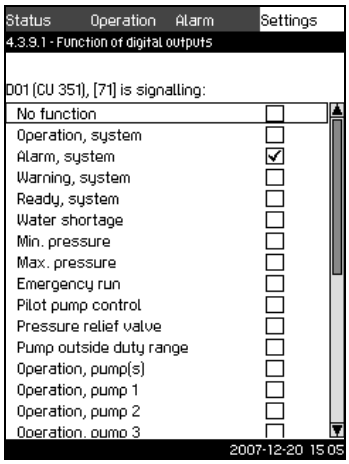
DO1	Digital output No 1
(IO 351-41)	IO 351B, GENIbus number 41
[71]	Terminal No 71

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

Setting range

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

11.7.32 Functions of digital outputs (4.3.9.1 to 4.3.9.16)



TM03 8974 4807

Fig. 73 Functions of digital outputs

Description

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

Setting range

It is possible to select one function in each display:

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

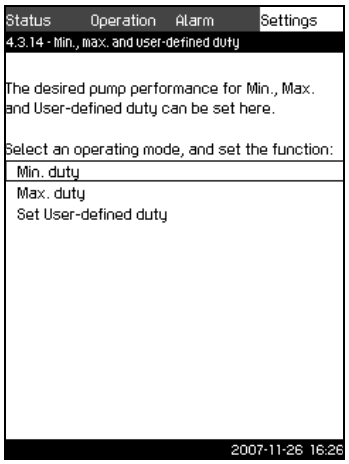
Setting via control panel

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

Factory setting

Digital output	Function
DO1 (CU 351) [71]	Alarm, system
DO2 (CU 351) [74]	Operation, system

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



TM03 2351 4807

Fig. 74 Min., max. and user-defined duty

Description

This function makes it possible to let the pumps run in open loop at a set pump performance.

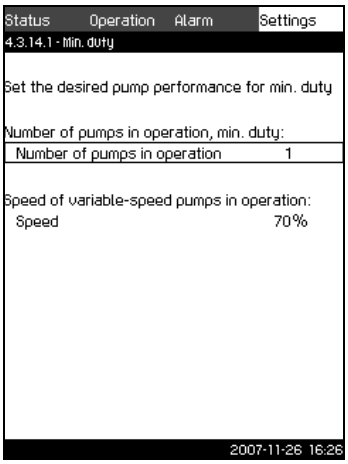
Setting range

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

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

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

11.7.34 Min. duty (4.3.14.1)



TM03 2354 4807

Fig. 75 Min. duty

Description

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

Setting range

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

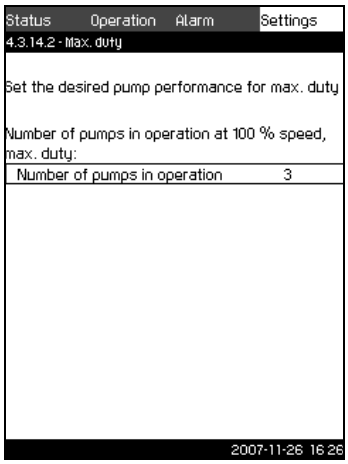
Setting via control panel

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

Factory setting

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

11.7.35 Max. duty (4.3.14.2)



TM03 2353 4807

Fig. 76 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.

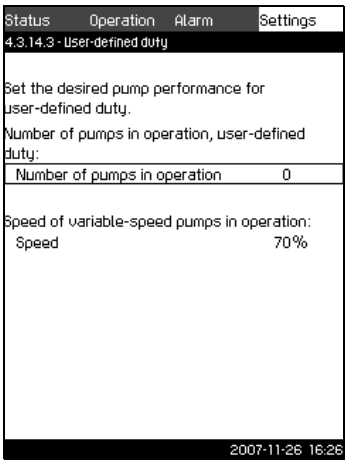
Setting via control panel

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)

11.7.36 User-defined duty (4.3.14.3)



TM03 2352 4807

Fig. 77 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 Control MPC systems with only variable-speed pumps, the speed can be set between 25 and 100 %; in systems with both variable-speed pumps and mains-operated pumps the speed can be set between 70 and 100 %.

Setting via control panel

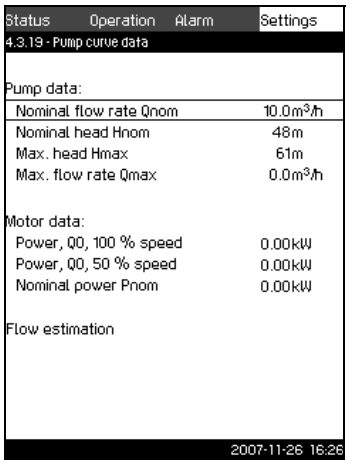
1. Mark the **Settings** menu with ⊙.
2. Mark **Secondary functions** with ⊙ or ⊙, and press ⊙.
3. Mark **Min., max. and user-defined duty** with ⊙ or ⊙, and press ⊙.
4. Mark **User-defined duty** with ⊙ or ⊙, and press ⊙.
5. Mark **Number of pumps in operation, user-defined duty** with ⊙ or ⊙.
6. Set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

11.7.37 Pump curve data (4.3.19)



TM03 8975 4807

Fig. 78 Pump curve data

Description

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

- Nominal flow rate, Q_{nom}, in m^3/h
- Nominal head, H_{nom}, in metres
- Max. head, H_{max}, in metres
- Max. flow rate, Q_{max}, in m^3/h
- Power, Q_0, 100 %, speed in kW
- Power, Q_0, 50 % speed, in kW
- Nominal power, P_{nom}, in kW.

Note

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

All other pump types require manual entering of hydraulic pump data.

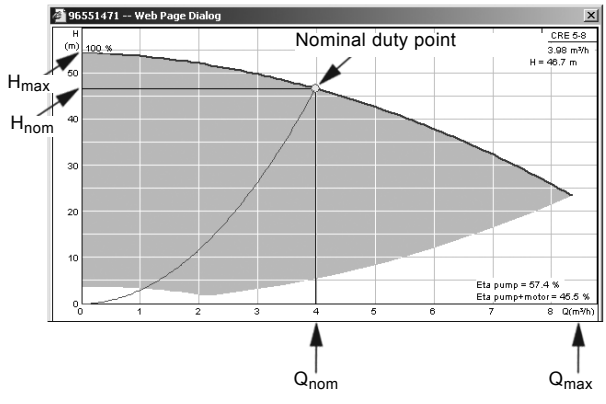
Note

The electrical data, "Power, Q_0, 100 % speed" and "Power, Q_0, 50 % speed" must be entered manually for all pump types, including CR, CRI, CRE and CRIE.

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

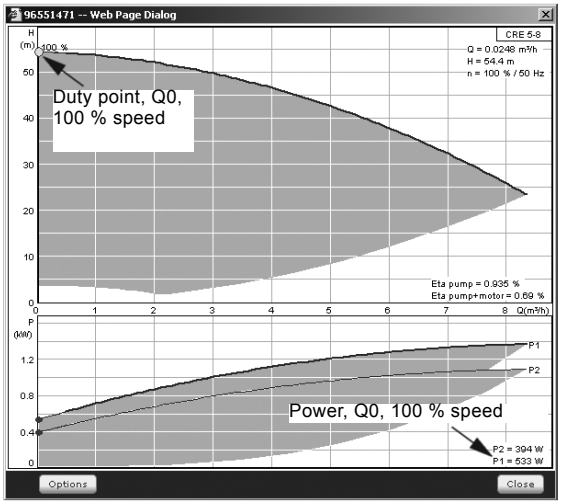
The data are read by means of the pump performance curves which can be found in WebCAPS on Grundfos' homepage, www.grundfos.com. See examples in figs 79 to 82.

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, Pnom. Read the power values in displays 1.3 to 1.8, depending on the pump. See section *11.4.8 Pump 1...6 (1.3 to 1.8)*.



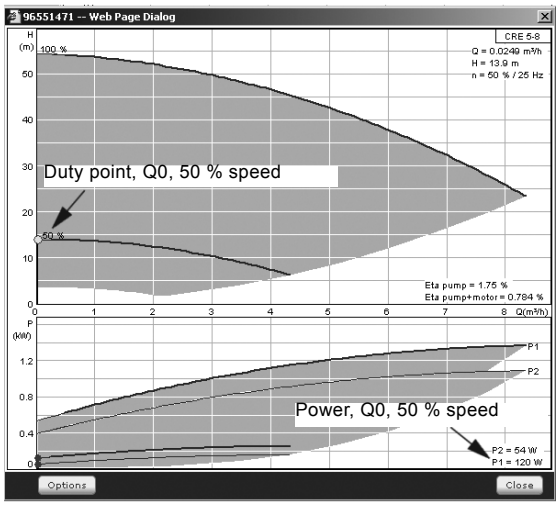
TM03 9993 4807

Fig. 79 Reading of Q_{nom}, H_{nom}, H_{max} and Q_{max} (WebCAPS)



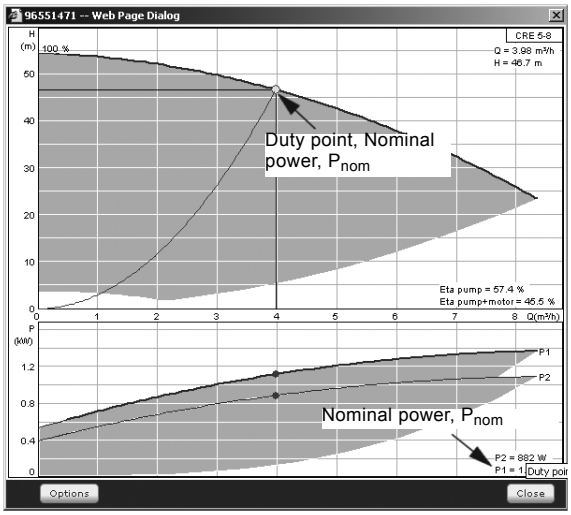
TM03 9994 4807

Fig. 80 Reading of Power, Q0, 100 % speed (WebCAPS)



TM03 9995 4807

Fig. 81 Reading of Power, Q0, 50 % speed (WebCAPS)



TM03 9996 4807

Fig. 82 Reading of Nominal power, P_{nom} (WebCAPS)

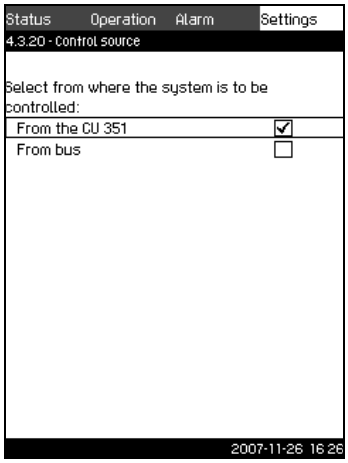
Note

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

Setting via control panel

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

11.7.38 Control source (4.3.20)



TM03 2342 4807

Fig. 83 Control source

Description

Control MPC can be remote-controlled via an external bus connection (option). See section *11.8.2 GENIbus*. Control can also take place via the bus connection. For further information, see section *11.8 Data communication*.

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

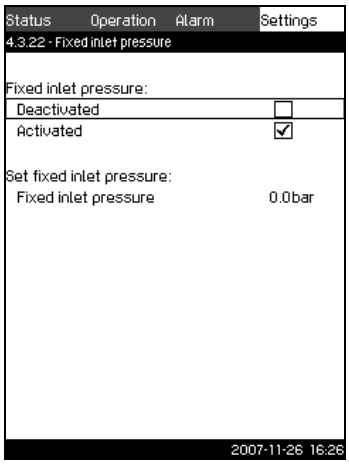
Setting via control panel

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

Factory setting

The control source is CU 351.

11.7.39 Fixed inlet pressure (4.3.22)



TM03 8975 4807

Fig. 84 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 booster system has a fixed inlet pressure, it can be entered in this display so that the CU 351 can optimise the performance and control of the system.

Setting range

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

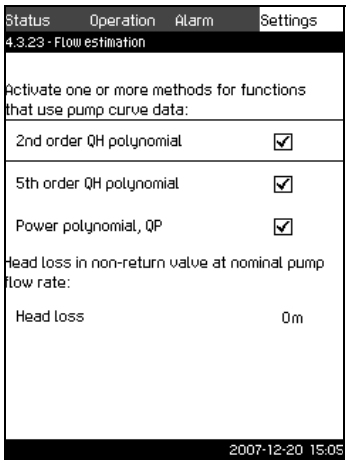
Setting via control panel

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

Factory setting

The function is deactivated.

11.7.40 Flow estimation (4.3.23)



TM03 8977 4807

Fig. 85 Flow estimation

Description

As described in section *11.7.37 Pump curve data (4.3.19)*, the CU 351 can optimise operation according to performance curves and motor data. In this display, curve types are selected which the CU 351 will use for the optimisation if they are available.

At large flow rates, there may be a considerable head loss between the pump discharge flange and the pressure sensor. The loss is caused by non-return valves and pipe bends. To improve the flow estimation of the system, it is necessary to compensate for the difference between the measured and the actual differential pressure across the pump. This is done by entering the head loss in non-return valves and pipe bends at the rated flow rate of one pump.

Setting range

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

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

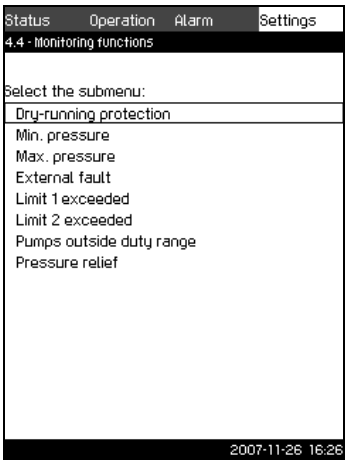
Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Secondary functions** with ⊙ or ⊙, and press ⊙.
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.

11.7.41 Monitoring functions (4.4)



TM03 8978 4807

Fig. 86 Monitoring functions

Description

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

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

Setting range

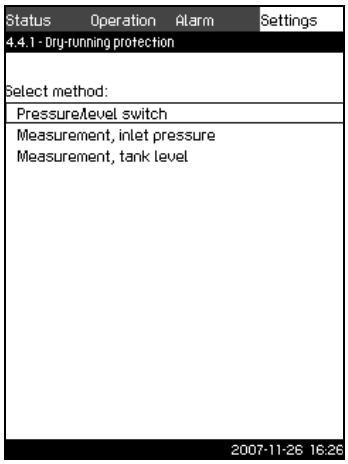
The following functions can be selected:

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

Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Monitoring functions** with ⊙ or ⊙, and press ⊙.
3. Select the function with ⊙ or ⊙, and press ⊙.

11.7.42 Dry-running protection (4.4.1)



TM03 2320 4807

Fig. 87 Dry-running protection

Description

Dry-running protection is one of the most important monitoring functions, as bearings and shaft seal may be damaged if the pumps run dry. Grundfos thus always recommends dry-running protection.

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.

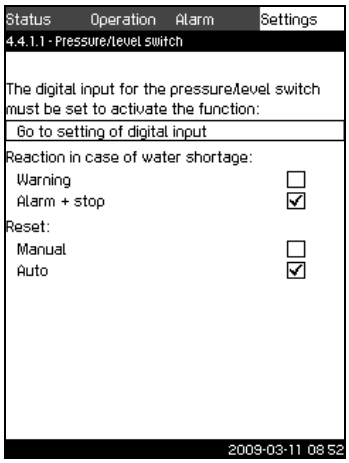
There are three different methods for detection of water shortage:

- Pressure switch on suction manifold or float switch/electrode relay in the supply tank. See section *11.7.43 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 *11.7.44 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 *11.7.45 Dry-running protection with level transmitter (4.4.1.3)*.

Setting via control panel

1. Mark the **Settings** menu with ⟩.
2. Mark **Monitoring functions** with ⌄ or ⌃, and press ok.
3. Mark **Dry-running protection** with ⌄ or ⌃, and press ok.
4. Select the method with ⌄ or ⌃, and press ok.

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



TM03 2329 1109

Fig. 88 Dry-running protection with pressure/level switch

Description

This function is primarily used in booster applications. Dry-running protection can take place by means of a pressure switch on the suction manifold or a level switch in a tank on the suction side.

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

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

Setting range

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

Setting via control panel

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

Factory setting

The setting is done in the start-up wizard and depends on the application.

11.7.44 Dry-running protection with pressure transmitter (4.4.1.2)

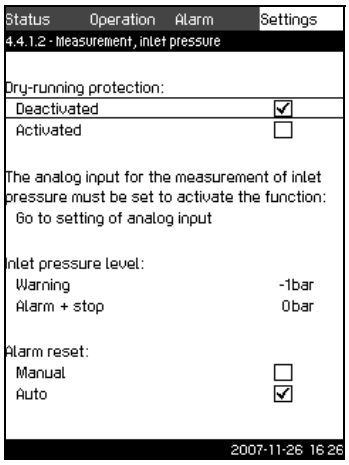


Fig. 89 Dry-running protection with pressure transmitter

Description

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

It is possible to set two levels of inlet pressure: Warning and alarm + stop. In the display, it is possible to set whether restart and reset of the alarm is to be automatic or manual.

Setting range

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

Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Monitoring functions** with ⊙ or ⊙, and press ⊙.
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

The setting is done in the start-up wizard and depends on the application.

11.7.45 Dry-running protection with level transmitter (4.4.1.3)

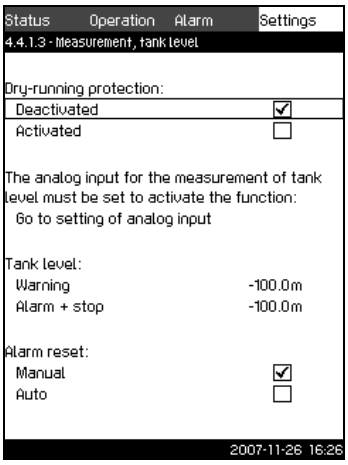


Fig. 90 Dry-running protection with level transmitter

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.

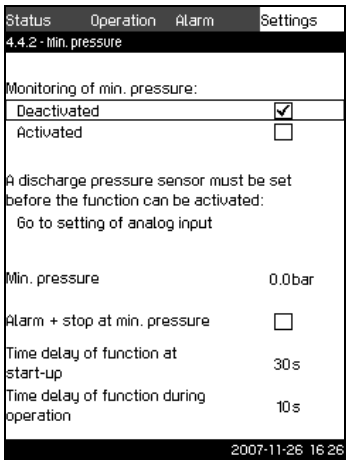
Setting via control panel

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.

11.7.46 Min. pressure (4.4.2)



TM03 8981 4807

Fig. 91 Min. pressure

Description

The discharge pressure is monitored if the application is pressure boosting. In all other applications, the system pressure is monitored. The CU 351 will 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 Control 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 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 system can build up pressure before the function is activated. It is also possible to set a time delay, i.e. for how long time the discharge pressure may be lower than the set minimum pressure before the alarm is activated.

Setting range

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

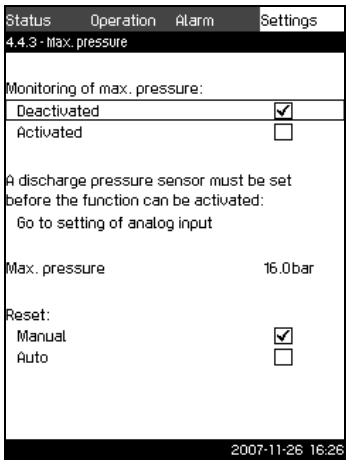
Setting via control panel

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

Factory setting

The function is deactivated.

11.7.47 Max. pressure (4.4.3)



TM03 8982 4807

Fig. 92 Max. pressure

Description

The discharge pressure is monitored if the application is pressure boosting. In all other applications, the system pressure is monitored. The CU 351 will 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 Control 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 *11.7.12 Min. time between start/stop (4.2.1)*.

Setting range

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

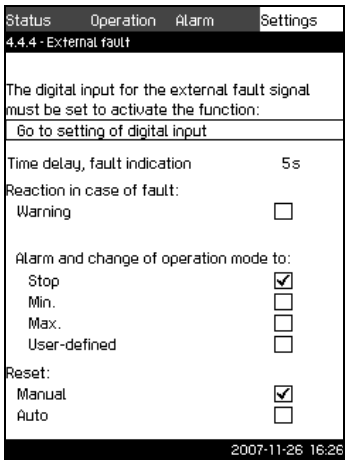
Setting via control panel

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

Factory setting

The function is deactivated.

11.7.48 External fault (4.4.4)



TM03 2313 4807

Fig. 93 External fault

Description

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

Setting range

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

Setting via control panel

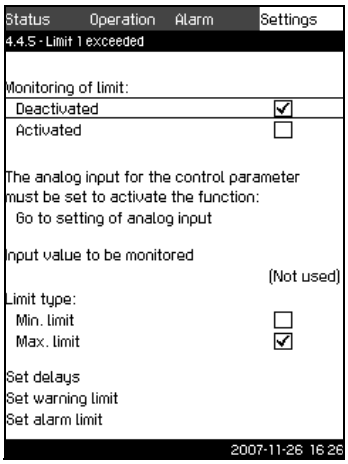
1. Mark the **Settings** menu with ▷.
2. Mark **Monitoring functions** with ▽ or △, and press OK.
3. Mark **External fault** with ▽ or △, and press OK.
4. Mark **Go to setting of digital input** with ▽ or △, and press OK. Now the display *Digital inputs (4.3.7)* appears. Set the input to **External fault**.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

Factory setting

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

- Time delay: 5 seconds.
- Operating mode in case of alarm: Stop.
- Restart: Manual.

11.7.49 Limit 1 and 2 exceeded (4.4.5 and 4.4.6)



TM03 8983 4807

Fig. 94 Limit 1 exceeded 1

Description

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

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

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

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

A warning can be reset automatically or manually.

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

Setting range

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

Setting via control panel

Note ***Analog inputs must be correctly set before the function is activated. See section 11.7.28 Analog inputs (4.3.8).***

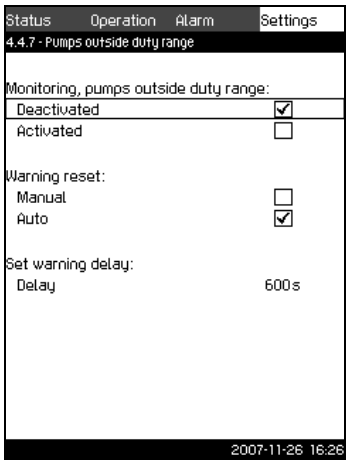
1. Mark the **Settings** menu with ▷
2. Mark **Monitoring functions** with ▽ or △, and press OK
3. Mark **Limit 1 exceeded 1** or **Limit 2 exceeded** with ▽ or △, and press OK.
4. Mark **Go to setting of analog input** with ▽ or △, and press OK.
5. Select the analog input with ▽ or △, and press OK.
6. Mark the setting of the analog input with ▽ or △, and activate it with OK.
   The activation is indicated by a check mark in the box.
7. Mark **Measured value** with ▽ or △, and press OK.
   Now the display 4.3.8.1.1 appears.
8. Select the input with ▽ or △, and press OK.
9. Press ESC to return to display 4.3.8.1.

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

Factory setting

The function is deactivated.

11.7.50 Pumps outside duty range (4.4.7)



TM03 8984 4807

Fig. 95 Pumps outside duty range

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 *11.7.37 Pump curve data (4.3.19)*.

Setting range

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

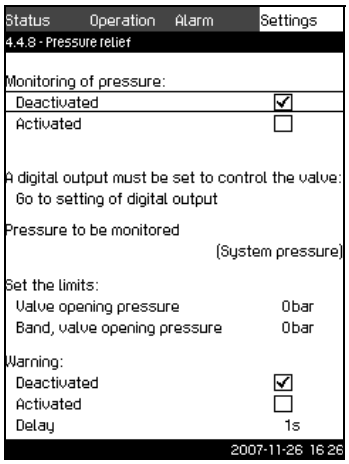
Setting via control panel

1. Mark the **Settings** menu with ⌄
2. Mark **Monitoring functions** with ⌄ or ⌃, and press ok.
3. Mark **Pumps outside duty range** with ⌄ or ⌃, and press ok.
4. Mark **Manual** or **Auto** with ⌄ or ⌃, and activate the function with ok.
5. Mark **Warning delay** with ⌄ or ⌃. Set the time with ⊕ or ⊖, and save with ok.
6. Mark **Activated** with ⌄ or ⌃, and press ok to activate the function.

Factory setting

The function is deactivated.

11.7.51 Pressure relief (4.4.8)



TM03 8986 4807

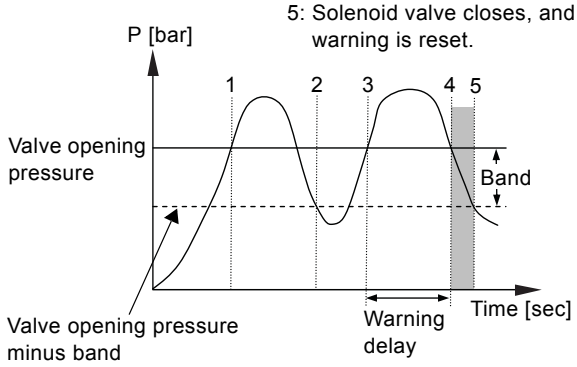
Fig. 96 Pressure relief

Description

This function is primarily used in heating and cooling applications.

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.

1: Solenoid valve opens.
2: Solenoid valve closes.
3: Solenoid valve opens.
4: Warning is activated.
5: Solenoid valve closes, and warning is reset.



TM03 9206 3607

Fig. 97 Pressure relief

Setting range

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

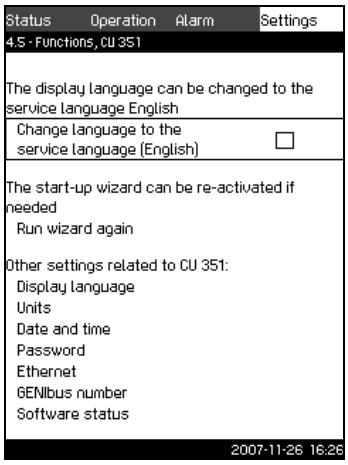
Setting via control panel

1. Mark the **Settings** menu with ⊙
2. Mark **Monitoring functions** with ⊙ or ⊙, and press ⊙.
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 ⊙ activate the function.

Factory setting

The function is deactivated.

11.7.52 Functions, CU 351 (4.5)



TM03 2295 4807

Fig. 98 Functions, CU 351

Description

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

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

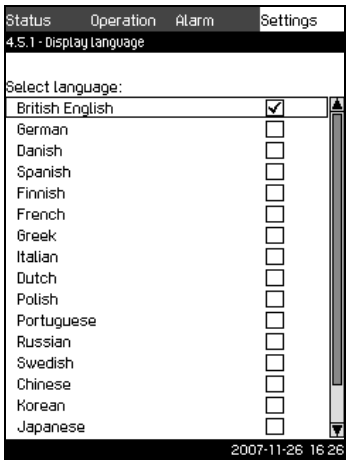
The service language, English, can be activated for service purposes. If no buttons are touched for 15 minutes, the display will return to the language selected at start-up or to the language set in section *11.7.53 Display language (4.5.1)*.

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

Setting range

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

11.7.53 Display language (4.5.1)



TM03 8987 4807

Fig. 99 Display language

Description

Here the language for the CU 351 display is selected.

Setting range

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

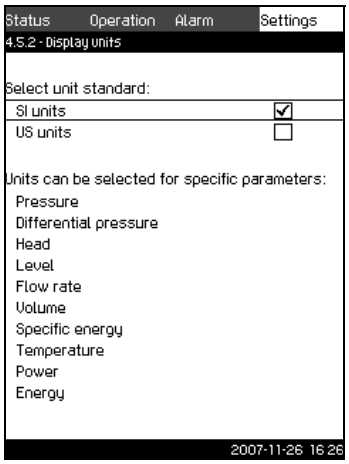
Setting via control panel

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

Factory setting

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

11.7.54 Display units (4.5.2)



TM03 8988 4807

Fig. 100 Display units

Description

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

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

Setting range

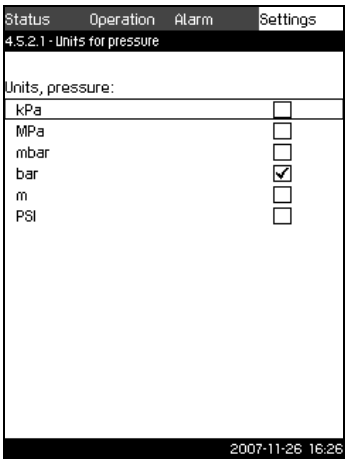
Parameter	Basic setting		Possible units
	SI	US	
Pressure	bar	psi	kPa, MPa, mbar, bar, m, psi
Differential pressure	m	psi	kPa, MPa, mbar, bar, m, psi
Head	m	ft	m, cm, ft, in
Level	m	ft	m, cm, ft, in
Flow rate	m^3/h	gpm	m^3/s, m^3/h, l/s, gpm, yd^3/s, yd^3/min, yd^3/h
Volume	m^3	gal	l, m^3, gal, yd^3
Specific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

Note

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

Setting via control panel

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



TM03 2310 4807

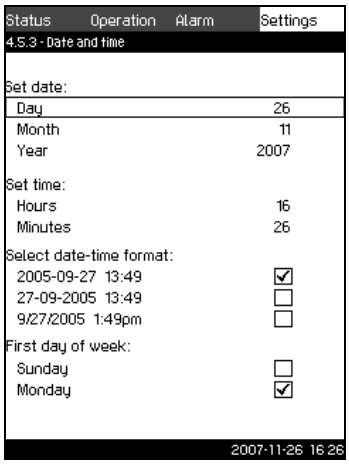
Fig. 101 Example of selection of display units

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

Factory setting

The setting is done in the start-up wizard and depends on the application.

11.7.55 Date and time (4.5.3)



TM03 8989 4807

Fig. 102 Date and time

Description

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

The clock has a built-in rechargeable voltage supply which can supply the clock for up to 20 days if the voltage supply to the Control 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 ok.
3. Mark **Date and time** with ⌄ or ⌃, and press ok.
4. Mark **Day**, **Month** and **Year** with ⌄ or ⌃, and set the date with + or −. Save with ok.
5. Mark **Hours** and **Minutes** with ⌄ or ⌃, and set the time with + or −. Save with ok.
6. Select the format with ⌄ or ⌃, and save with ok.
7. Mark **First day of week**, **Sunday** or **Monday** with ⌄ or ⌃, and save with ok.

Factory setting

Local time.

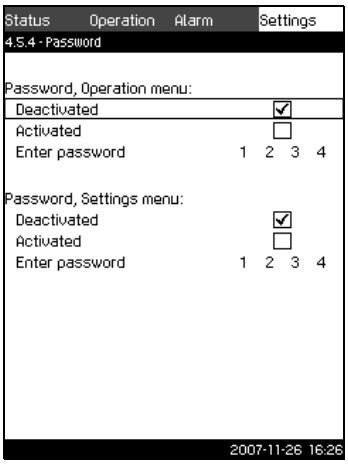
Note

If the Control MPC 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 Control MPC.

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

11.7.56 Passwords (4.5.4)



TM03 2899 4807

Fig. 103 Passwords

Description

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

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

Note

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

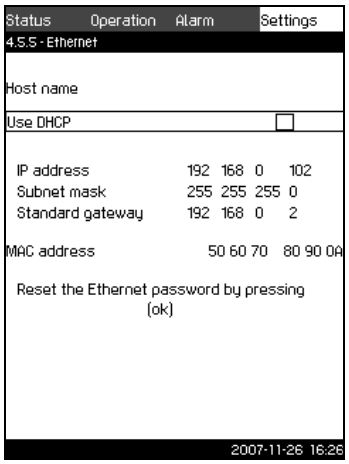
Setting via control panel

1. Mark the **Settings** menu with ›.
2. Mark **Functions, CU 351** with ⌄ or ⌃, and press ok.
3. Mark **Password** with ⌄ or ⌃, and press ok.
4. Mark the password to be activated, and press ok.
5. Mark **Enter password**, and press ok.
   Now the first digit of the password is flashing.
6. Select the digit with + or −, and save with ok.
   Now the second digit of the password is flashing.
7. Repeat steps 4 to 6 if it is necessary to activate the other password.

Factory setting

Both passwords are deactivated. If a password is activated, the factory setting will be "1234".

11.7.57 Ethernet (4.5.5)



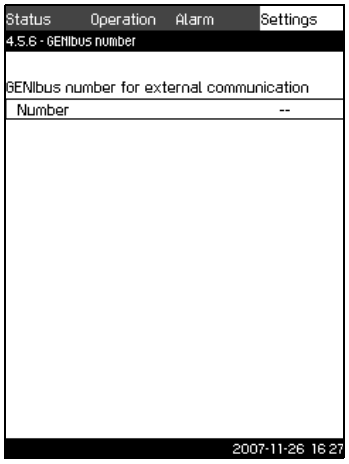
TM03 2298 4807

Fig. 104 Ethernet

Description

The CU 351 is equipped with an Ethernet connection for communication with a computer, either directly or via Internet. For further information, see section *11.8.1 Ethernet*.

11.7.58 GENIbus number (4.5.6)



TM03 2297 4807

Fig. 105 GENIbus number

Description

CU 351 can communicate with external units via an RS-485 interface (option). For further information, see fig. 107 and section *11.8.2 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.

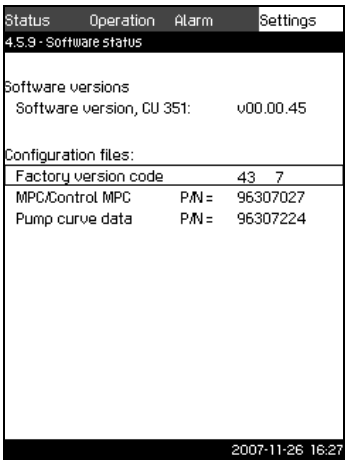
Setting via control panel

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 ("–").

11.7.59 Software status (4.5.9)



TM03 2296 4807

Fig. 106 Software status

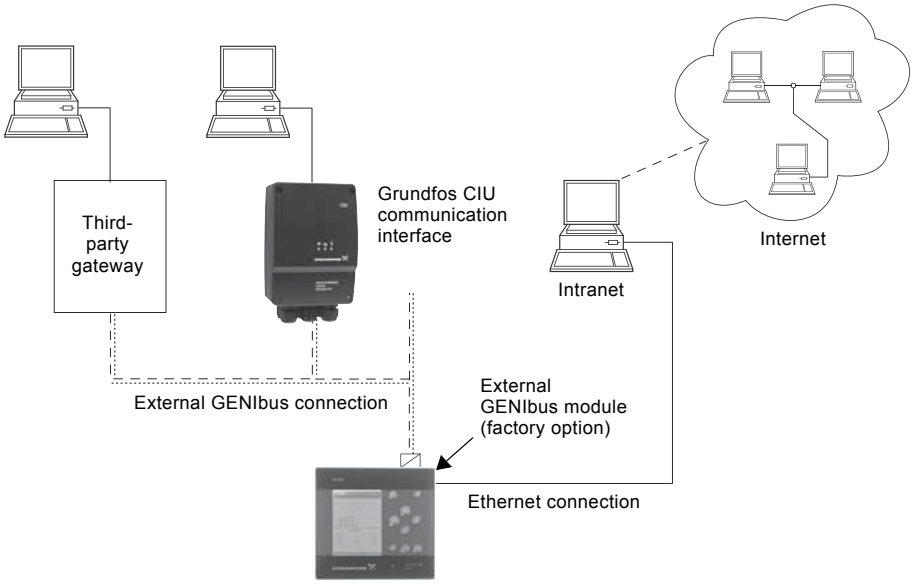
Description

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

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

11.8 Data communication

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



TM03 2044 1009

Fig. 107 Data communication via external GENIbus and Ethernet connection

11.8.1 Ethernet

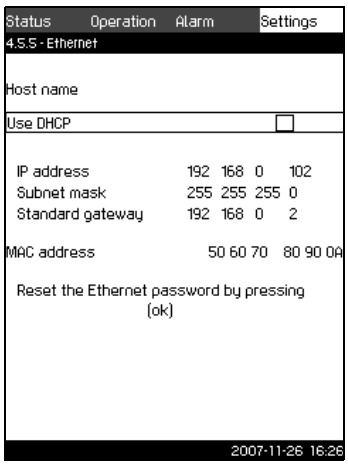
Ethernet is the most widely used standard for local networks (LAN). The standardisation of this technology has created some of the easiest and cheapest ways of creating communication between electrical units, for instance between computers or between computers and control units.

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 system can be monitored and controlled externally.

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

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

Alternatively to the factory-set IP address, it is possible to use a dynamic assignment of IP address. This is possible by activating a DHCP (Dynamic Host Configuration Protocol) either directly in the CU 351 or via the web server. See the example in fig. 108.



TM03 2298 4807

Fig. 108 Example of setting of Ethernet

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

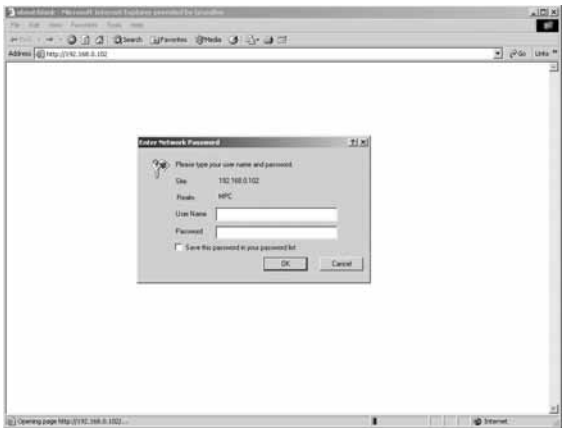
A traditional Internet browser is used for connection to the web server of the CU 351.

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

In order to use dynamic assignment, the function must be activated. Click (ok) **Use DHCP** in the menu line. A check mark next to the menu line shows that activation has been made. After activation in the display, open the Internet and enter the host name of the CU 351 instead of the IP address. The Internet browser will now try to connect to the CU 351. The host name can be read in the display, but can only be changed by either a GSC-file (configuration file) or via a web server. See *Change of network setting* on page 60.

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

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



TM03 2048 3505

Fig. 109 Connection to CU 351

Factory setting

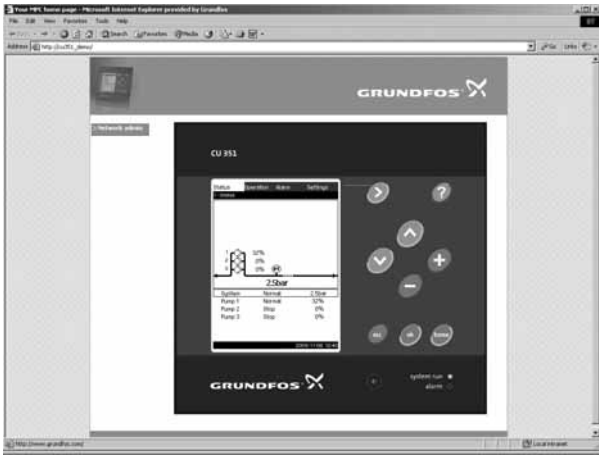
User name: admin
Password: admin

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

TM03 2049 3505

Fig. 110 Display with link to the JavaScript® program

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



TM03 2047 3505

Fig. 111 Network setting

Change of network setting

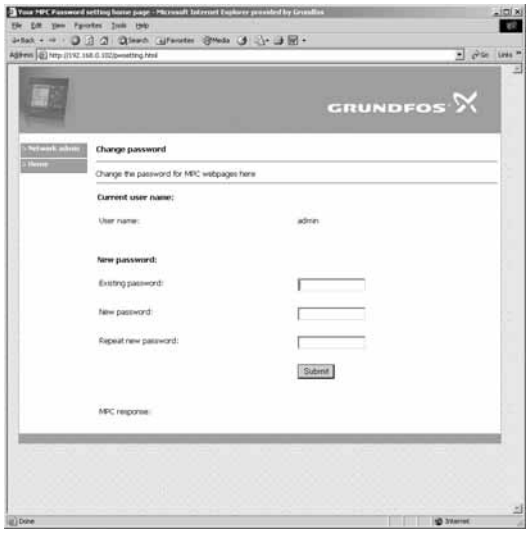
When connection to the web server of the CU 351 has been established, it is possible to change the network setting.

TM03 2050 3505

Fig. 112 Change of network setting

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

Change of password



TM03 2051 3505

Fig. 113 Change of password

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

11.8.2 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. 107. 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.

12. Measuring parameters

12.1 Transmitter types

The transmitter types in the table below can be used for the measurement of values in the system.

Abbreviation	Transmitter
DPT	Differential pressure transmitter
DTT	Differential temperature transmitter
FT	Flow transmitter
LT	Level transmitter
PT	Pressure transmitter
TT	Temperature transmitter

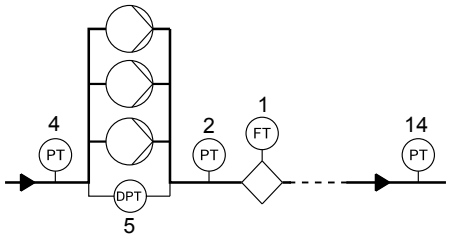
12.2 Parameter list

The table below shows which measured values the CU 351 can receive via its analog inputs. Figures 114 to 115 117 show where the values can be measured.

No	Parameter
1	Flow rate
2	Discharge pressure
3	Differential pressure, external
4	Inlet pressure
5	Differential pressure, pump
6	Differential pressure, inlet
7	Differential pressure, outlet
8	Tank level, discharge side
9	Tank level, suction side
10	Return pipe temperature, external
11	Flow pipe temperature
12	Return pipe temperature
13	Differential temperature
14	External pressure
15	Series 2000, differential pressure
16	Series 2000, flow rate
17	System pressure
Not shown	Ambient temperature*
Not shown	0-100 % signal**

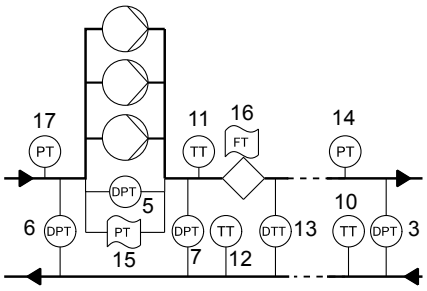
* The ambient temperature is typically the temperature in the room where the Control MPC is located.

** A 0-100 % signal from an external controller. It can for instance be a 0-10 V signal.



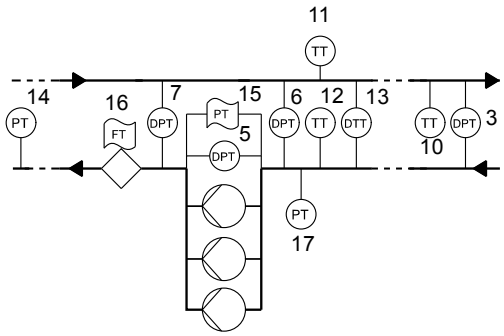
TM03 8823 3507

Fig. 114 Pressure boosting



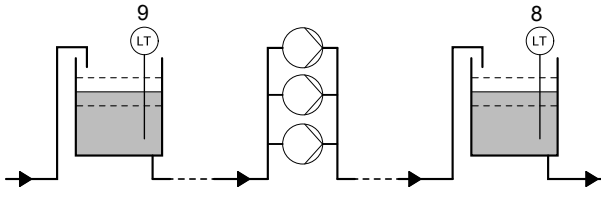
TM03 9964 4707

Fig. 115 Heating and cooling, pumps in flow pipe



TM03 9965 4707

Fig. 116 Heating and cooling, pumps in return pipe



TM03 8824 2607

Fig. 117 Level monitoring

13. Fault finding chart

Warning

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

Fault	Possible cause	Remedy
The Control MPC is stopped and cannot restart.	Primary sensor fault - Primary sensor is defective.	Replace the primary sensor. Transmitters with 0-20 mA or 4-20 mA output signals are monitored by the Control MPC.
	- Cable is broken or short-circuited.	Repair or replace the cable.
	CU 351 fault - Electricity supply disconnected.	Connect the electricity supply.
	- CU 351 defective.	Contact Grundfos.
	Electricity supply disconnected.	Connect the electricity supply.
	Main switch switched off.	Switch in the main switch.
	Main switch is defective.	Replace the main switch.
	Motor protection is activated.	Contact Grundfos.

14. Maintenance

Warning

Before starting work on the Control MPC, 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.

14.1 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 *16. Technical data*.

15. Taking out of operation

Switch off the main switch to take the Control MPC 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.

16. Technical data

16.1 Temperature

Ambient temperature: 0 °C to +40 °C

16.2 Relative humidity

Max. relative humidity: 95 %

17. Electrical data

Supply voltage

See nameplate of the Control MPC.

Backup fuse

See the wiring diagram supplied with the Control MPC.

Digital inputs

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

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

Analog inputs

Input current and voltage:	0-20 mA 4-20 mA 0-10 V
Tolerance:	±3.3 % of full scale
Repetitive accuracy:	±1% of full scale
Input resistance, current:	< 250 Ω
Input resistance, voltage, CU 351:	10 kΩ ±10 %
Input resistance, voltage, IO 351:	> 50 kΩ ± 10 %
Supply to sensor:	24 V, maximum 50 mA, short-circuit protected

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

Digital outputs (relay outputs)

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

All digital outputs are potential-free relay contacts.

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

18. Related documents

Further product information about Control MPC and pumps that can be controlled by the Control MPC are available in WebCAPS on Grundfos' homepage, www.grundfos.com.

19. 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.

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