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LCR2652
BHD50
Level Controller, Operating and Display Unit
Installation and Maintenance Instructions

BHD50

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Appendix

1. Safety information

The equipment must only be installed, wired and commissioned by qualified and competent staff. Retrofitting and maintenance work must only be performed by qualified staff who - through adequate training - have achieved a recognised level of competence.

Danger
The terminal strips of the equipment are live during operation.
This presents the danger of electric shock!
Always cut off power supply to the equipment before mounting, removing or connecting the terminal strips!

Important
The name plate specifies the technical features of the equipment.
Note that any piece of equipment without its specific name plate must neither be commissioned nor operated.

Directives and standards

VdTÜV Bulletin "Wasserstand 100" (Water Level 100)
The functional unit consisting of the operating and display unit BHD50/level controller LCR2652 in conjunction with level transmitter LP20/LP21/PA420 is type approved to the VdTÜV Bulletin "Water Level 100".
The VdTÜV Bulletin "Wasserstand (Water Level) 100" specifies the requirements made on water level control and limiting equipment for boilers.

LV (Low Voltage) Directive and EMC (Electromagnetic Compatibility)
The equipment meets the requirements of the Low Voltage Directive 2014/35/EU and the EMC Directive 2014/30/EU.

ATEX (Atmosphère Explosible)
According to the European Directive 2014/34/EU the equipment must not be used in explosion risk areas.

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2. General product information

2.1 Intended use

The functional unit consisting of the operating and display unit BHD50 and the LCR2652 level controller in conjunction with level transmitter LP20/LP21/PA420 is used as water level controller and as a limit switch, for instance in steam boilers, (pressurized) hot-water installations as well as condensate and feedwater tanks. One BHD50 can be used with a LCR2652 and a BCR3250 controller to provide a combined level and TDS control system.

A level limit switch (LCS3050 and/or LCS3051) can be connected to the LCR2652 to signal and log level alarms on the BHD50.

2.2 Function

The LCR2652 level controller processes the level-dependent current signal from the LP20/LP21/PA420 level transmitter. This input signal is recognised by the controller as 0 and 100 % of the boiler measuring range.

The operating and display unit BHD50 and the level controller LCR2652 form a functional unit featuring the following properties:

- 3-position stepping controller with proportional-plus-integral control action (PI controller) and control of an electrically actuated control valve (VMD - Valve Motor Drive).

- Continuous controller as PI controller for the control of an electro-pneumatically operated control valve and a relay for pump ON/OFF control

- Indication of MIN/MAX water level limit

- Fill or discharge control

- Level damping filter

- Current inputs for steam and feedwater flowrate (2 or 3-element control)

- Actual value output 4-20 mA

- Level limit switch alarm input (24Vdc), to display the status of any LCS3050 or LCS3051 level limit switch

- Indication of actual value (indicated in percent and as bar graph)

- Standardized measuring range when the level transmitter LP20/LP21/PA420 is connected

- Indication/adjustment of control parameters

- Adjustment and evaluation of current inputs for steam and feedwater flowrate (2 or 3-element control)

- Trend record

- Indication and listing of errors, alarms and warnings

- Test of MIN/MAX output relays

- Manual/automatic operation

- Modbus RTU (RS232, RS422 or RS485) and Modbus TCP (Ethernet 10/100Mb) communication

- Password protection

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3. Mechanical installation

3.1 Dimensions (LCR2652) (approximate) in mm

Item	
1	Upper terminal strip
2	Lower terminal strip
3	Housing
4	Support rail TH 35, EN 60715
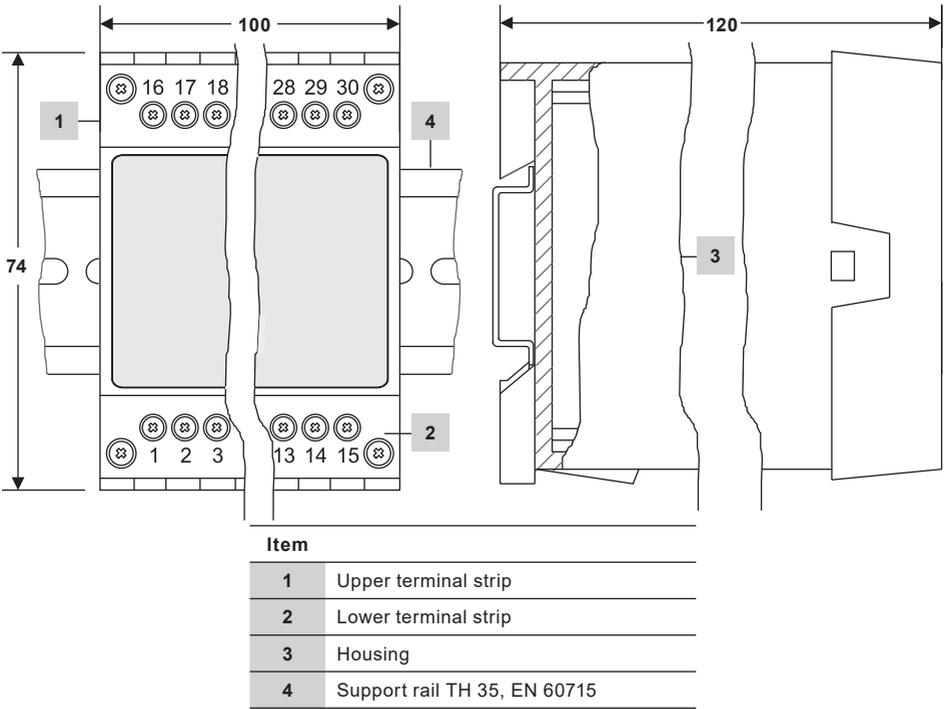
Fig. 1

3.1.1 Installation in control cabinet
The level controller LCR2652 is clipped onto the support rail type TH 35, EN 60715 in the control cabinet. Fig. 1, item **4**

3.2 Dimensions (BHD50) (approximate) in mm
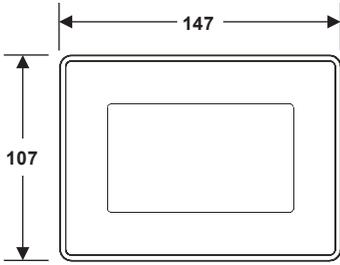
Fig. 2a
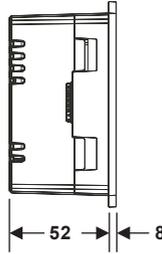
Fig. 2c
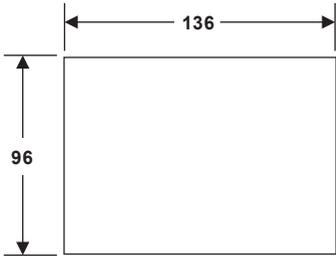
Fig. 2b
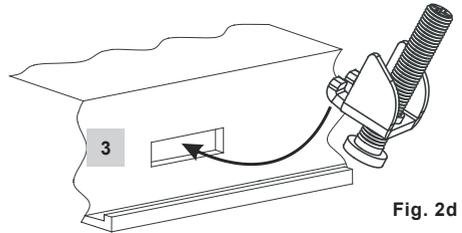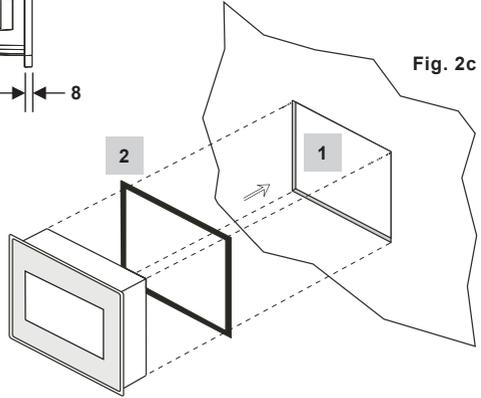
Fig. 2d

Item	
1	Cut-out in control cabinet 136 x 96 mm
2	Gasket
3	Fixing elements

3.2.1 Installation in control cabinet

- Provide a control panel cut-out with the dimensions indicated in Fig 2a and 2c.

- Insert the operating and display unit into the control panel cut-out. Make sure the gasket 2 is properly seated.

- Insert and fasten the screws Fig. 2d until the edges of the frame are flush with the panel of the control cabinet.

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3.3 Name plates

LCR2652

BHD50

Fig. 3

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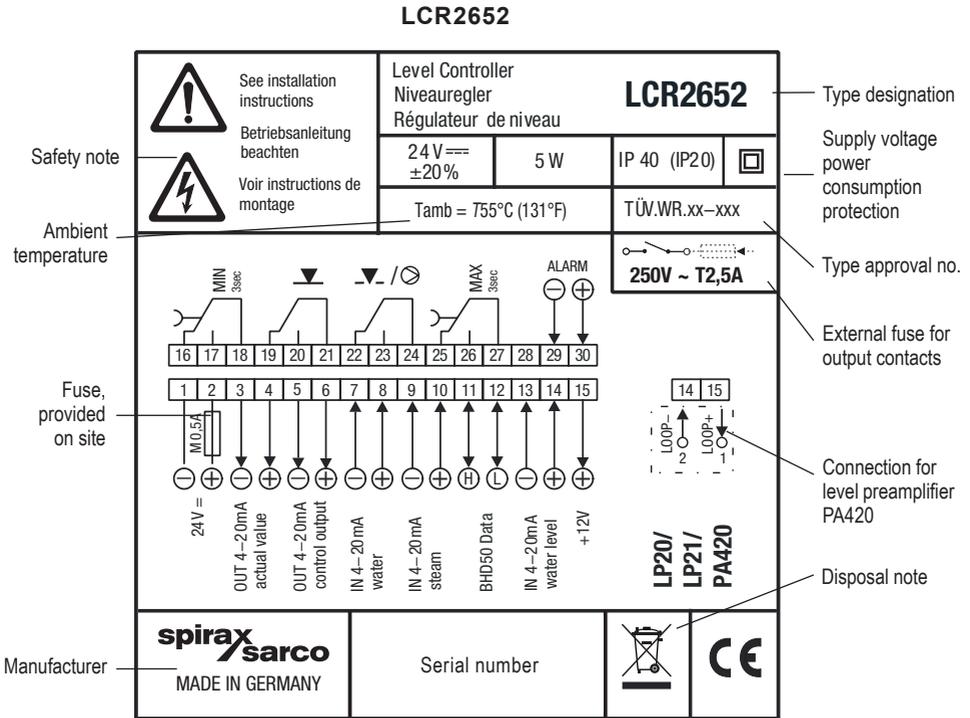
4. Electrical installation

4.1 Wiring diagrams

4.1.1 Wiring diagram (LCR2652) - Valve Motor Drive Controller (VMD)
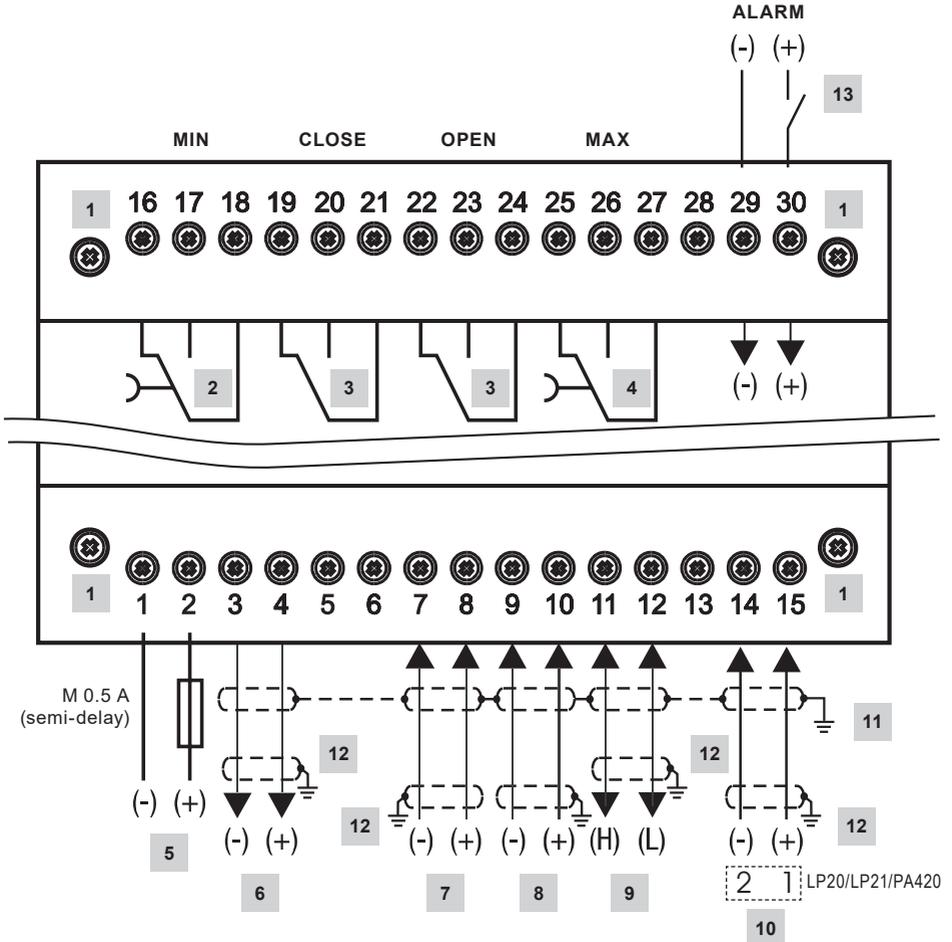
Fig. 4

Item	
1	Fixing screws for terminal strip
2	MIN output contact, de-energizing delay: 3 sec.
3	Output contacts for activating the control valve. External link wire necessary for function.
4	MAX output contact, de-energizing delay: 3 sec.
5	Connection of supply voltage 24 Vdc with fuse 0.5 A (semi-delay) provided on site
6	Actual value output 4-20 mA
7	Feedwater flowrate input, 4-20 mA
8	Steam flowrate input, 4-20 mA
9	Data line for operating and display unit BHD50
10	Level transmitter LP20/LP21/PA420, 4-20 mA
11	Central earthing point (CEP) in control cabinet
12	Earthing point at the auxiliary equipment (e.g. PA420/LP20/LP21)
13	Input for level limit switch (24Vdc), ON = alarm, OFF = normal water level

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4.1.2 Wiring diagram (LCR2652) -
For continuous controller (4 - 20 mA) or Pump ON/OFF controller
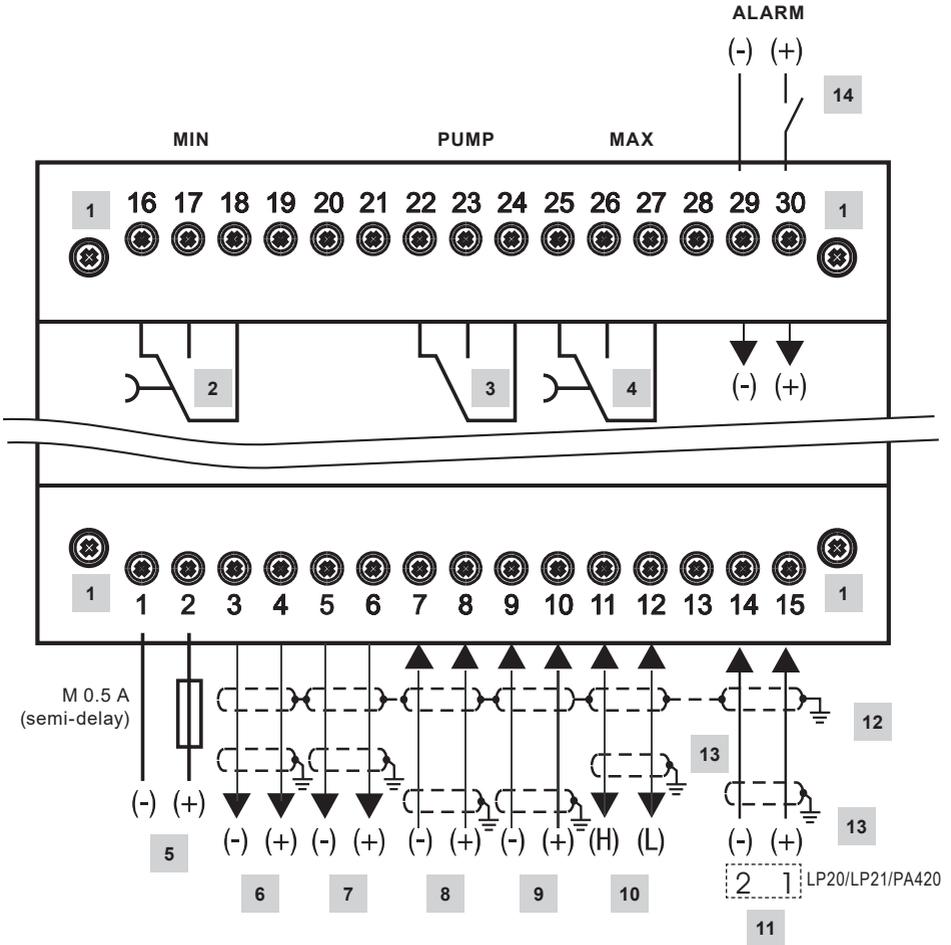
Fig. 5

Item	
1	Fixing screws for terminal strip
2	MIN output contact, de-energizing delay: 3 sec.
3	Pump output contact
4	MAX output contact, de-energizing delay: 3 sec.
5	Connection of supply voltage 24 Vdc with fuse 0.5 A (semi-delay) provided on site
6	Actual value output 4-20 mA
7	Output 4-20 mA manipulated variable Y
8	Feedwater flowrate input, 4-20 mA
9	Steam flowrate input, 4-20 mA
10	Data line for operating and display unit BHD50
11	Level transmitter LP20/LP21/PA420, 4-20 mA.
12	Central earthing point (CEP) in control cabinet
13	Earthing point at the auxiliary equipment (e.g. PA420/LP20/LP21)
14	Input for level limit switch (24Vdc), ON = alarm, OFF = normal water level

4.1.3 Wiring diagram (BHD50)
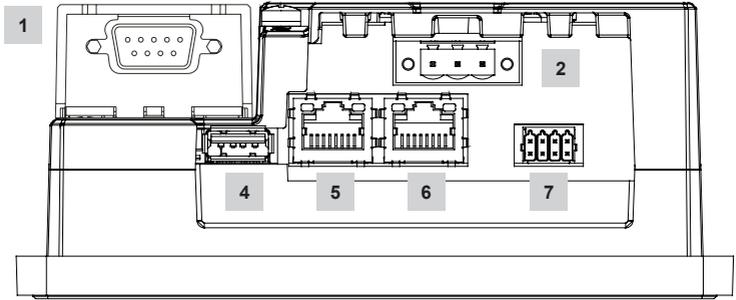
Fig. 6

4.1.4 Connection of 24Vdc supply voltage
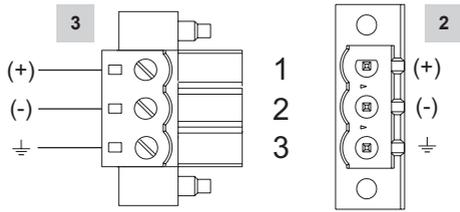
Fig. 7

4.1.5 Pin assignment for data line LCR2652 to the BHD50

Fig. 8

PIN 2	Data_L
PIN 7	Data_H

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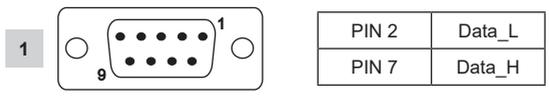
4.1.6 Pin assignment for serial port
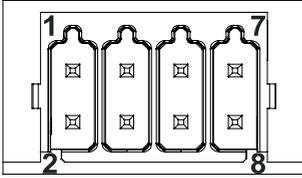
RS-232

Pin	Description
1	RX
2	TX
3	CTS
4	RTS
5	+5V output
6	GND
7	
8	

RS-422, RS-485

Pin	Description
1	CHB-
2	CHA-
3	CHB+
4	CHA+
5	+5V output
6	GND
7	
8	

To operate in RS-485 pins 1-2 and 3-4 must be connected externally.

Fig. 9

4.1.7 Pin assignment for Ethernet ports

OFF: Valid link has NOT been detected
ON: Valid link has been detected
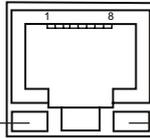
Green ON:
No activity
BLINKING: Activity

Fig. 10

Item	
1	D-SUB connector with 9 poles for data line
2	Connector with 3 poles for 24 Vdc supply voltage
3	Connection for 24 Vdc supply voltage, pin assignment
4	USB Port V2.0, max. 500 mA - for maintenance only
5	Ethernet Port 0 (10/100Mb)
6	Ethernet Port 1 (10/100Mb)
7	Serial port (RS232/422/485)

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4.2 Connection of supply voltage

The equipment must be supplied with 24 Vdc from a SELV (Safety Extra Low Voltage) power supply. For LCR2652 an external 0.5A semi-delay fuse must also be fitted.

This power supply unit must be electrically isolated from dangerous live voltages and meet the requirements for double or reinforced insulation in accordance with one of the following standards: EN 50178, EN 61010-1, EN 60730-1, EN 60950-1 or EN 62368-1.

After switching on the supply voltage and start-up of the equipment the LED of the level controller LCR2652 lights up green (see fig 11).

Tri-colour LED indicator
(start-up = amber,
power ON = green,
malfunction = red)

Fig. 11

4.3 Connecting output contacts

Wire the upper terminal strip (terminals 16-27) according to the desired and ordered switching functions. Provide an external slow-blow fuse 2.5 A for the output contacts.

When switching off inductive loads, voltage spikes are produced that may impair the operation of control and measuring systems. Connected inductive loads must be provided with suppressors such as RC combinations as specified by the manufacturer.

4.4 Connecting level transmitter

To connect the equipment use screened multi-core control cable with a min. conductor size of 0.5 mm², e.g. LiYCY 2 x 0.5 mm², max. length 100 m.

Wire terminal strip in accordance with the wiring diagram. Fig. 4, 5

Wire screen in accordance with the wiring diagram.

Make sure that connecting cables are segregated and run separately from power cables.

4.5 Connection of IN ../ OUT/4-20 mA

To connect the equipment use screened multi-core control cable with a min. conductor size of 0.5 mm², e.g. LiYCY 2 x 0.5 mm², max. length: 100 m.

Please observe the max. load of 500 ohm for the outputs.

Wire terminal strip in accordance with the wiring diagram. Fig. 4, 5

Connect the screen to the central earthing point (CEP) in the control cabinet.

Make sure that connecting cables are segregated and run separately from power cables.

4.6 Connection of input for level limit switch alarm (24Vdc)

An input for connecting the equipment to any alarm or limit switch (e.g. LCS3050 or LCS3051), to display the alarm status on the operating and display unit (BHD50).

Wire terminal strip in accordance with the wiring diagram. Fig. 4, 5

Make sure that connecting cables are segregated and run separately from power cables.

4.7 Connection of data line for the level controller/operating and display unit

The BHD50 is connected to the level controller with a preconfigured data cable assembly (with 9-pole D-SUB female connector, cable length 5 m), which is supplied with the BHD50 and available as an accessory.

If you do not use the above mentioned data cable assembly, use screened multi-core control cable, e. g. LiYCY 2 x 0.25 mm², conductor size of 0.25 mm² and a maximum length of 30 m. Wire a 9-pole D-SUB connector according to figure 8. Connect a 120 Ohm termination resistor between the Data L and Data H lines at the BHD50 end of the assembly.

Wire the terminal strips according to the wiring diagram (see Fig. 4 and 5).

Connect the earthing point of the housing (BHD50) to the central earthing point in the control cabinet.

Check the connection of the screen to the central earthing point (CEP) in the control cabinet and the auxiliary equipment.

Make sure that connecting cables leading to the equipment are segregated and run separately from power cables.

4.8 Connection of serial ports for operating and display unit

The operating and display unit is supplied with an 8 way push-in spring connector which will accept up to 0.5 mm² conductors. Use screened twisted pair data cable suitable for RS232 / RS485 communications. The cable must be chosen for the type of device being connected.

Wire connector in accordance with wiring diagram. Fig. 9

The RS232 serial interface should be used for short distance only (typically less than 20m).

The maximum cable length for RS485 serial interface is up to 1000 m. If the data transfer is unstable the selected baud rate or cable length should be reduced.

Consider terminating the two furthest ends of the bus to match the transmission line impedance. A 150 Ohm (0.5 W) resistor or a 120 Ohm (0.25 W) resistor which is in series with a 1 nF (at least 10V) capacitor is commonly used, but ideally the line impedance should be matched to each individual installation. Termination for short lengths of cable should not be necessary (< 300m @ 9600 Baud).

When using RS485 serial interface the bus common (GND) must be connected to protective ground/earth at one point only. Generally this point is at or near the master device. Make sure that connecting cables leading to the equipment are segregated and run separately from power cables.

4.9 Connection of Ethernet ports for operating and display unit

The BHD50 can be connected to a single Ethernet network via one of the two ports (ETH0 or ETH1). Both ports have same Mac address and are configured as an Ethernet switch to enable daisy-chaining.

Important

- To put the equipment into operation follow the instructions given in the installation and operating manuals for LP20, LP21 and PA420.

- Make sure that connecting cables leading to the equipment are segregated and run separately from power cables.

- not use unused terminals as support point terminals.

Danger

The 24V power supply, 4-20mA input/output, data, serial, Ethernet and level limit switch circuits must be electrically isolated from dangerous voltages and must meet at least the requirements on double or reinforced isolation according to one of the following standards: DIN EN 50178, DIN EN 61010-1, DIN EN 60730-1 or DIN EN 60950.

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5. Commissioning

5.1 Factory settings (LCR2652)

- De-energizing delay 3 sec., factory set

- Current input for connecting a level transmitter LP20/LP21/PA420.

- Measuring range = 100%

- MAX switchpoint = 80 %

- MIN switchpoint = 20 %

- Setpoint = 50 % (VMD/Continuous Controller only)

- Pump on = 40% and Pump off = 60% (ON/OFF controller only)

- Proportional band Pb = +/– 20 % of setpoint (VMD/Continuous Controller only)

- Integral action time Ti = 0 s (VMD/Continuous Controller only)

- Neutral band = +/– 5% of setpoint (VMD/Continuous Controller only)

- Valve travel time tt = 40 s (VMD Controller only)

- Filter time = 2 s

- Function: fill control

Code switch **C**: S1 = OFF, S2 = OFF, S3 = ON, S4 = OFF   See Figure 12

5.2 Level controller: Changing factory settings

	Danger
⚡	The upper terminal strip of the equipment is live during operation. This presents the danger of electric shock! Always cut off power supply to the equipment before mounting, removing or connecting the terminal strips!

5.3 Changing function and input for level transmitter

The input and the function are determined by the code switch **C** setting.
To change the code switch setting proceed as follows:

- Switch off supply voltage.

- Lower terminal strip: Unscrew the left and right fixing screws. Fig. 12

- Remove the terminal strip.
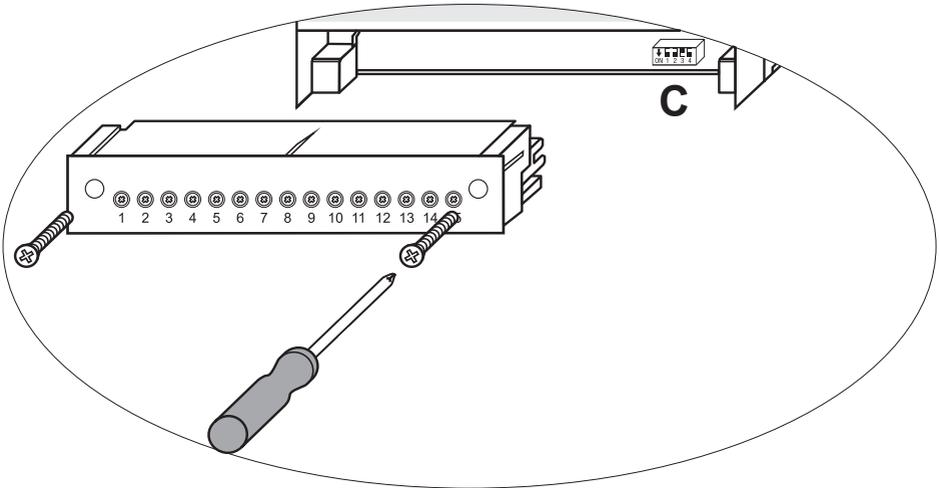
Fig. 12

After the new code switch settings have been established:

- Attach lower terminal strip and fasten fixing screws.

- Apply supply voltage. Equipment is restarted.

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If you want to change the input or the function, set the switches S1 to S4 of the code switch **C** as indicated in the table below.

Table 1

Code switch C	ON 1 2 3 4 Toggle switch, white			
Level controller LCR2652	**S 1**	**S 2**	**S 3**	**S 4**
Not used	OFF			
	ON			
Not used			OFF	
Input for connecting of level transmitter LP20/LP21/PA420 *			ON	
Fill control		OFF		
Discharge control		ON		
Valve motor drive control (VMD)				OFF
Continuous control or Pump ON/OFF control				ON

grey = factory setting

⚠️ **Important**

* When connecting level transmitter LP20/LP21/PA420 set the lower and the upper end of the measuring range only in the transmitter.

For this purpose follow the instructions given in the installation and operating manual for the LP20, LP21 and PA420.

Do not change the code switch C settings of S1!

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5.4 Setting the measuring range
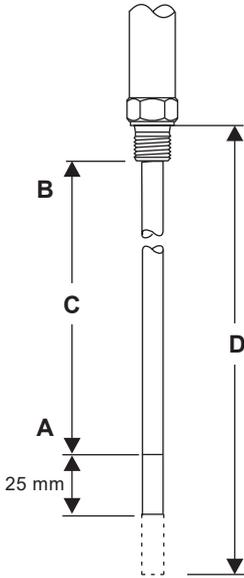
A	Lower end of measuring range, adjustable
B	Upper end of measuring range, adjustable
C	Measuring range [mm] = xxx %
D	Maximum installed length at 238 °C

Adjust the lower and upper end of the measuring range for level control. The resulting measuring range **C** is the active control range.

There is always a 0 - 100% measuring range and these correspond to a measuring range of xxx mm.

Fig. 13 LP20/LP21 with a PA420 level transmitter.

Important

Set the upper and lower end of the measuring range only in the transmitter.

---

6. BHD50 - Operating and display unit

6.1 Switch on supply voltage

Switch on the supply voltage for the level controller LCR2652 and for the operating and display unit BHD50. The LED of the level controller first turns amber and then green. The operating and display unit shows the splash, welcome and then the home window.

Fig. 14 Splash window

Fig. 15 Welcome window

<table>
<tr>
<td>ⓘ</td>
<td>Note
After approx. 2 minutes of user inactivity the display brightness automatically dims.

If you call up another screen display from the start window and you do not make an entry, the system automatically returns to the start window after approx. 5 minutes (time out).</td>
</tr>
</table>

6.2 User interface
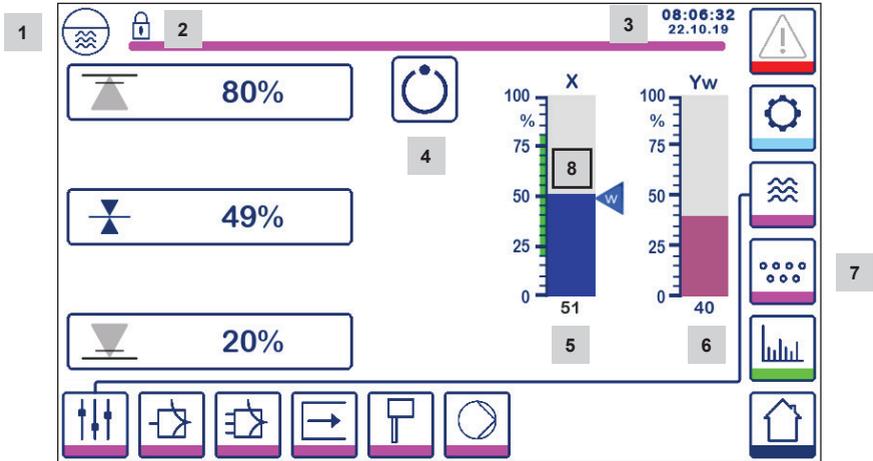
Fig. 16 Start window (no BCR3250 fitted)

Item	
1	Level controller window
2	Lock/unlock status
3	Current time and date
4	Status indication: automatic operation
5	Bar chart indication of liquid level, actual value [in %]
6	Bar chart indication of control valve position [in %]
7	TDS Settings (will not be displayed if a BCR3250 is not fitted)
8	Normal level (green bar) - section between MIN and MAX switchpoints

<table>
<tr>
<td>i</td>
<td>See Appendix for the explanation of the icons</td>
</tr>
</table>

LCR2652, BHD50 Level Controller, Operating and Display Unit
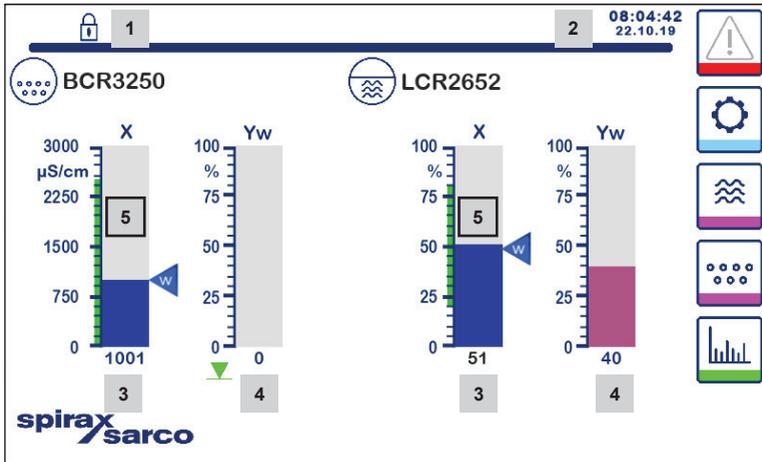
Fig. 17 Start window (with BCR3250 fitted)

Item	
1	Lock/unlock status
2	Current time and date
3	Bar chart indication of liquid level, actual value [in %], also the conductivity in µS/cm (or ppm)
4	Bar chart indication of control valve position [in %]
5	Normal level (green bar) - section between MIN and MAX switchpoints

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i   **See Appendix A** for the explanation of the icons

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6.3 Setting the MIN/MAX switchpoints and setpoint
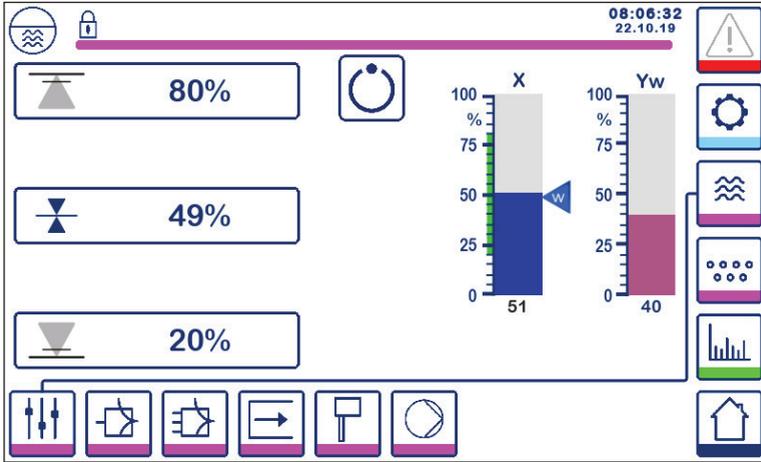
Fig. 18 MIN/MAX switchpoints and setpoint setup

To change the setpoint or MIN/MAX values, press the desired button. Use the numberpad (Fig. 19) to enter the parameter settings.
Note: If the system is locked, the password numberpad will first appear (Fig. 20).

6.4 Numberpad (parameters)

Fig. 19 Numberpad

The bar **A** shows the old value and the limit range.
To undo any incorrect data input press the Backspace button.
If you do not want to enter data press the Esc button. The home window re-appears.
To confirm your data input press the Enter button. The home window re-appears again.

Item	
A	Bar showing the old value and the limit range

6.5 Numberpad (password)
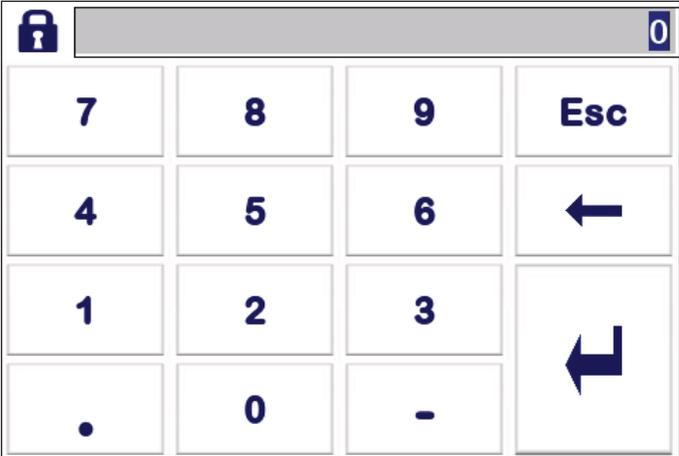
Fig. 20 Password numberpad

Enter the correct security password, to edit the desired parameter settings.

See security protection section.

6.6 Manual actuation of control valve/pump

Press the ⟳ button to switch to manual operating mode. The button will change to confirm manual mode has been selected 👆, and the parameter edit window will appear. **See figure 21.**

For valve control:
Press the Yw box to display the numberpad and enter the desired valve position (%).

For pump on/off control:
Press the square button the stop the pump or the triangle button to start the pump.
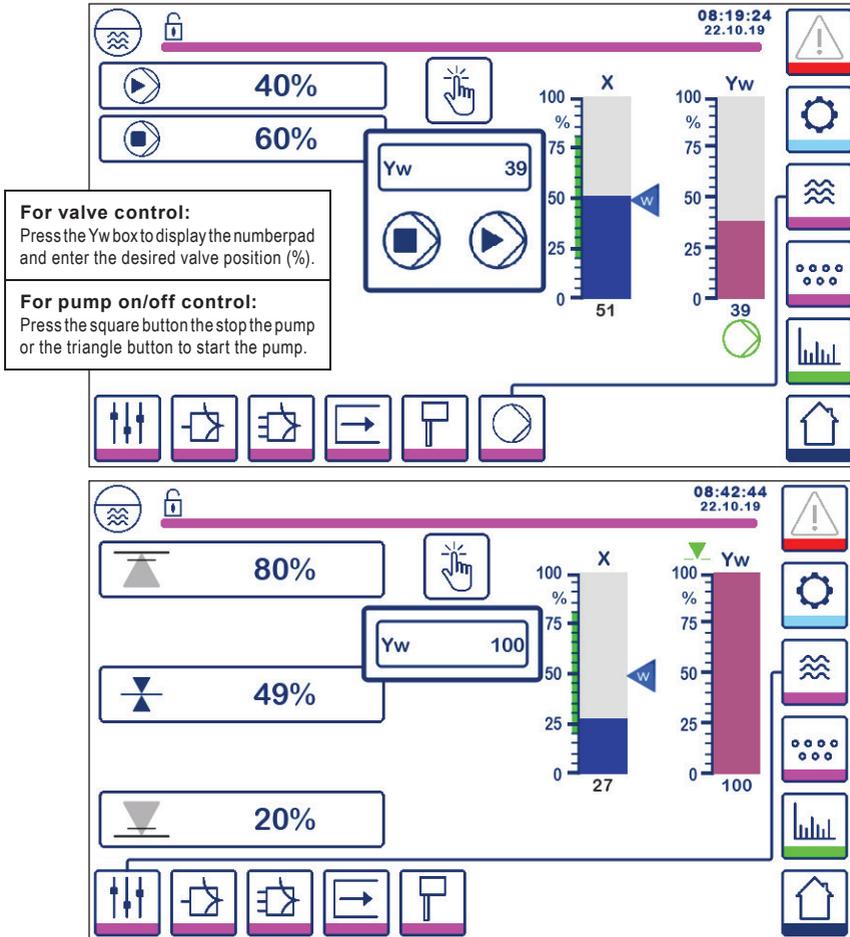
Fig. 21 Manual actuation of control valve/pump

Press the 👆 button to switch to automatic operating mode. The button will change to confirm automatic mode has been selected ⟳ .

6.7 Setting the control parameters

Press the [icon] button to open the parameter setting window for the valve controller.
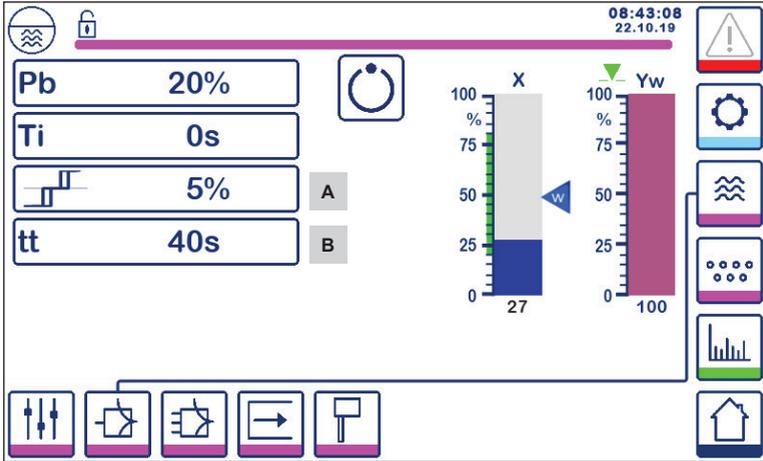
Fig. 22 Valve control parameters setup

For use with continuous control or valve motor drive (VMD).

For each parameter setting press the parameter button (e.g. Pb). Use the numberpad to enter the desired value.

6.8 Additional information on control parameter settings

Parameter		Deviation	Control valve
Proportional band Pb	larger	large remaining deviation	responds slowly
	smaller	small remaining deviation	responds quickly and may open/closes all the time
	Example	Measuring range 100% = 200 mm of sightglass Setpoint SP = 80 % of measuring range = 160 mm Proportional band Pb = +/- 20% of setpoint = +/- 16% = +/- 32 mm If the measuring range is 100% (200 mm) and the setpoint 80% (160 mm), the proportional band will be +/- 16% (+/- 32 mm) or within the range of 128 to 192 mm.	
Integral action time ti	larger	slow correction of deviations	responds slowly
	smaller	fast correction of deviations, control system may tend to overshoot	responds quickly
Neutral band **A**	larger	time-delayed correction of deviations	will not respond until the deviation exceeds the neutral band
	smaller	fast correction of deviations	
Valve travel time tt **B**			Adjust the valve travel time specified by the valve manufacturer.

Item	
A	Neutral band
B	Valve travel time (appears if valve motor drive is selected - VMD)

6.9 Setting the control parameters for 2 or 3-element control

Press the ⬚ button to open the parameter setting window for 2 and 3-element control.
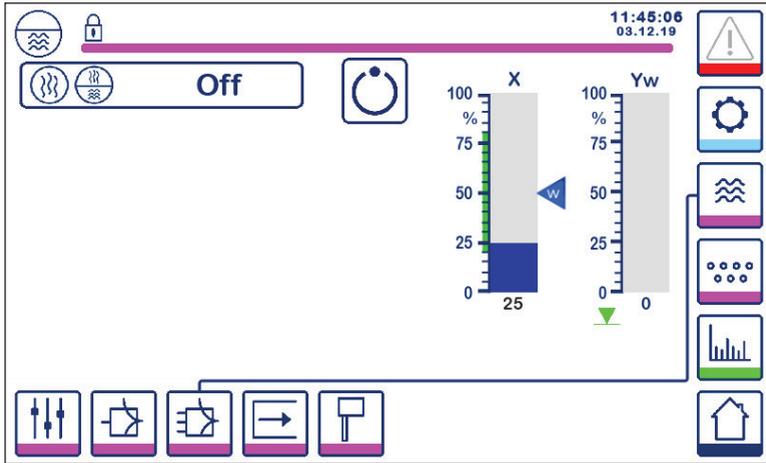
Fig. 23 Two or three element control parameter setup

Press the ⬚ ⬚ button to select the two and three element control functionality.

The 2 or 3-element selection window (figure 24) will be displayed.

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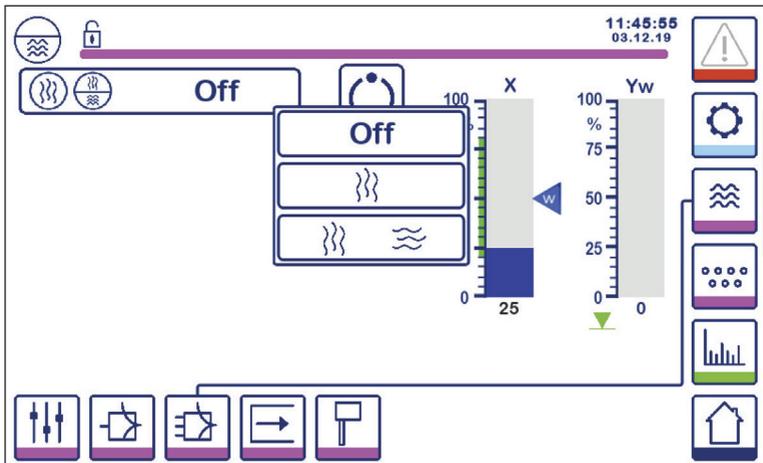
Fig. 24 Two or three element control selection

Press the "Off" button to select single element control. Screen display figure 23 will be displayed.

Press the ⟨⟨⟨ button to select the second element control (steam).

Screen display figure 25 will be displayed.

Press the ⟨⟨⟨ ≈ button to select the second and third element control (steam and water).

Screen display figure 26 will be displayed.
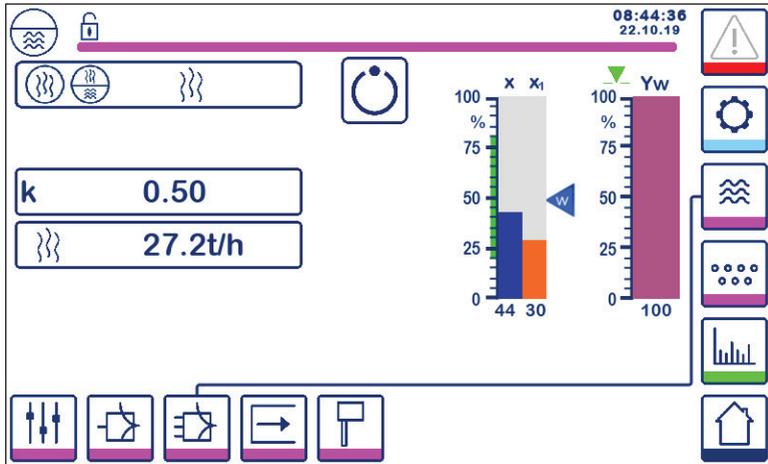
Fig. 25 Two element control active (level + steam)

Press the "k" button to select the numberpad to enter the desired value.

The factor evaluates the influence of the difference (steam flowrate) on the measured level signal.

Press the ⧼⧽ button to enter the 4mA and 20mA flow values for steam meter.
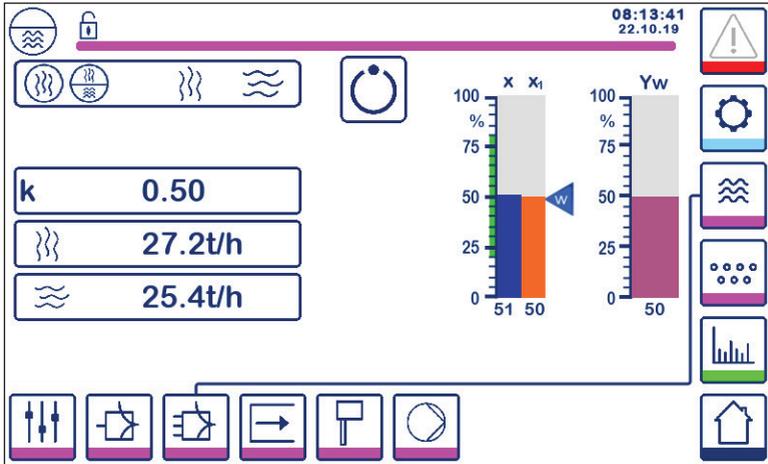
Fig. 26 Three element control active (level + steam + feedwater)

Press the "k" button to select the numberpad to enter the desired value. The factor evaluates the influence of the difference (steam flowrate - feedwater flowrate) on the measured level signal.

Press the ⟨⟨⟩ ≋ button to enter the 4mA and 20mA flow values for the steam and water meters.

ⓘ Note

Controlled actual value = level - (steam flowrate - feedwater flowrate) x evaluation factor (only if steam flowrate - feedwater flowrate > 0)

LCR2652, BHD50 Level Controller, Operating and Display Unit

6.10
Setting the output parameters (testing MIN/MAX alarm and input/output status)

Press the [→] button to open the output window
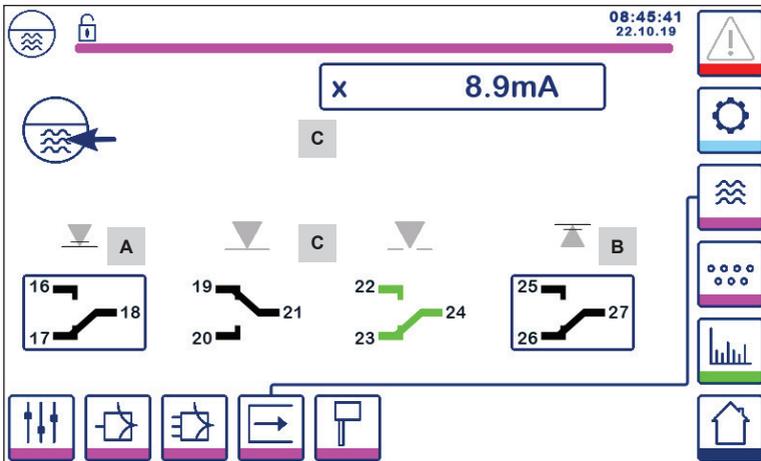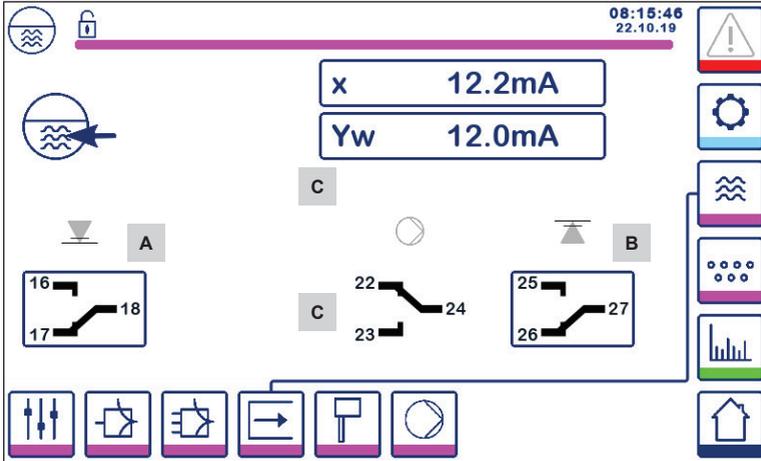
Fig. 27 Output parameters setup

Item	
A	Test button for MIN alarm
B	Test button for MAX alarm
C	Input/output status

A Testing MIN alarm

Press and hold down button **A** for at least 3 sec. After the de-energizing delay the output contact 17-18 opens and the respective contact icon turns red.

B Testing MAX alarm

Press and hold down button **B** for at least 3 sec. After the de-energizing delay the output contact 26-27 opens and the respective contact icon turns red.

C Input/output status

The window also shows the level input (x), valve output (Yw) and relay contacts for pump or valve motor drive, whichever is selected. Contacts change to a green colour to indicate they are energised.

6.11 Setting the level probe parameters

Press the [button icon] button to open the level probe window
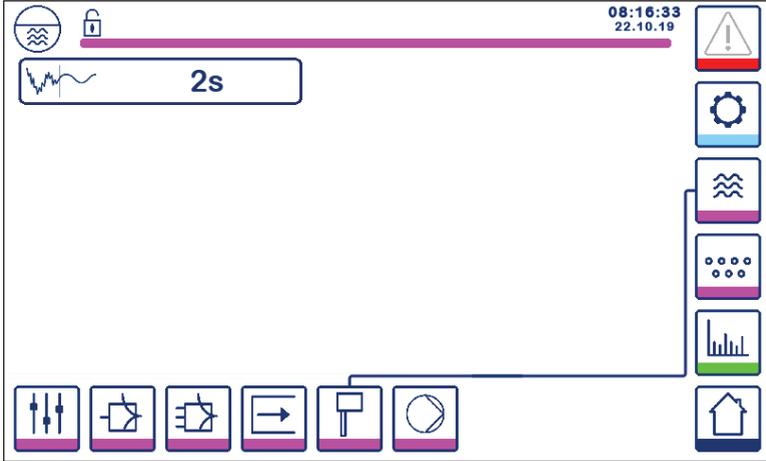
Fig. 28 Level probe paramters setup

Press the [waveform icon] button to select the required filter time (2, 4, 8 or 16 seconds).

Used to dampen the effects of turbulent water level.

6.12 Setting the pump on/off control parameters

Press the ⬡ button to open the pump on/off window.

This setup page is only available if pump on/off control is selected by code switch.
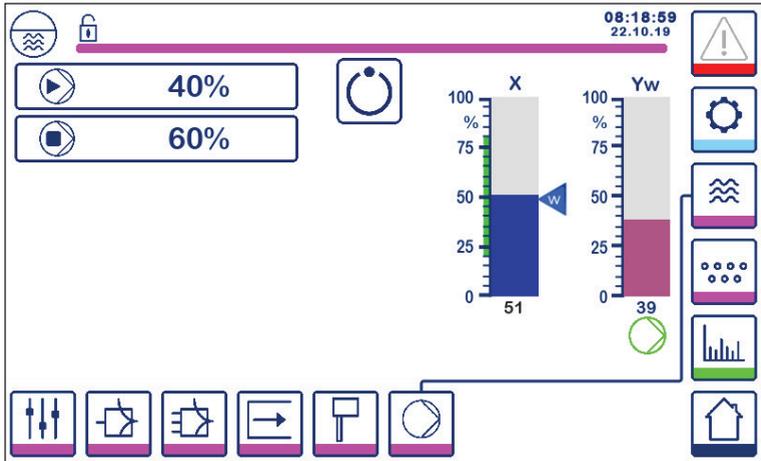
Fig. 29 Pump on/off control parameter setup

Press the ▶ button to select the required pump on level (%).

Press the ■ button to select the required pump off level (%).

The ⬡ symbol appears to indicate the pump is on.

6.13 Setting the set up parameters

Press the [⚙] button to open the set up window
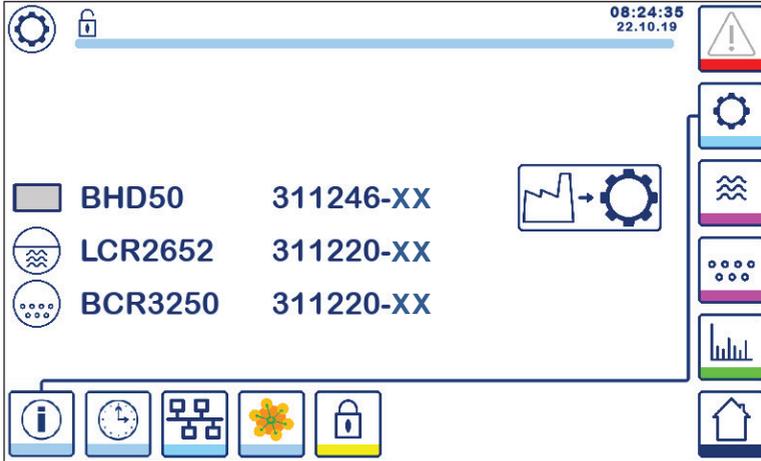
Fig. 30 Setup window

Figure 30 shows the setup window info screen showing the name of the devices in the system with the corresponding software number and software version (XX).

Press the [🏭→⚙] button to reset the parameters to the factory default (not the code switches).

Press the [↵] button to confirm or the [✖] button to cancel the factory reset.

Note: The [🌸] button will be visible if Modbus communication is activated.

6.14 Setting the time and date parameters

Press the [clock icon] button to open the time and date window
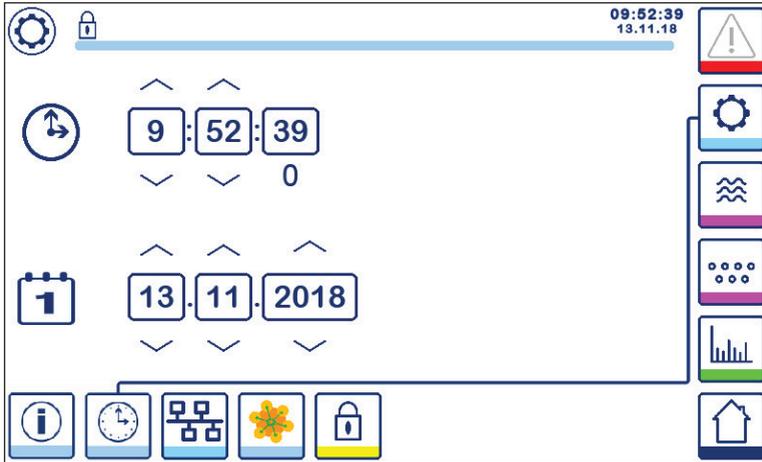
Fig. 31 Time and date setup window

Press the up or down buttons to change the parameters (hours, minutes, days, months or years) and "0" to reset the seconds.

Note: The [icon] button will be visible if Modbus communication is activated.

6.15 Setting the network parameters

Press the [icon] button to open the network window
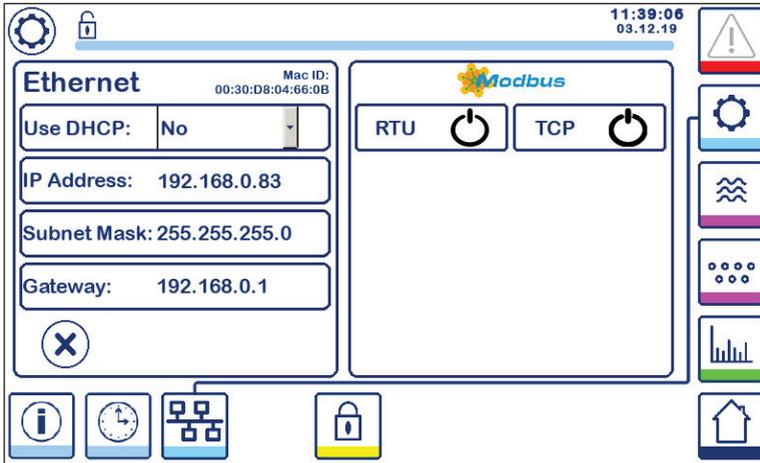
Fig. 32 Network settings

6.15.1 Ethernet

The settings of the Ethernet port can be configured on the left side of the window (See Figure 32).

The Mac ID for the Ethernet port is displayed above the port settings.

The DHCP drop down menu enables the addressing to be allocated dynamically or statically.

If DHCP = "no" is selected, the IP address, subnet mask and gateway address can be entered manually.

Press the [icon] button to confirm or the [icon] button to cancel the network settings.

6.15.2 Modbus TCP protocol

Press the **TCP** ⏻ to enable/disable the Modbus TCP protocol
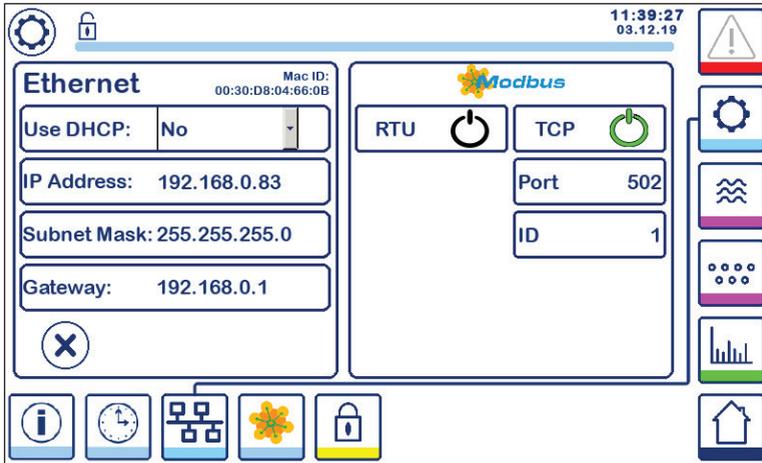
Fig. 33 Modbus TCP settings

The "on" icon will change to green, to indicate the TCP protocol has been enabled.

The port and ID number will also appear. Press the port number to display the numberpad and the enter the required value.

Note: The [icon] button will appear to allow the user to see the content of the modbus registers.

See figure 33.

6.15.3 Modbus RTU protocol

Press the **RTU** ⏻ to enable/disable the Modbus RTU protocol
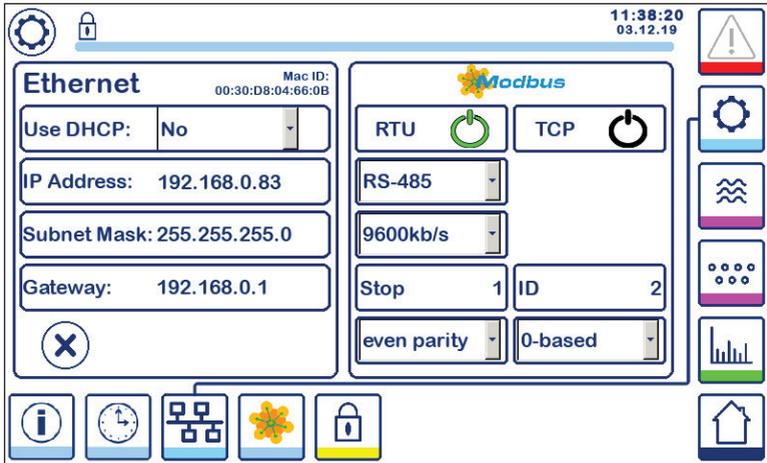
Fig. 34 Modbus RTU protocol

The "on" icon will change to green, to indicate the RTU protocol has been enabled.

Select the different drop down menus to select the hardware protocol, baud rate, parity base and ID number.

Note: The [icon] button will appear to allow the user to see the content of the modbus registers.

See figure 34.

6.15.4 Modbus registers

Press the [icon] button to open the modbus register window
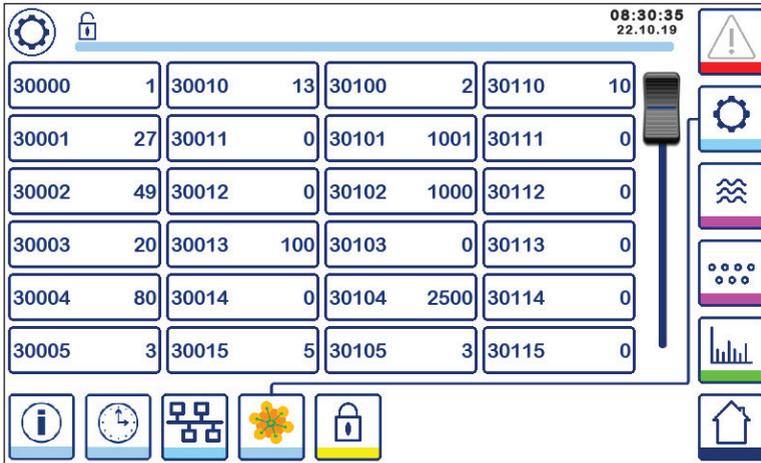
Fig. 35 Modbus register data

Use the sliding tool to view the content of all the registers.

See appendix to see the register allocations.

6.16 Setting up a security protection

Press the [🔒] to open the security protection window
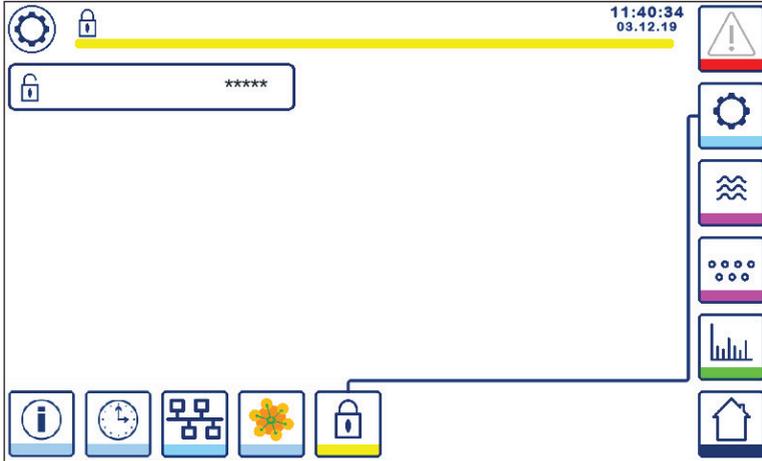
Fig. 36 Security protection window

To protect the system from unauthorised access, all settings and parameters are password protected. The default password is "111".

The system can be:

🔒 Locked, where the settings can not be changed.

🔓 Unlocked, where the settings can be changed.

The system automatically locks after 30 minutes of inactivity (i.e. the screen has not been touched) and after a power cycle.

To unlock the system, press the "*****" button and enter the correct password using the numberpad.

If successful, the unlocked symbol **A** and the 'lock system' button **B** will appear. Screen figure 37

To lock the system, press the [🔒] button **B**.
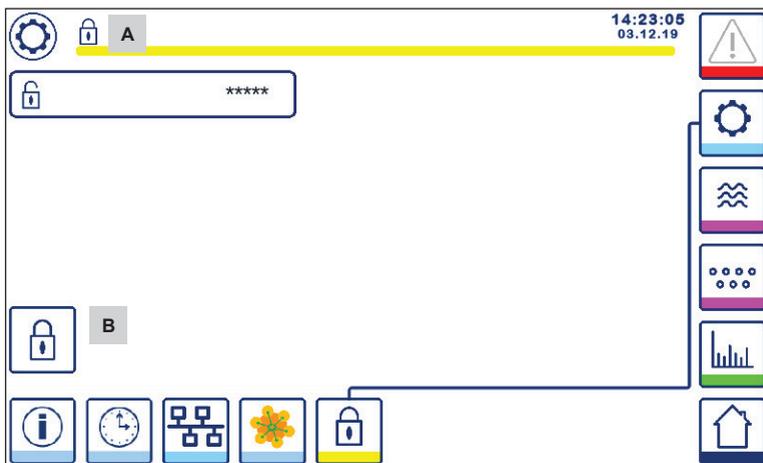
Fig. 37 Security protection unlock

Item	
A	Lock/unlock status
B	Lock system button
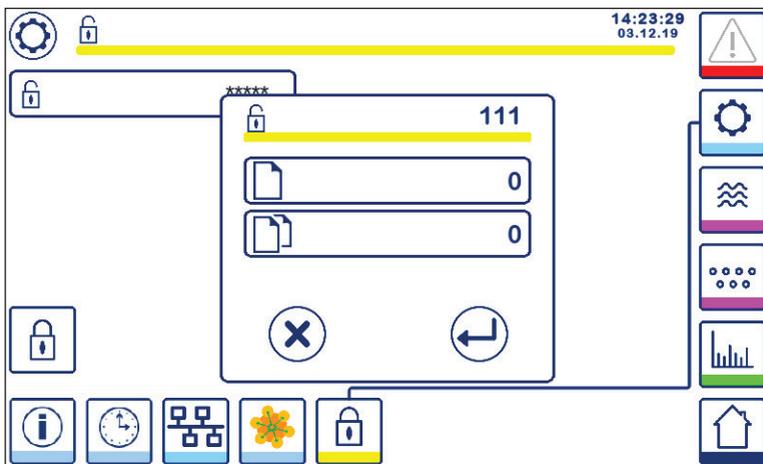
Fig. 38 Security password change

To change the password, unlock the system first (see above) and press the "*****" button again.
The current password will appear at the top right of the smaller window.
Use the numberpad to enter the new password twice.

Press the button to confirm the password and return back to screen display 20.

Pressing the button or entering two different/incorrect passwords, cancels the password change

and returns back. See figure 36.

6.17 Operation

Press the ⌂ button to open the home window

6.17.1 MIN Alarm (3 s delay)

Reduce the water below the "MIN" level. The alarm button **B** will flash yellow/red, MIN alarm symbol **C** and the level bar graph (x) will change to a red colour.
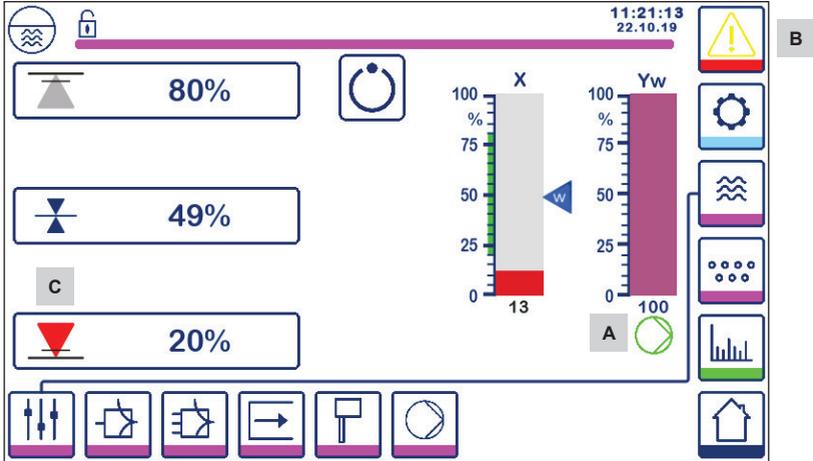
Fig. 39 Water level MIN alarm

6.17.2 Pump ON/OFF control (fill control)

Reduce the water below the "Pump ON" level. The pump symbol **A** will appear. **See figure 39.**

Increase the water above the "Pump OFF" level. The pump symbol **A** will disappear.

6.17.3 MAX Alarm (3 s delay)

Increase the water above the "MAX" level. The alarm button **B** will flash yellow/red, MAX alarm symbol **D** and the level bar graph (x) will change to a red colour.

See figure 40

If an error is detected by the controller, both MIN/MAX alarms will occur.
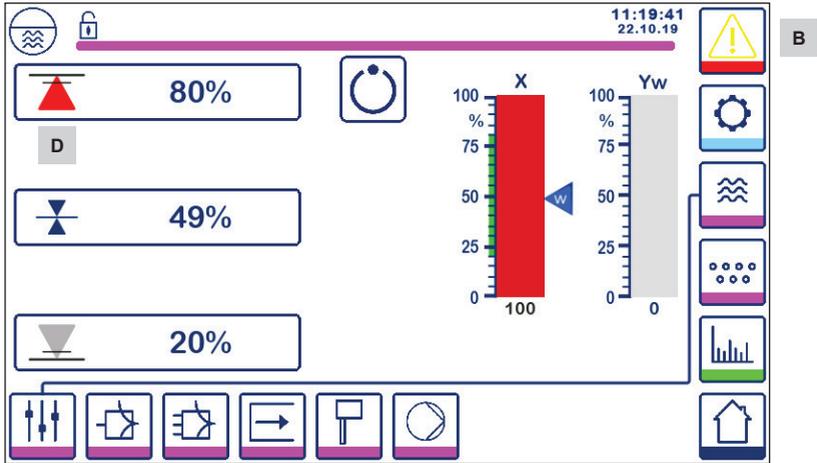
Fig. 40 Water level MAX alarm

Item	
A	Pump on indicator
B	Active alarm button flashing red and yellow, indicating an alarm or error
C	MIN alarm active (red)
D	MAX alarm active (red)

6.17.4 Control valve position (single element control)

The bar chart (Yw) indicates the position of the valve, for continuous and valve motor drive (VMD) control. With the integral action time (Ti) set to zero and the water level set to SP, the valve will control to the 50% position.

If valve motor drive (VMD) is used, a valve opening symbol will be displayed above bar chart (Yw) to show the valve is opening.

If the valve is closing, a valve closing symbol will be displayed below bar chart (Yw) **A**.

If the integral time is greater than zero, the valve will control (0 - 100%) to maintain the setpoint.
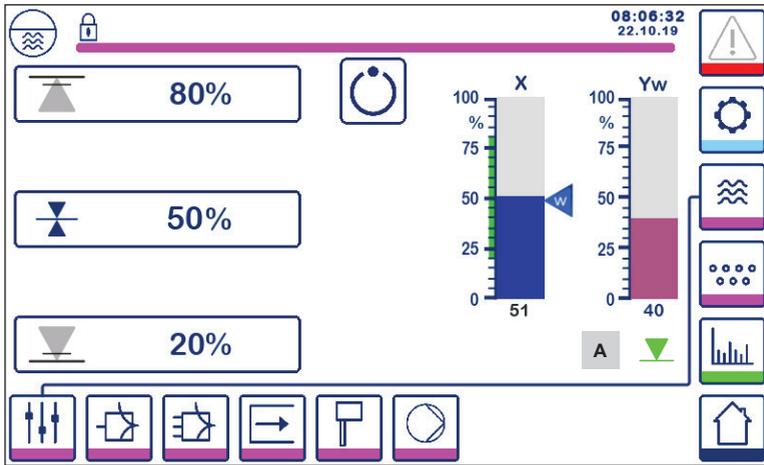
Fig. 41 Valve position

6.17.5 Dual Control window

The following shows the home window where an LCR2652 and an BCR3250 is connected to one BHD50.

Two/three element control

When two/three element control is used, the level bar chart (x) **B** is subdivided into two levels. The blue level indicate the measured water level and the orange indicates the adjusted level.

See Section 6.9 for further information.
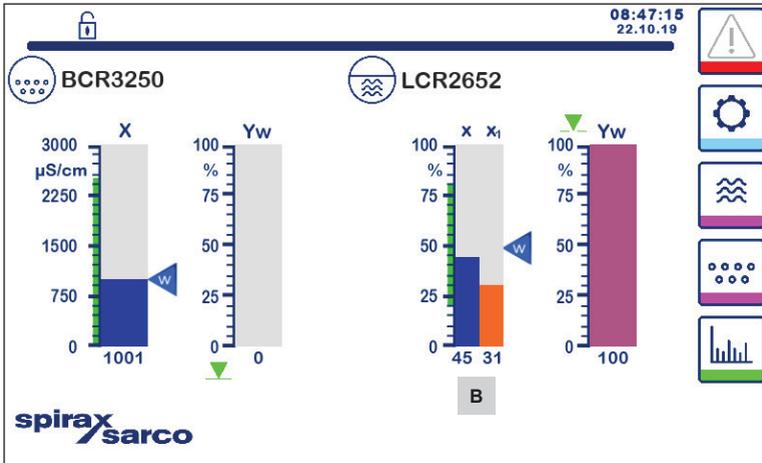
Fig. 42 Dual control screen

Item	
A	Valve closing symbol
B	Level bar graph with two-three element control

6.17.6 Alarms

Pressing the [⚠] button in the right column takes you to the active alarms window.

By pressing the [⚠] button, the current error messages are displayed.
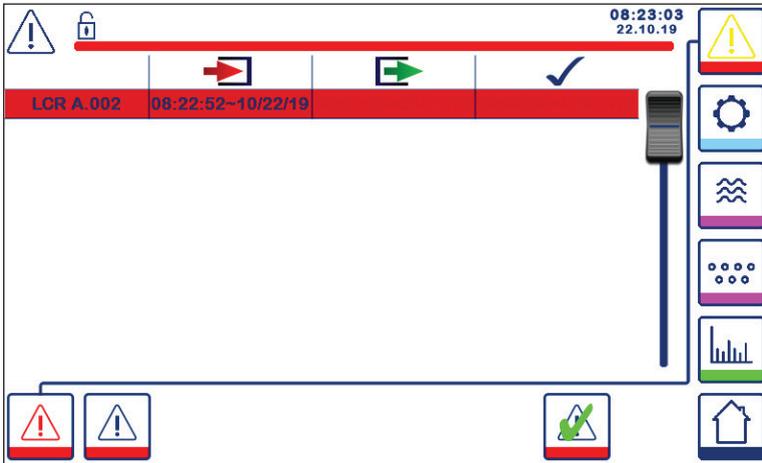
Fig. 43 Active alarms window

Shows all active alarms and errors. Each entry includes:

- Controller type (LCR = LCR2652 or BCR = BCR3250)
- Error number (see fault finding section)
- Time and date received
- Time and date corrected
- Time and date acknowledged

The entry remains in the window until the alarm or error has been corrected and the acknowledge

button [✓] pressed.

Use the scroll tool to view later entries.

Press the button to open the historic alarm window

Fig. 44 Historic alarm window

Shows a record of all active and historical alarms and errors.

See active alarm window above (for entry explanation see page 49).

6.17.7 Trending

Press the [image] button to open the trend window
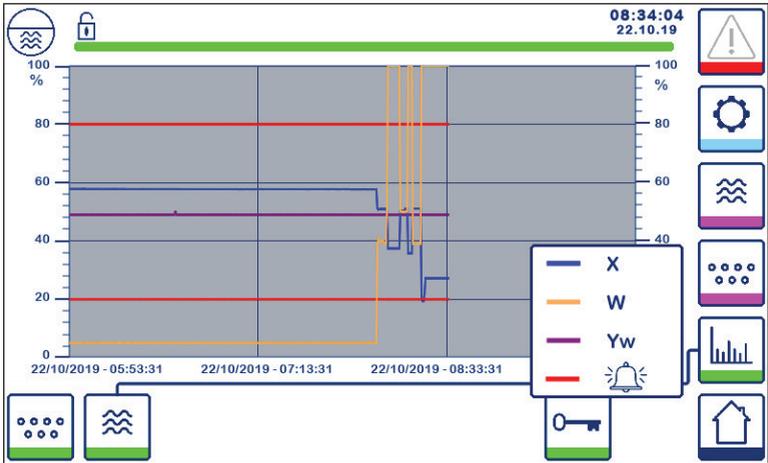
Fig. 45 Level controller trending window

Pressing the [image] button shows the input and output trend graphs for LCR2652 in the last 4 hours.

The date and time is displayed on the x-axis, with the latest data shown on the right hand side.

Scroll and zoom functionality is available to see historic trend data.

To scroll the time axis forward or backward place a finger on the graph and move it in the desired direction without lifting it from the screen.

To zoom in the time axis place two fingers close together on the graph and move them apart in x-axis direction without lifting them from the screen.

To zoom out the time axis place two fingers a little distance apart on the graph and move them toward each other in x-axis direction without lifting them from the screen.

Pressing the [image] button shows the colour key for each level trend

X = actual level, W = level setpoint, Yw = valve position, [image] = Alarm and Errors.

The TDS trend button [image] will be shown, if a BCR3250 is also fitted.
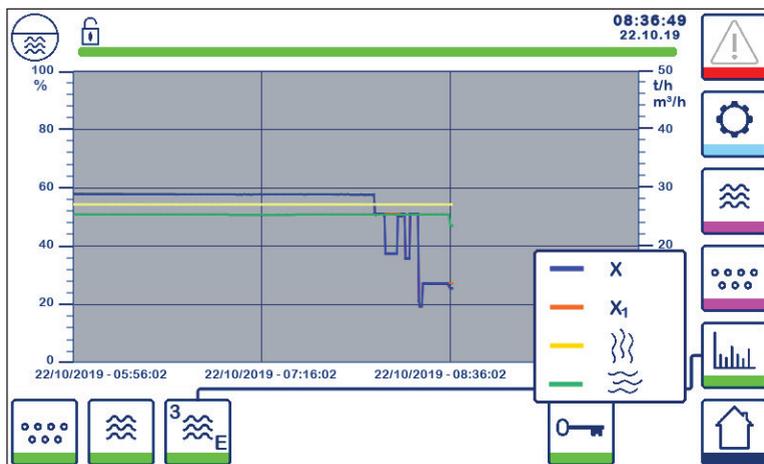
Fig. 46 Two/three element control trending window

Pressing the button shows the two/three element control parameters of LCR2652.

Pressing the button shows the colour key for each input trend for the LCR2652:

X = actual level

X_1 = adjusted level

 = steam meter

 = water meter

7. Fault finding

7.1 Display, diagnosis and troubleshooting

⚠️ **Important**

Before carrying out the fault diagnosis please check:

Supply voltage:
Is the equipment supplied with the voltage specified on the name plate?

Wiring:
Is the wiring in accordance with the wiring diagram?

Alarm list/window		
Code	Status/error	Remedy
LCR offline	Communication LCR/BHD disrupted	Check electrical connection. Switch supply voltage off and on again to re-start the equipment.
A.001	MAX switchpoint exceeded	
A.002	Value below MIN switchpoint	
A.003	External alarm (Level limit switch alarm)	Check level limit switch status. Check electrical connection.
E.005	Level transmitter defective, measuring current < 4 mA	Check level transmitter and, if necessary, replace it. Check electrical connection.
E.006	Level transmitter defective, measuring current > 20 mA	
E.015	Steam meter defective, measuring current < 4 mA	Check steam meter and, if necessary, replace it. Check electrical connection.
E.016	Steam meter defective, measuring current > 20 mA	
E.017	Feedwater meter defective, measuring current < 4 mA	Check feedwater meter and, if necessary, replace it. Check electrical connection.
E.018	Feedwater meter defective, measuring current > 20 mA	
E.103	MIN switchpoint above MAX switchpoint	Re-adjust the switchpoints.
In the event of a malfunction (E. xxx) a MIN and MAX alarm will be triggered.		

Further internal error codes are possible. If an undocumented error is persistent, restart the device by interrupting the power supply for at least 10 seconds. If still persistant contact custumer support and replace the device if necessary.

⚠️ **Important**

Please follow the instructions given in the installation and operating manual for the LP20, LP21 and PA420 for further fault finding and troubleshooting.

ℹ️ **Note**

If a malfunction occurs in the level controller, MIN and MAX alarms will be triggered and the equipment is restarted.
Should this happen over and over again, replace the equipment with a new one.

7.2 Action against high frequency interference

High frequency interference can occur for example as a result of out-of-phase switching operations. Should such interference occur and lead to sporadic failures, we recommend the following actions in order to suppress any interference.

- Provide inductive loads with RC combinations according to manufacturer's specification to ensure interference suppression.

- Make sure that all connecting cables leading to the level transmitter are segregated and run separately from power cables.

- Increase the distance to sources of interference.

- Check the connection of the screen to the central earthing point (CEP) in the control cabinet and the auxiliary equipment.

- HF interference suppression by means of hinged-shell ferrite rings.

7.3 Decommissioning/replacing the level controller LCR2652

- Switch off supply voltage and cut off power supply to the equipment.

- Unscrew the left and right fixing screws. See Fig. 47

- Remove the lower and upper terminal strips.

- Release the white fixing slide at the bottom of the equipment and take the equipment off the supporting rail.
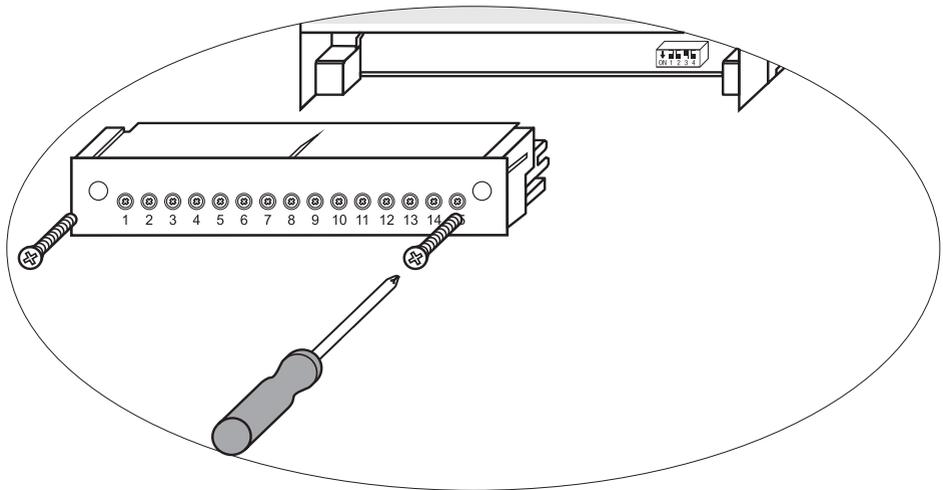
Fig. 47

7.4 Decommissioning/replacing the operating and display unit BHD50

- Switch off supply voltage and cut off power supply to the equipment.
- Unplug the connector Fig. 7, 8, 9 and 10.
- Unscrew screws Fig. 2d and remove fixing elements.
- Push the equipment out of the control cabinet panel cut-out.

7.5 Disposal

For the disposal of the equipment observe the pertinent legal regulations concerning waste disposal.

> **If faults occur that are not listed above or cannot be corrected, please contact our service centre or authorized agency in your country.**

8. Technical information

LCR2652	
Supply voltage	24 Vdc +/– 20%
Fuse	external 0.5 A (semi-delay)
Power consumption	5 W
Connection of level transmitter	1 analogue input 4-20 mA, e. g. for level transmitter LP20/LP21/PA420, with 2 poles and screen
Supply voltage of level transmitter	12 Vdc
Inputs	1 analogue input 4-20 mA (steam flowrate) 1 analogue input 4-20 mA (feedwater flowrate) 1 volt-free digital input (level limit alarm switch), 24 Vdc +/– 20%, 10mA
Outputs	1 or 2 volt-free change-over contacts, 8 A 250 Vac/30 Vdc cos ϕ = 1 (pump/VMD control). 2 volt-free change-over contacts, 8 A 250 Vac/30 Vdc cos ϕ = 1, De-energizing delay: 3 seconds (MIN/MAX alarm). 1 analogue output 4-20 mA, max. load 500 ohm (manipulated variable Y). 1 analogue output 4-20 mA, max. load 500 ohm (actual value indication). Provide inductive loads with RC combinations according to manufacturer's specification to ensure interference suppression
Data line	1 interface for data exchange with operating and display unit BHD50
Indicators and adjustors	1 tri-colour LED indicator (start-up = amber, power ON = green, malfunction = red) 1 code switch with four poles for configuration
Housing	Housing material: base: polycarbonate, black; front: polycarbonate, grey Conductor size: 1 x 4,0 mm² solid per wire or 1 x 2.5 mm² per stranded wire with sleeve to DIN 46228 or 2 x 1.5 mm² per stranded wire with sleeve to DIN 46228 (min. $\varnothing$ 0.1 mm) terminal strips can be detached separately Fixing of housing: Mounting clip on supporting rail TH 35, EN 60715
Electrical safety	Pollution degree 2 for installation in control cabinet with protection IP 54, completely insulated
Protection	Housing: IP 40 to EN 60529 Terminal strip: IP 20 to EN 60529
Weight	approx. 0.5 kg
Ambient temperature	when system is switched on: 0° ... 55 °C, during operation: –10 ... 55°C,
Transport temperature	–20 ... +80 °C (<100 hours), defrosting time of the de-energized equipment before it can be put into operation: 24 hours.
Storage temperature	–20 ... +70 °C, defrosting time of the de-energized equipment before it can be put into operation: 24 hours.
Relative humidity	max. 95%, no moisture condensation

Approvals:	TÜV certificate VdTÜV Bulletin "Water Lever 100" (Water Level 100):
	                                  Requirements made on water level limiting and control equipment.
	                                  Type approval no. TÜV · WR · XX-XXX (see name plate).

LCR2652, BHD50 Level Controller, Operating and Display Unit

spirax sarco   **IM-P693-11** EMM Issue 2

BHD50	
Supply voltage	24 Vdc +/– 20%
Fuse	internal automatic
Power consumption	14.4 W
User interface	Analogue capacitive touch screen, resolution 800 x 480 pixels, illuminated.
Communication interface	RS232, RS422, RS485 and Ethernet 10/100Mb (USB for maintenance only)
Data line	For connection to a LCR2652 and BCR3250 (in parallel)
Dimensions	Front panel: 147x107 mm Panel cut-out: 136x96 mm Depth: 52 + 8 mm
Weight	approx. 1.3 kg
Protection	Front: IP 66 to EN 60529 Rear: IP 20 to EN 60529
Electrical connection	1 power connector with 3 poles 1 D-SUB connector with 9 poles 2 Ethernet (10/100Mb) RJ45 connector 1 USB Port V2.0, max. 500 mA - for maintenance only 1 Serial connector with 8 poles

Contents of package

LCR2652
1 x Level controller LCR2652
1 x Installation manual

BHD50
1 x Operating and display unit BHD50
1 x Data line L = 5 m
1 x 8-way push-in spring connector
4 x fixing elements
1x connector for 24 Vdc supply
1 x Installation manual

9. Technical assistance

Contact your local Spirax Sarco representative. Details can be found on accompanying order/delivery documentation or on our web site:

www.spiraxsarco.com

Returning faulty equipment
Return all items to your local Spirax Sarco representative. Ensure all items are suitably packed for transit (preferably in the original cartons).

Please provide the following information with any equipment being returned:

1. Your name, company name, address and telephone number, order number and invoice and return delivery address.

2. Description and serial number of equipment being returned.

3. Full description of the fault or repair required.

4. If the equipment is being returned under warranty, please indicate:
    a. Date of purchase.
    b. Original order number.

LCR2652, BHD50 Level Controller, Operating and Display Unit

spirax/sarco

Appendix

1. Modbus register allocation

Register	Parameter
30000	3 - Identity
30001	Water level (%)
30002	Set point (SP)
30003	Control band (CB)
30004	Alarm 1
30005	Alarm 1 delay (s)
30006	Alarm 2
30007	Alarm 2 delay (s)
30008	Steam offset (%)
30009	Water flowrate (%)
30010	Output state (relays 1 - 4)
30011	Status 1 (alarms and errors)
30012	Status 2 (alarms and errors)
30013	Valve position (%)
30014	Ti (seconds)
30015	Hysteresis (%)

Register	Parameter
30100	
30101	
30102	
30103	
30104	
30105	
30106	
30107	See BCR3250 IMI
30108	
30109	
30110	
30111	
30112	
30113	
30114	
30115	

LCR2652 Modbus Status register data

Status 1 register data

Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7
A.001	A.002	A.003	-	E.005	E.006	E.007*	E.008*
Bit 8	**Bit 9**	**Bit 10**	**Bit 11**	**Bit 12**	**Bit 13**	**Bit 14**	**Bit 15**
E.009*	E.101*	E.102*	E.103*	E.013*	E.014*	E.015	E.016

    *   internal errors
   ** MIN/MAX alarm triggered
        (any E.xxx is set)
 *** manual testing of MIN/MAX alarm is
        running
**** malfunction of the device
        (any status bit is set)

Status 2 register data

Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7
E.017	E.018	-	-	-	-	-	-
Bit 8	**Bit 9**	**Bit 10**	**Bit 11**	**Bit 12**	**Bit 13**	**Bit 14**	**Bit 15**
E.025*	E.026*	E.027*	-	MIN/MAX**	TEST***	-	FAULT****

Data Register Format

- 16 bit integer (MSB transmitted first).

Function Codes

- 03, 'read holding registers'

- 83, 'exception response' (01 illegal function or 02 illegal data address)

LCR2652, BHD50 Level Controller, Operating and Display Unit

2. Icon explanation

Home window	
Icon	**Description**
	Level controller
	TDS/Conductivity Controller
	Security protection level. System locked.
	Security protection level. System unlocked.
	Go to active alarm window (flashes yellow if alarms or errors are active).
	Go to historic alarm window
	Go to parameter set up window for the system
	Go to the level window
	Goto the TDS/Conductivity window
	Go to trend window

Home window (continued)

Icon	Description
	MAX switchpoint
	Setpoint
	MIN switchpoint
	Indicates automatic mode. Press button to switch from automatic to manual
	Indicates manual mode. Press button to switch from manual to automatic
	Go to process setting window
	Go to parameter setting window for control valve
	Go to parameter setting window for 2 and 3-element controller
	Go to parameter setting window for level probe
	Go to parameter setting window for the outputs
	Go to parameter setting window for Pump ON/OFF controller

Icon	Description
	Manual pump start button
	Manual pump stop button
	Pump on indicator
	Control valve closing indicator
	Control valve opening indicator
	Shows the SP graphically on the bar graph.
	Go to home window

Valve motor drive/continuous control window

Icon	Description
Pb	Proportional band, adjustable between 10 and 150 %, based on the setpoint,
	Neutral band, adjustable between + / – 0 and 20%, based on the setpoint,
Ti	Integral action time: adjustable between 0 and 120 sec.
tt	Valve travel time: adjustable between 10 and 600 sec.

2 and 3-element control window

Icon	Description
	Go to 2 and 3 element control sub-window.
Off	2 or 3-element control is not used.
	2 element control used. A steam meter is fitted.
	2 and 3 element control used. Both a steam meter and a water meter are fitted.
k	Meter gain
t/h	Metric ton per hour

Output window

Icon	Description
	Alarm status. Press the button for 3 seconds to de-energise the relays
	Valve motor drive contact or pump contact status (green when energised).
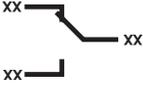
Level transmitter window

Icon	Description
	Used to reduce the affects of turbulent water levels. Select 2, 4, 8 or 16 seconds.

Alarm history window

Icon	Description
	Alarm window
	Go to historic alarm window
	Go to active alarm window (flashes yellow if alarms or errors are active).
	Acknowledge all alarms
	Date and time alarm or error message received.
	Date and time alarm or error message corrected.
	Date and time alarm or error message acknowledged.
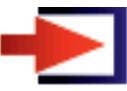
Set up window

Icon	Description
	Set up window.
	Go to parameter setting window for time and date
	Go to parameter setting window for set up information
	Go to parameter setting window for network
	Go to modbus register window. Shows the contents of the registers.
	Go to parameter setting window for security protection
	Reset to factory settings

Time and date window

Icon	Description
	Setting the current time.
	Setting the current date.

Network window

Icon	Description
↵	Save parameter
✗	Exit without saving new parameter and close window.
⏻	Switch RTU or TCP on (changes to green)

Security protection window

Icon	Description
📄	Enter new password
📄	Re-enter new password
↵	Save password
✗	Exit without saving new password and close window.
🔒	Security protection - lock the system.

Trend window

Icon	Description
	Go to level trend window
	Go to two or three-element trend window (appear if selected).
	Go to trend key window
	Go to TDS trend window (appear if fitted).

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