BCR3250
BHD50
Blowdown Controller, Operating and Display Unit

Installation and Maintenance Instructions

BHD50

Contents

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 "Wasserüberwachung 100" (Water Monitoring 100)

The functional unit consisting of the operating & display unit BHD50, blowdown controller BCR3250 and conductivity probes CP10, CP30/CP40 and CP32/CP42 are type approved according to VdTÜV Bulletin "Wasserüberwachung (Water Monitoring) 100".
The VdTÜV Bulletin "Water Monitoring 100" states the requirements made on water monitoring equipment.

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.

Note

The conductivity probes CP10, CP30/CP40 and CP32/CP42 are simple items of electrical equipment as specified in EN 60079-11 section 5.7.
According to the European Directive 2014/34/EU the equipment must be equipped with approved Zener barriers if used in potentially explosive areas. Applicable in Ex zones 1, 2 (1999/92/EC). The equipment does not bear an Ex marking.

2. General product information

2.1 Intended use

The functional unit consisting of the operating and display unit BHD50, blowdown controller BCR3250 and conductivity probes CP10, CP30/CP40 and CP32/CP42 is used as blowdown controller and limiter. Typical applications include steam boilers, (pressurised) hot-water installations as well as condensate and feedwater tanks.

A Pt100 temperature sensor may be connected to the controller to display the boiler water temperature and provide temperature compensation. This is recommended if the boiler is working at varying pressures, or for other applications such as condensate monitoring or coil boilers, where the temperature may vary.

The blowdown controller indicates when the preset MAX TDS/Conductivity is reached, opens or closes a blowdown valve and may also control a bottom blowdown valve. The controller can provide either a MIN alarm or a bottom blowdown timer function. One BHD50 can be used with a LCR2652 and a BCR3250 controller to provide a combined level and TDS control system.

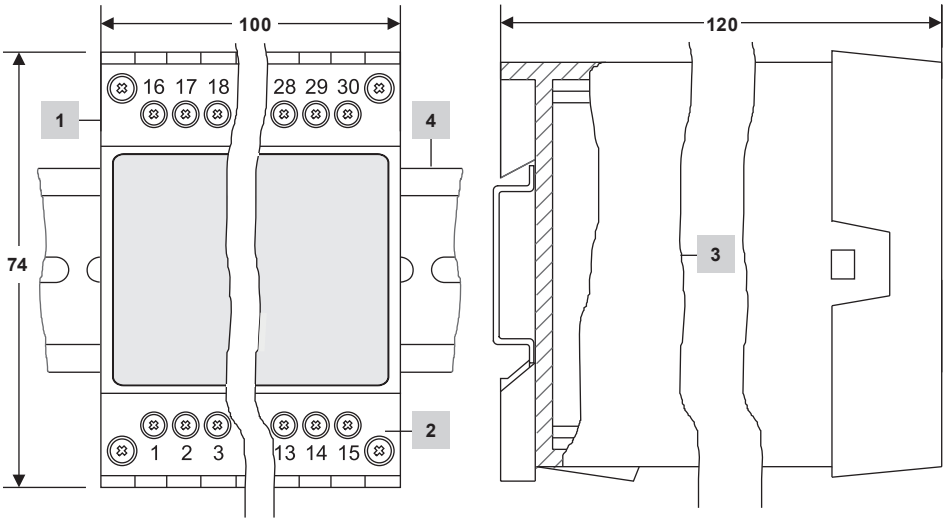
2.2 Function

The operating and display unit BHD50 and the blowdown controller BCR3250 form a functional unit featuring the following properties:

- TDS/Conductivity control and limiter using conductivity probes CP10 or CP30/CP40, with or without a separate temperature sensor Pt 100 (TP20) to provide temperature compensation (0 - 250 °C)
- TDS/Conductivity control and limiter using conductivity probe CP32/CP42, with an integrated temperature sensor (temperature compensation), scale management and optional alarm
- Electronic probe cleaning, to remove scale from probe tip
- Modulating control using a valve motor drive (VMD) by proportional-plus-integral control action (PI controller) on an electrical blowdown valve.
  A 3-position stepping control is used, therefore no feedback potentiometer is required
- ON/OFF control with purge time for probe in pipeline installations
- An optional filter to increase damping effects, to avoid over-frequent valve operation.
- Indication of MAX TDS/Conductivity limit (TDS/Conductivity limiter)
- Indication of MIN TDS/Conductivity limit or control of a bottom blowdown valve
- Conductivity to TDS conversion (unit in µS/cm or ppm)
- Standby/burner input (24 Vdc), to reduce boiler water loss, if the boiler is on standby or low demand
- Real time clock controlled Bottom Blowdown (BB), with limit switch box and priority link for multiple boiler applications (interlocking up to 9 BCR3250 or BT1050 controllers)
- Actual value output 4-20 mA
- Indication of actual value (indicated in ppm or µS/cm and as bar graph)
- Indication/adjustment of control parameters and settings
- 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

3. Mechanical installation

3.1 Dimensions (BCR3250) (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 blowdown controller BCR3250 is clipped onto the support rail type TH 35, EN 60715 in the control cabinet. Figure 1, item **4**

3.2 Dimensions (BHD50) (approximate) in mm

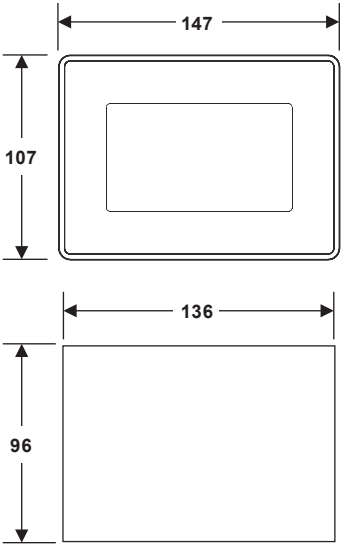
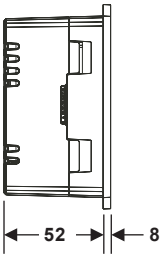


Fig. 2a



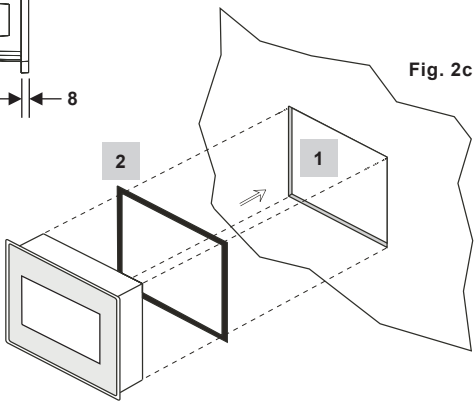


Fig. 2c

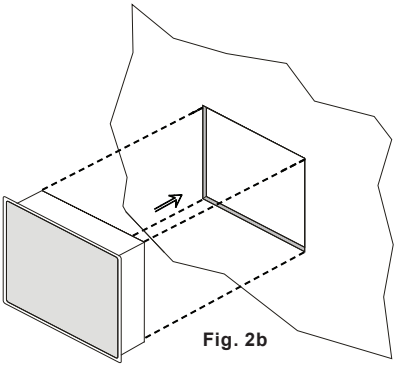


Fig. 2b

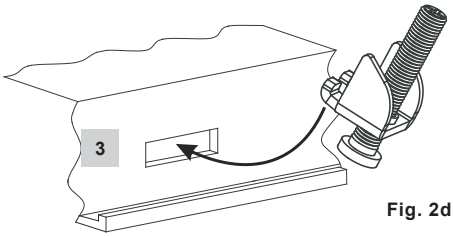


Fig. 2d

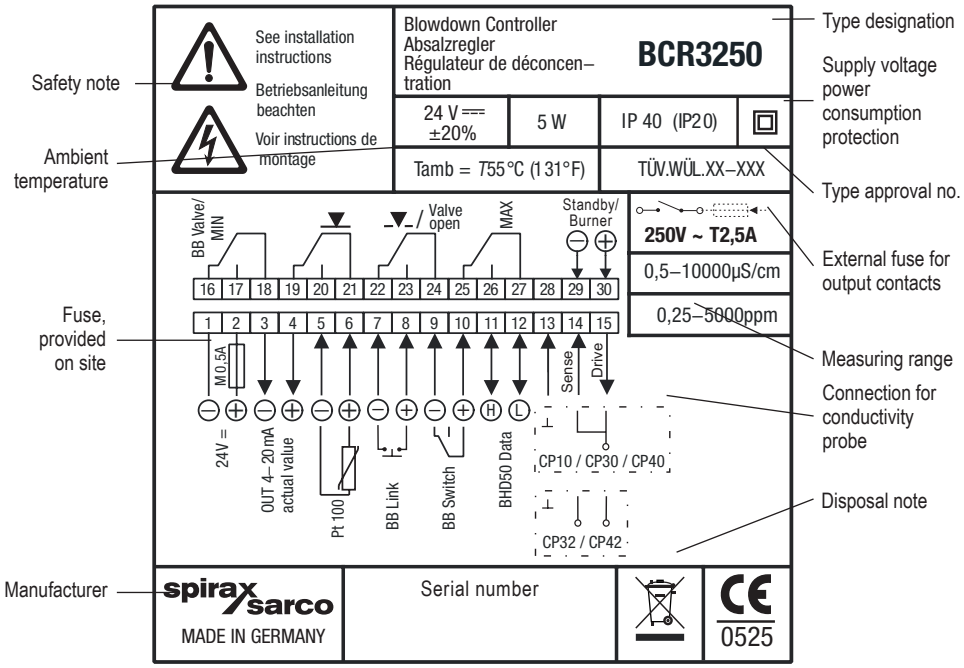
Item	
1	Cut-out in control cabinet 136 x 96 mm
2	Gasket
3	Fixing elements

3.2.1 Installation in control cabinet

- Provide a control panel cut-out with the dimensions indicated in Figure 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 Figure 2d until the edges of the frame are flush with the panel of the control cabinet.

3.3 Name plates

BCR3250



BHD50

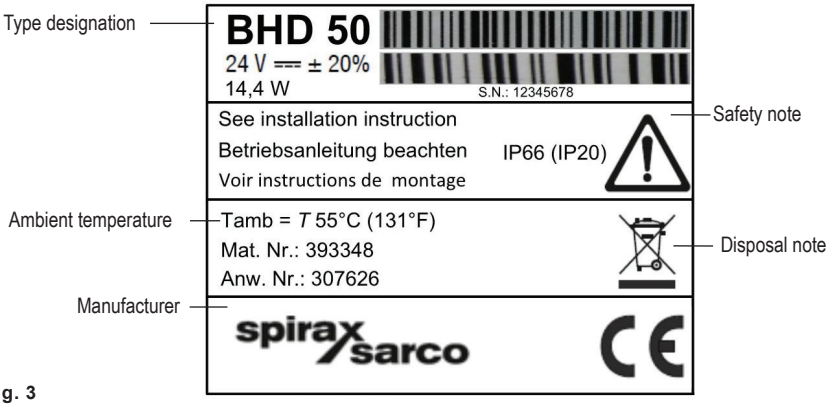


Fig. 3

4. Electrical installation

4.1 Wiring diagrams

4.1.1 Wiring diagram (BCR3250)

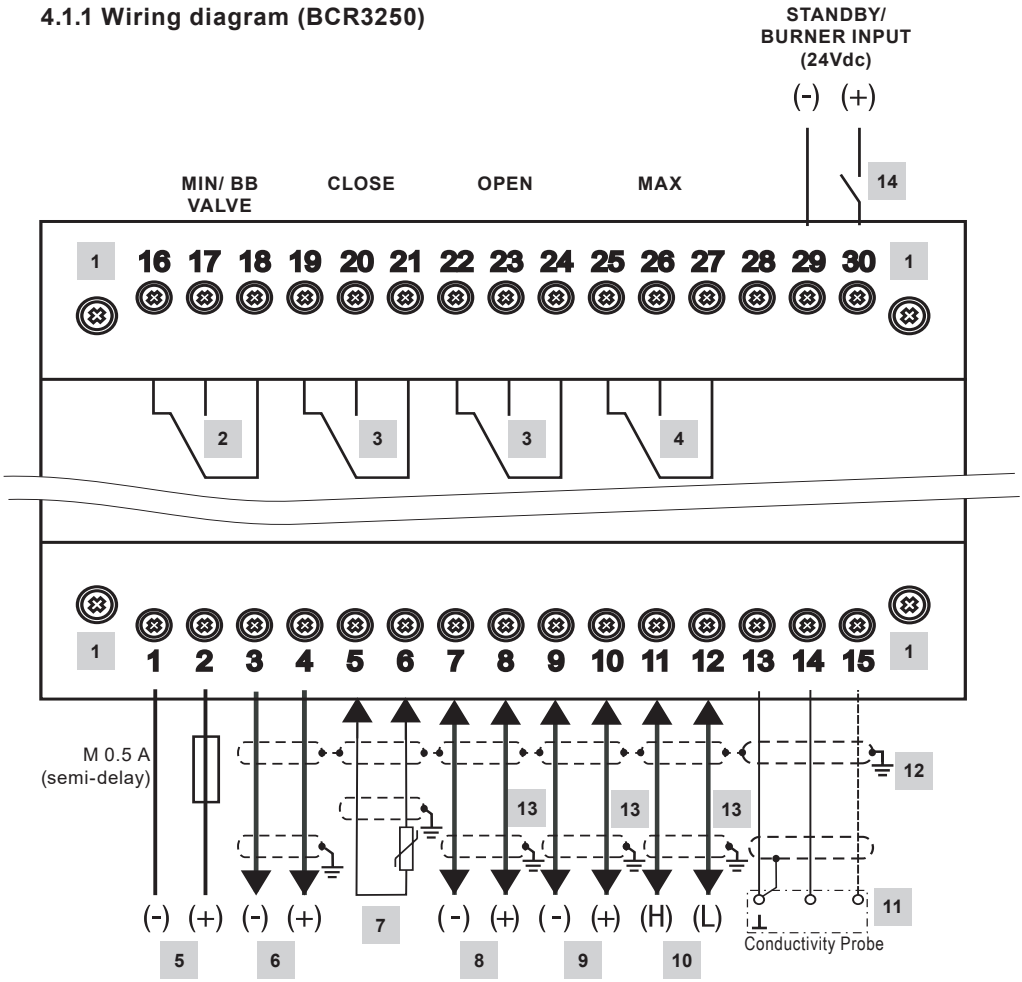


Fig. 4 Wiring Diagram

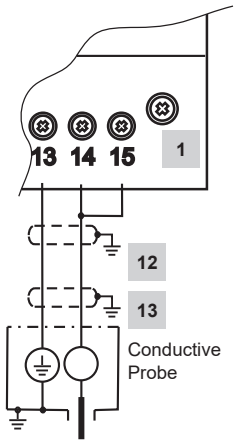


Fig. 5(a) CP10 Connection

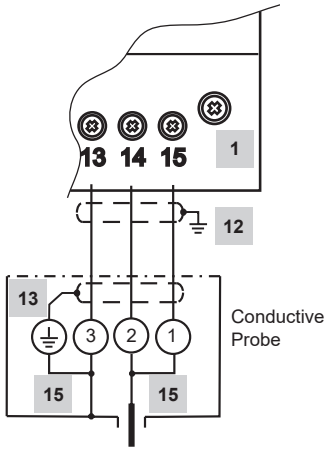


Fig. 5(b) CP30/CP40 Connection

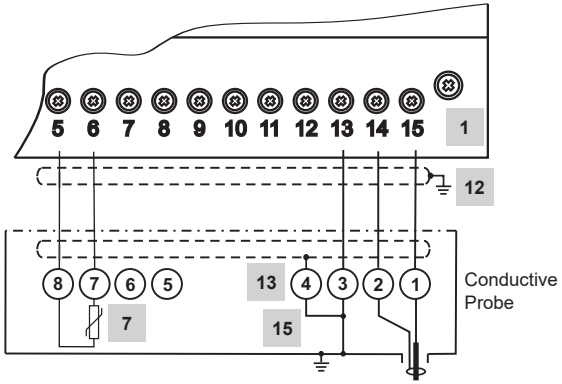


Fig. 5(c) CP32/CP42 Connection

For Items list, please go to page 10

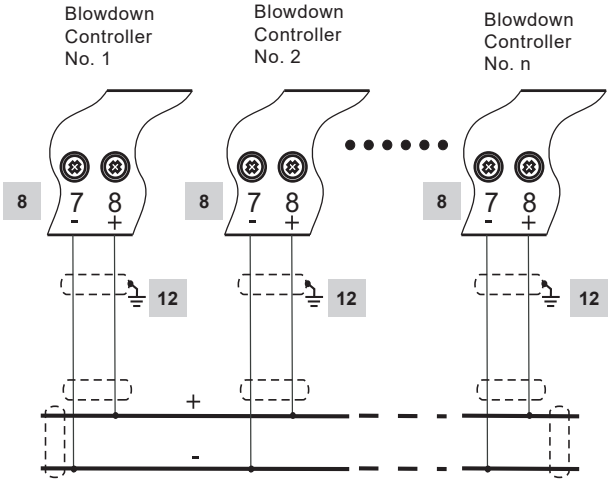


Fig. 6
Bottom Blowdown priority link connection

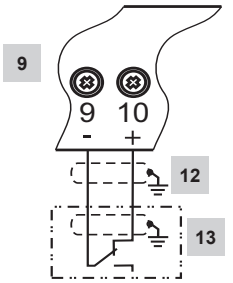


Fig. 7
Bottom Blowdown switch connection (shown valve closed)

Item	
1	Fixing screws for terminal strip
2	MIN alarm output contact or Bottom Blowdown (BB) output contacts
3	Output contacts for activating the control valve
4	MAX alarm output contact
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	2 wire Pt 100 temperature sensor input
8	Bottom blowdown (BB) link input
9	Bottom blowdown (BB) switch input
10	Data line for operating and display unit BHD50
11	Conductivity Probes - See figure 5
12	Central earthing point (CEP) in control cabinet
13	Earthing point at the auxiliary equipment (e.g. CP30/CP40)
14	Standby/burner input (24 Vdc), ON = standby/burner on, OFF = normal running/burner off
15	Internal links in conductivity probe

4.1.2 Wiring diagram (BHD50)

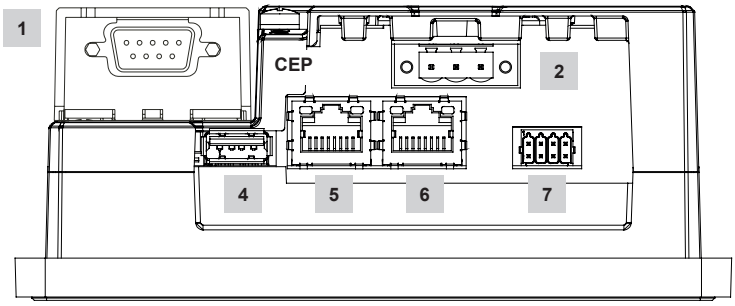


Fig. 8

4.1.3 Connection of 24 Vdc supply voltage

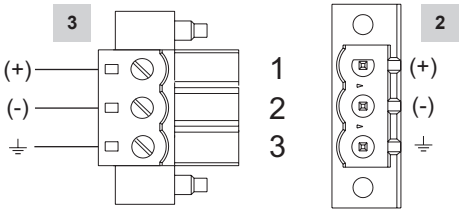
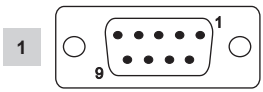


Fig. 9

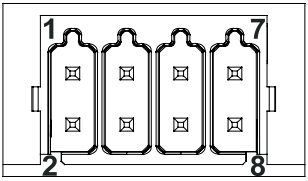
4.1.4 Pin assignment for data line BCR3250 to the BHD50



PIN 2	Data_L
PIN 7	Data_H

Fig. 10

4.1.5 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

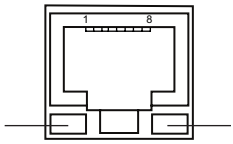
Pin	Description
1	CHB-
2	CHA-
3	CHB+
4	CHA+
5	+5V output
6	GND
7	
8	

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

Fig. 11

4.1.6 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. 12

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)

4.2 Connection of supply voltage

The equipment must be supplied with 24 Vdc from a SELV (Safety Extra Low Voltage) power supply. For BCR3250 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 blowdown controller BCR3250 lights up green (see Figure 13).

Fig. 13

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.

When used as TDS/Conductivity limiter the blowdown controller BCR3250 does not interlock automatically when the readings exceed the MAX limit.

If an interlock function is required for the installation it must be provided in the follow-up circuitry (safety circuit). The circuitry must meet the requirements of the EN 50156.

4.4 Connecting the TDS/Conductivity probes and Pt 100 temperature sensor

To connect the equipment use screened multi-core control cable with a min. conductor size 0.5 mm^2, e.g. LiYCY 2 x 0.5 mm^2 (for CP10 and TP20), LiYCY 3 x 0.5 mm^2 (for CP30/CP40) or LiYCY 5 x 0.5 mm^2 (for CP32/CP42).

Max. cable length for conductivity probe:

10 m	0,5 – 10 µS/cm
30 m	10 - 10000 µS/cm

Max. cable length for temperature sensor:

30 m

Wire terminal strip in accordance with the wiring diagram. Figure 4 and 5. Connect the screen to the central earthing point (CEP) in the control cabinet and the auxiliary equipment (e.g. CP30/CP40).
Make sure that connecting cables leading to the equipment are segregated and run separately from power cables.

4.5 Connecting the 4-20 mA output, BB switch and BB link

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 4-20 mA output.
Wire terminal strip in accordance with the wiring diagram. Figure 4, 6 and 7.
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 standby/burner (24 Vdc)

To connect the equipment use multi-core control cable with a min. conductor size of 0.5 mm², e.g. LiYY 2 x 0.5 mm², max. length: 100 m.
Wire terminal strip in accordance with the wiring diagram. Figure 4.
Make sure that connecting cables are segregated and run separately from power cables.

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

The BHD50 is connected to the blowdown 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 10. 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 Figure 4).
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. Figure 11.
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 the same Mac ID (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 CP10, CP30/CP40, CP32/CP42 and TP20.**
- **Make sure that connecting cables leading to the equipment are segregated and run separately from power cables.**
- **Do not use unused terminals as support point terminals.**

Danger

The 24V power supply, probes, temperature sensor, 4-20mA output, BB link, BB switch, data, serial, Ethernet and standby/burner 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.

5. Commissioning

5.1 Factory settings (BCR3250)

- Control mode = modulating (VMD)
- Probe selection = CP40
- Probe filter = ON
- Probe scale fault action (for CP32/CP42 only) = OFF (no alarm or cleaning)
- Units = µS/cm
- Measuring range = 0,5 to 6000 µS/cm
- MAX switchpoint = 6000 µS/cm
- MIN switchpoint = 500 µS/cm (not available if bottom blowdown selected)
- Reset hysteresis: MAX limit – 3 % (fixed) and MIN limit + 3 % (fixed)
- Setpoint SP = 3000 µS/cm
- Setpoint SP hysteresis = 150 µS/cm (ON/OFF control only)
- Proportional band Pb** = +/– 20 % of the setpoint
- Integral time Ti** = 0 seconds
- Dead band** = +/– 5 % of the setpoint
- Valve travel time tt** = 360 seconds
- Probe factor C = 1/cm
- Temperature compensation = deactivated
- Temperature coefficient = 2.1 %/°C
- Rinsing duration** = 180 seconds (valve opens 180 sec. and closes 180 sec.)
- Rinsing interval** = 0 hours
- Purging duration = 0 seconds
- Purging interval = 30 minutes
- Standby/burner input function = standby

****Only available if modulating control (VMD) is selected by code switch**

Bottom blowdown parameters

- Pulse duration = 0 seconds
- Priority = 0 (not linked)
- Recovery time = 4 hours
- Monday - Sunday = enabled, Start time = 00:00, Stop time = 23:59, repeat time = none

Bottom blowdown switch parameters

- Fitted = None
- Closing time = 5 seconds
- Lift time = 5 seconds
- BB alarm = Off

Code switch **C**: S1 = ON, S2 = OFF, S3 = OFF, S4 = OFF	See Figure 14

5.2 Blowdown 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 blowdown controller

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. See Figure 14
- Remove the terminal strip.

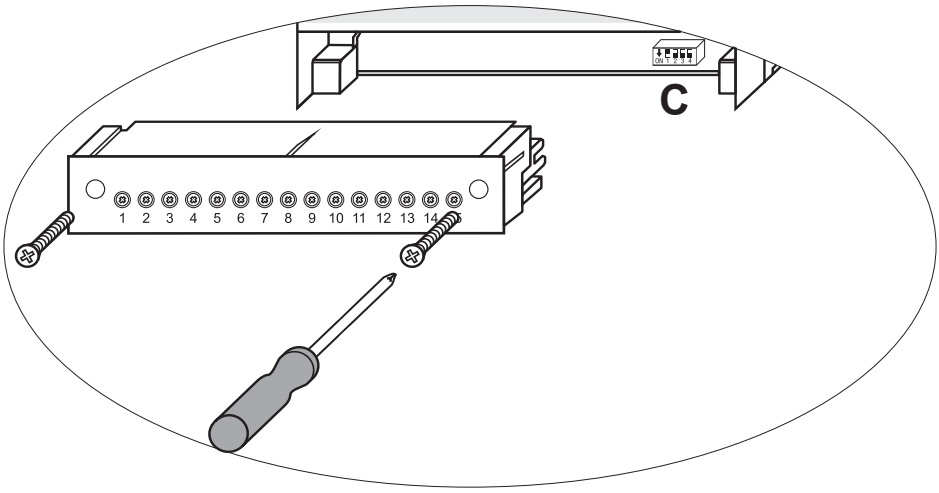


Fig. 14

After the new code switch settings have been established:

- Attach lower terminal strip and fasten fixing screws.
- Apply supply voltage. Equipment is restarted.

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	 Toggle switch, white			
Blowdown controller BCR3250	**S 1**	**S 2**	**S 3**	**S 4**
Output contacts 16, 17, 18 set as MIN output contacts	OFF			
Output contacts 16, 17, 18 set for actuating a bottom blowdown valve	ON			
Input terminals 29, 30 = Standby function		OFF		
Input terminals 29, 30 = Burner function*		ON		
Modulating control using valve motor drive (VMD)			OFF	
ON/OFF control using a solenoid or valve			ON	
Conductivity measured in µS/cm				OFF
TDS measured in ppm				ON

*only allowed for ON/OFF mode

grey = factory setting

Important

For this purpose follow the instructions given in the installation and operating manual for the CP10, CP30/CP40, CP32/CP42 and TP20.

5.4 Modes of Operation

5.4.1 Modulating control - Valve motor drive (VMD)

Used when the probe is mounted in the boiler. The probe is able to constantly monitor the conductivity from the probe tip to the boiler shell. With no integral time set, the TDS/conductivity will be proportionally controlled within the defined band (proportional band - Pb). With an integral time greater than zero, the controller will attempt to control the TDS/conductivity measurement close to the setpoint (SP). See examples below of proportional control only (Figure 15a) and proportional control with integral action (Figure 15b).

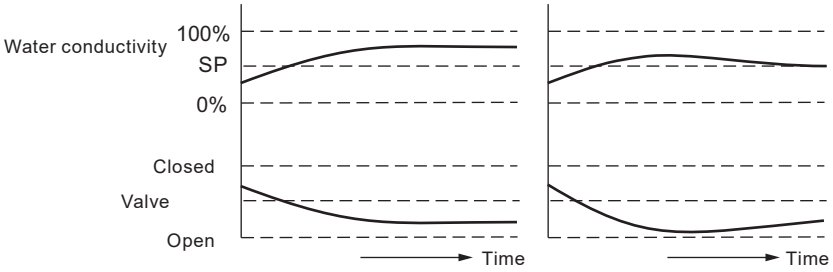


Fig. 15a Integral time = 0 **Fig. 15b Integral time > 0**

5.4.2 ON/OFF control without purge.

Used when the probe is mounted in the boiler. The probe is able to constantly monitor the conductivity from the probe tip to the boiler shell. When the TDS/conductivity value exceeds the set-point (SP) the valve will open and will remain open until the TDS/conductivity value drops below the hysteresis. See Figure 16.

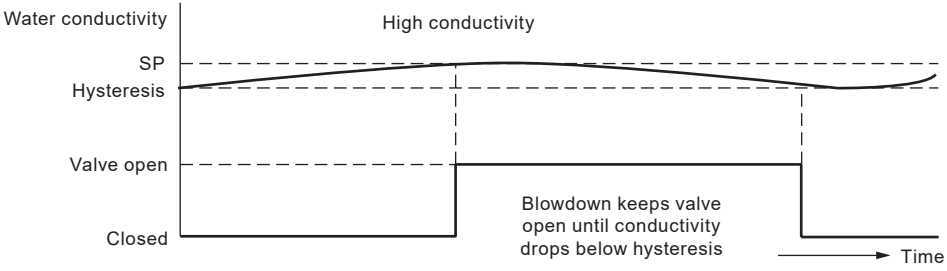


Fig. 16 ON/OFF control without purge

5.4.3 ON/OFF control with purge

Used only when the probe is mounted in the blowdown line. Purge ensures the sensor measures the conductivity at boiler temperature. The purge duration is the time the valve is open to enable a representative boiler sample to reach the probe. A purge occurs every interval either independent of burner firing, or dependent on cumulative boiler firing time.

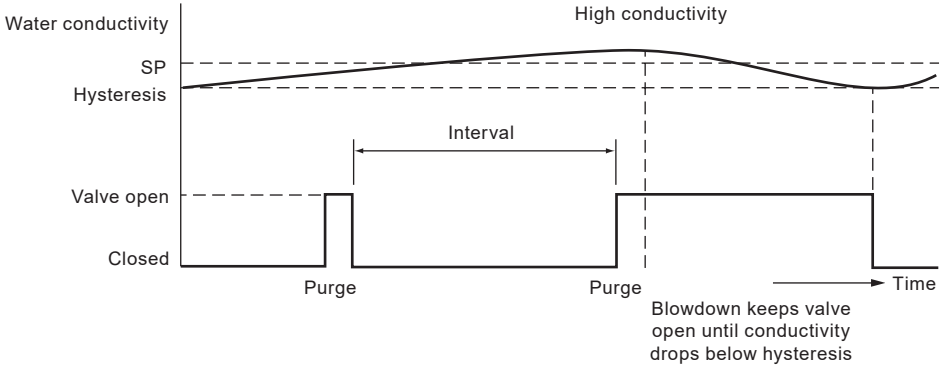


Fig. 17 ON/OFF control with purge

5.4.4 ON/OFF control with purge and pulsed output

For smaller boilers where the capacity of the blowdown valve is relatively high compared to the boiler size, the blowdown may be set to pulsed, rather than continuous output, opening for 10 seconds, and closing for 20 seconds. This slows the rate at which the boiler water is removed so that the level is not unduly affected, avoiding the risk of triggering a low water alarm.

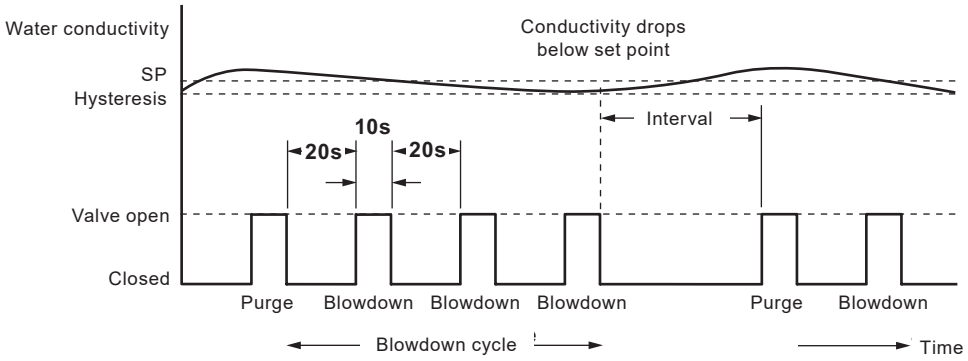


Fig. 18 ON/OFF control with purge and pulsed output

6. BHD50 - Operating and display unit

6.1 Switch on supply voltage

Switch on the supply voltage for the blowdown controller BCR3250 and for the operating and display unit BHD50. The LED of the blowdown controller first turns amber and then green. The operating and display unit shows the splash, welcome and then the home window.

Fig. 19 Splash window

Fig. 20 Welcome window

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).

6.2 User interface

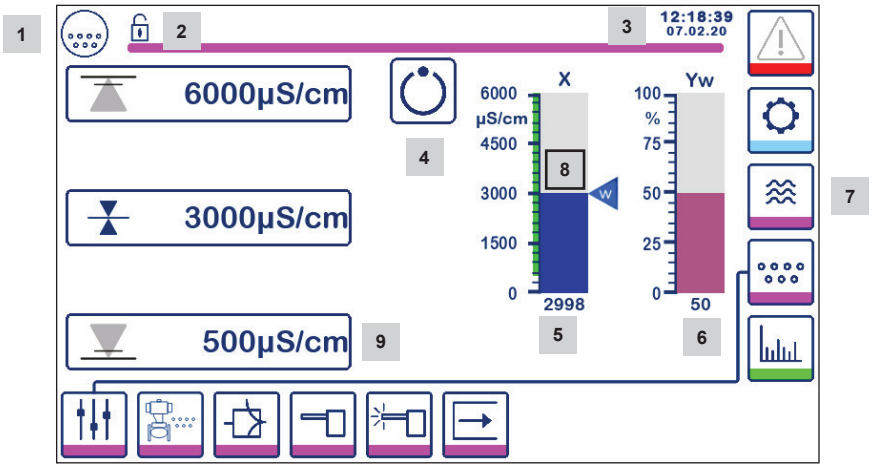


Fig. 21 Start window (without LCR2652 fitted)

Item	
1	Blowdown controller window
2	Lock/unlock status
3	Current time and date
4	Status indication: automatic operation
5	Bar chart indication of TDS/Conductivity value [in µS/cm or ppm]
6	Bar chart indication of control valve position [in %]
7	Level Settings (will not be displayed if a LCR2652 is not fitted)
8	Normal Level and TDS/Conductivity range (green bar) - section between MIN and MAX switchpoints
9	MIN alarm setting is only visible if MIN alarm is configured by code switch

See Appendix for the explanation of the icons

Icons may appear or disappear, depending on the controllers status. See appendix to find an explanation of the icons

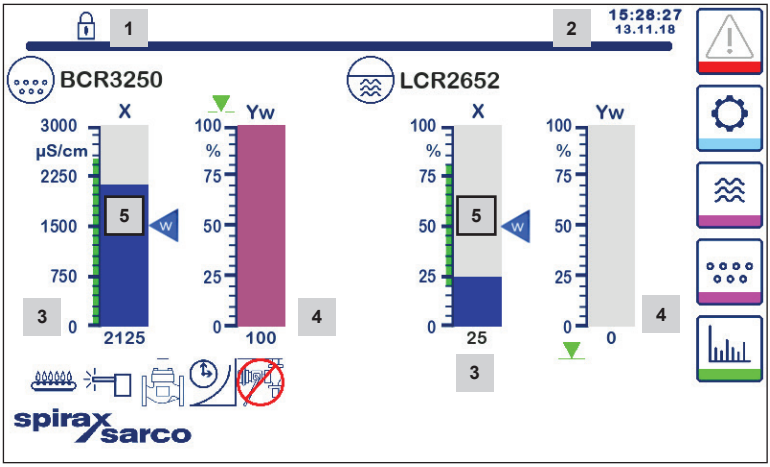


Fig. 22 Start window (with BCR3250 and LCR2652 fitted)

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

See Appendix A for the explanation of the icons

Icons may appear or disappear, depending on the controllers status. See appendix to find an explanation of the icons

6.3 Setting the MIN/MAX switchpoints and setpoint

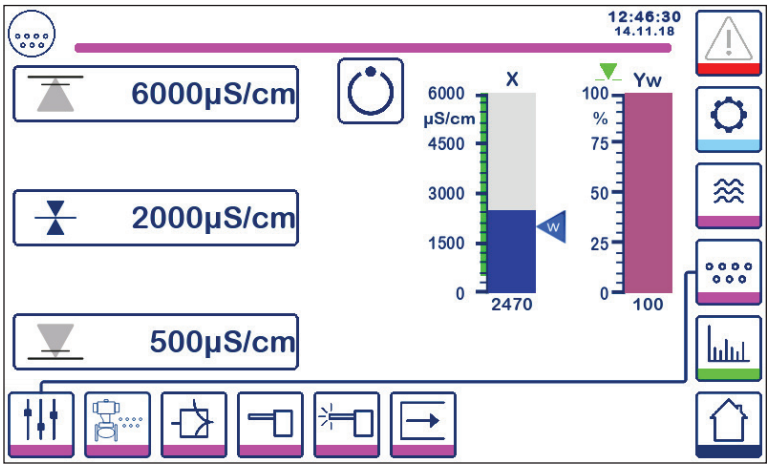


Fig. 23a Modulating control (VMD)

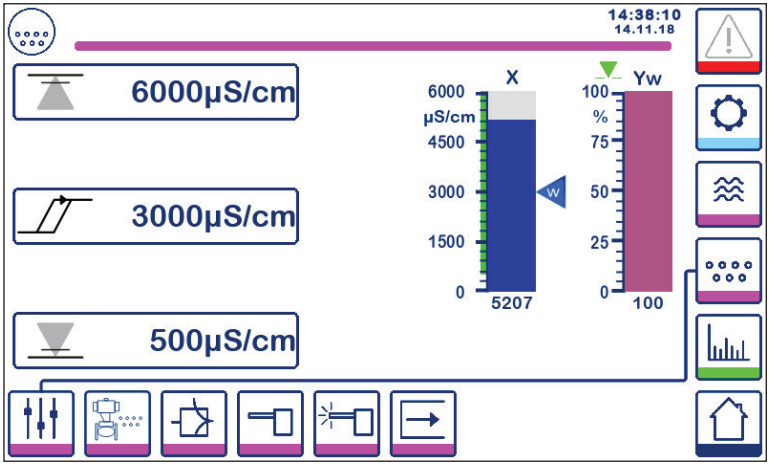


Fig. 23b ON/OFF control

To change the setpoint or MIN/MAX values, press the desired button. Use the numberpad Figure 24 to enter the parameter settings.

Note: If the system is locked, the password numberpad will first appear Figure 25.
Note: MIN will not appear if the relay output is configured for bottom blowdown.

6.4 Numberpad (parameters)

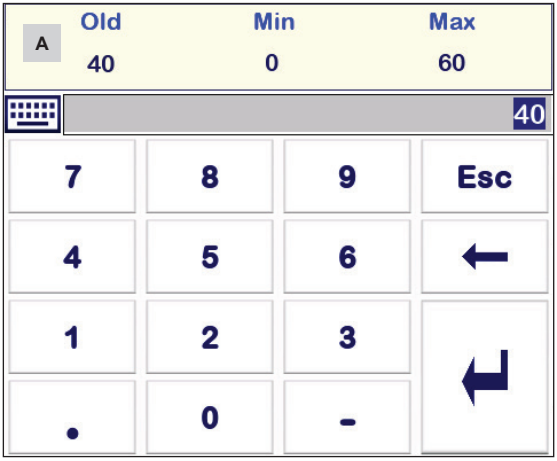


Fig. 24 Numberpad

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)

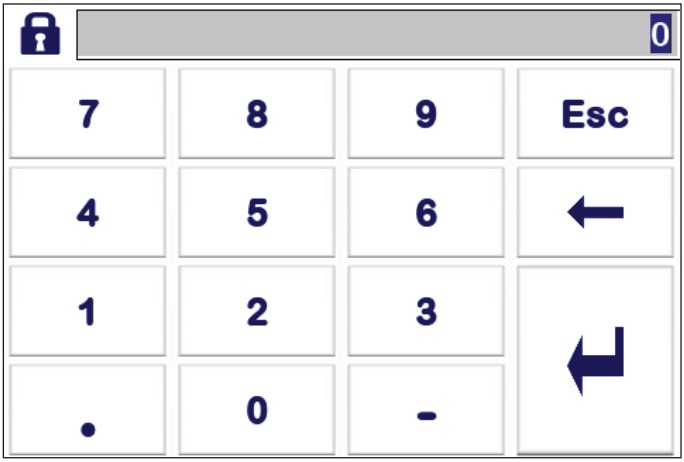


Fig. 25 Password numberpad

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

See security protection section.

6.6 Manual actuation of blowdown valve

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. Figure 26.

In modulating control (VMD) the control valve can be manually operated to the required position. Press the Yw box to display the numberpad and enter the desired valve position (%).

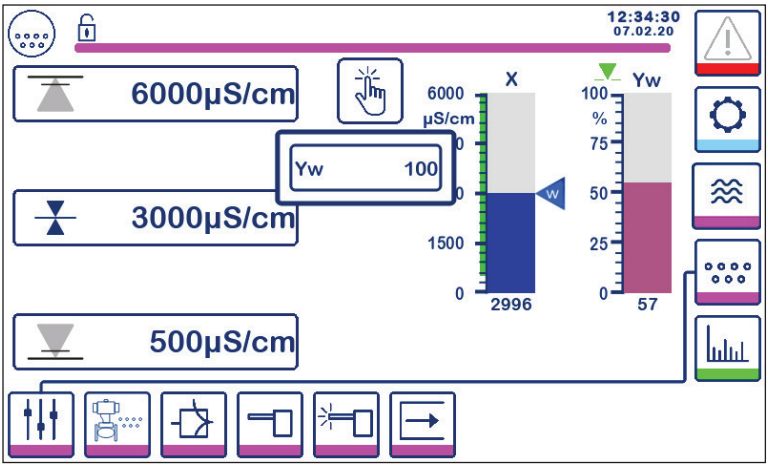


Fig. 26a Modulating control (VMD)

In ON/OFF control the valve can be opened and closed manually. Press the valve open or close buttons:

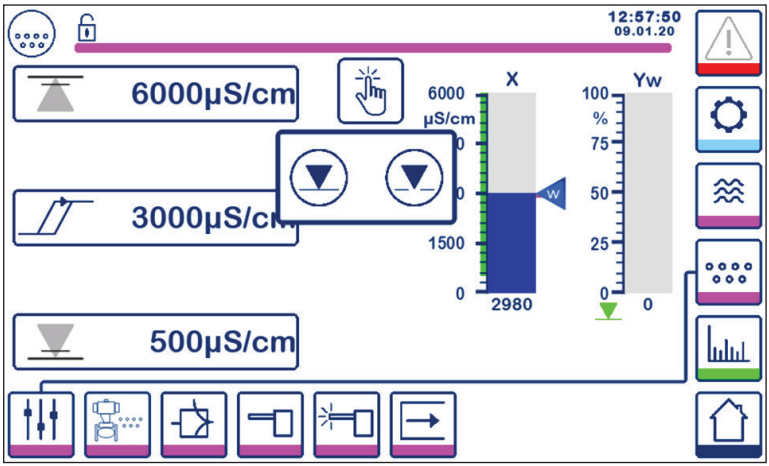


Fig. 26b ON/OFF control

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

6.7 Setting purge and rinsing parameters

Press the  button to open the parameter setting window for purge and rinsing parameters.

6.7.1 Rinsing setup for modulating control (VMD)

The controller can be configured to rinse the valve periodically (open and close) to reduce the risk of valve seizing.

To enable this feature, select "On"

Enter the rinsing interval and rinsing duration. Use the numberpad to enter the desired times.

The new times are accepted after the system is re-started or as soon as the previous rinsing duration is over. If this feature is enabled, a rinsing cycle is started immediately after power-up.

The icon  will appear when the rinsing cycle is running - See Figure 27.

To disable this feature, select "Off".

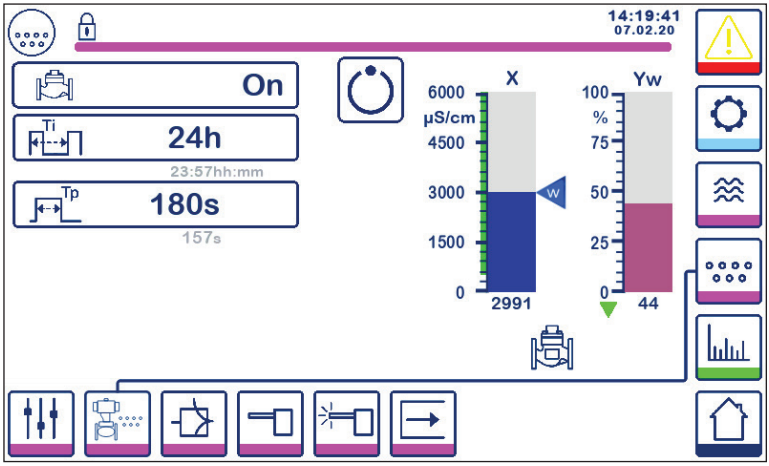


Fig. 27 Rinsing setup for modulating control (VMD)

6.7.2 Purge setup for ON/OFF control

Select standard or pulsed valve drive operation. Pulsed valve drive is for small boilers.

Select a Purge Duration, if the probe is installed in the pipeline and use the numberpad to enter a suitable valve open time (> 0 seconds). This time should be sufficient to ensure the probe measures a representative sample of water at boiler operating temperature.

The purge duration is set to zero if the probe is installed in boiler or for a CCD system. On BCS1 and BCS4 systems a duration of 30 seconds is normally sufficient to ensure the sensor reaches boiler temperature. Where a slow-opening valve is used or where there is a long or large bore pipework between the boiler and the sensor, a longer purge time will be required. The time can be entered from 0 (default) to 180 seconds in 1-second steps.

To manually find the best purge time:

- Allow the blowdown pipework to cool for 15 minutes.
- Start the calibration procedure (Figure 36) and note the time taken for the display to stabilise
- Set this time as the purge duration

Select the Purge Interval and use the numberpad to enter a suitable time between blowdowns. A purge cycle is started immediately after power-up.

The new settings are accepted after the system is re-started or as soon as the previous purging pulse is over.

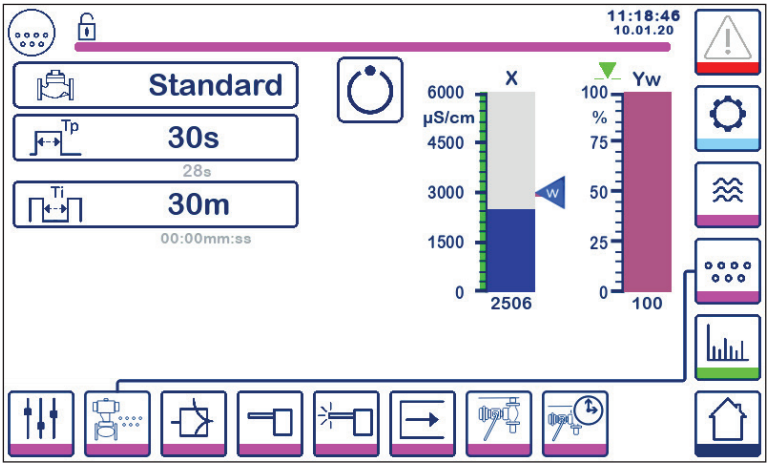


Fig. 28 Purge setup for ON/OFF control

6.7.3 Purge setup for ON/OFF control - Burner input

Note: This feature is not visible if the purge duration is set to zero (i.e. sensor in boiler).

The purge interval can be either independent of burner firing (normal) or dependant on cumulative burner firing time (cumulative). The cumulative function is set by selecting the burner input using the code switches.

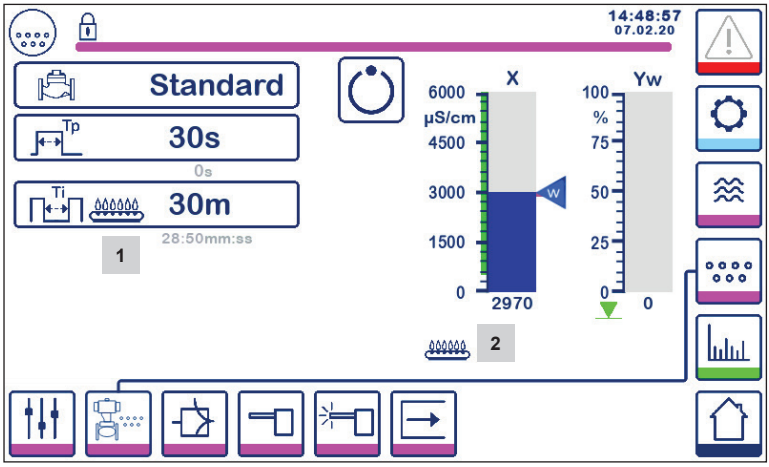


Fig. 29 Purge setup for ON/OFF control - burner input

Item	
1	Icon indicates that the burner input is selected using code switch.
2	Icon indicates that the burner is on.

6.8 Setting the control parameters

Press the  button to open the control parameter setup window.

For each parameter press the corresponding button (e.g. Pb) and use the numberpad to enter the desired value.

6.8.1 Modulating control (VMD):

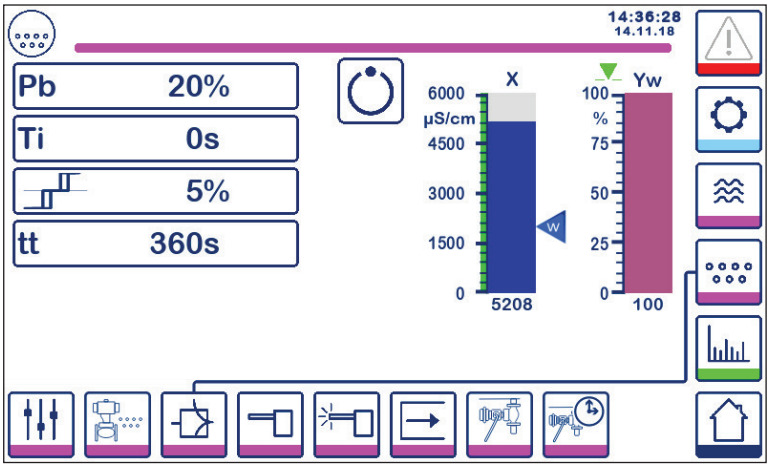


Fig. 30 Modulating control parameters

6.8.2 ON/OFF control:

Select the set-point or hysteresis and use the numberpad to enter the required values:

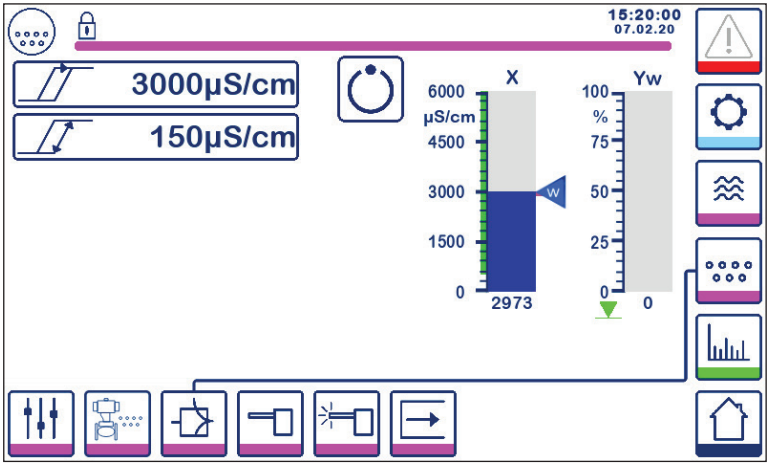


Fig. 31 ON/OFF control parameters

6.8.3 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 0 - 6000 µS/cm Setpoint SP = 3000 µS/cm Proportional band Pb = +/- 20% of setpoint = +/- 600 µS/cm With a measuring range of 0 - 6000 µS/cm and a setpoint of 3000 µS/cm the proportional band will be +/- 600 µS/cm within a range of 2400 to 3600 µS/cm.	
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 	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			Adjust the valve travel time specified by the valve manufacturer or measured at installation**.

Valve travel time measuring procedure:**

To ensure optimal valve control determine the real valve travel time in your application:

- In manual mode drive the valve to 0% (closed)
- Drive the valve to 100% (open) and measure the time elapsed.
- Enter the value measured as “valve travel time” parameter.

Adjust the travel time if the valve is replaced, refurbished or if the compression gland (sealing of the motor shaft) is tightened up.

6.9 Setting the TDS/Conductivity probe parameters

Press the  button to open the TDS/Conductivity probe window

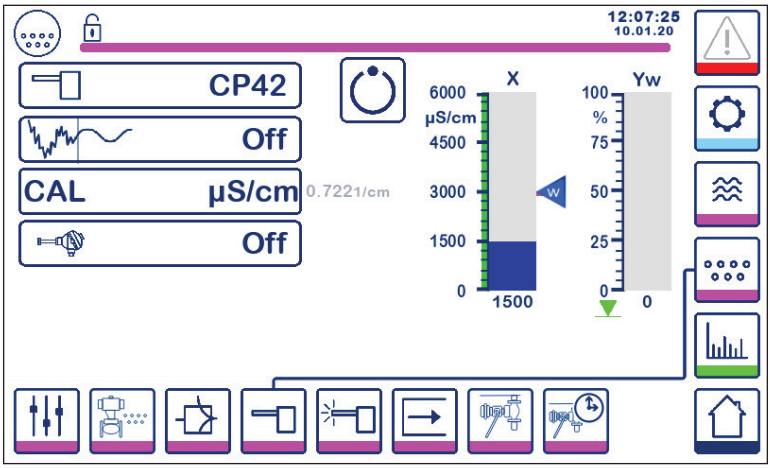


Fig. 32 Probe parameters

6.9.1 Probe selection

Press the probe selection button and select the probe that is used in the system. To ensure correct function of the controller it is very important to have the right probe selected.

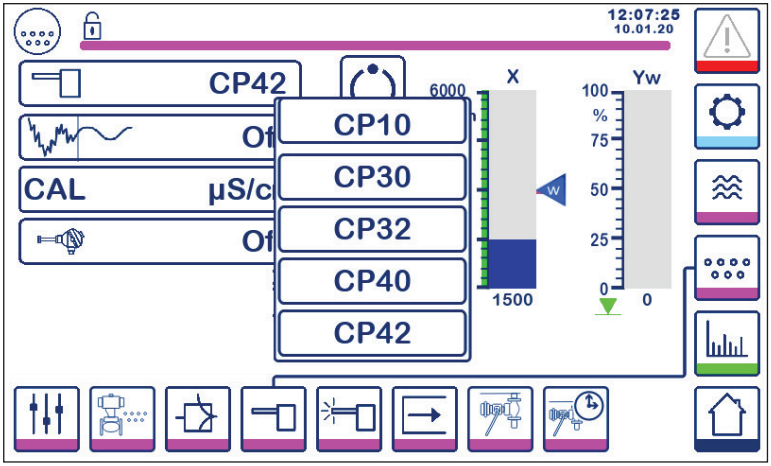


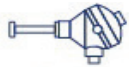
Fig. 33 Probe selection

6.9.2 Input filter

Press the  button to turn the input filter on or off.

The filter can be activated to dampen the effects of turbulent TDS/Conductivity value. This feature is not available in ON/OFF control when Purge Time is greater than zero seconds (probe installed in pipeline).

6.9.3 Temperature compensation

Press the  button to turn the temperature compensation on.

The measured water temperature (approximate) reading will appear to the right of the button.
Press the temperature compensation adjustment button to modify the compensation value.

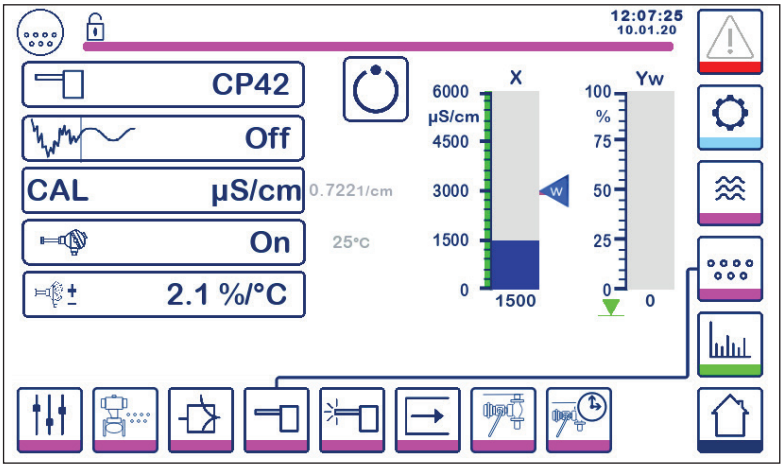


Fig. 34 Temperature compensation

6.9.4 Calibration - general

The boiler must be at working temperature when calibrating a system. This is particularly important if a temperature sensor is not fitted.

For best accuracy calibrate the controller with the TDS/Conductivity as close as possible to the Set Point. In some cases the boiler may need to be run for a period of time to allow the TDS to build up before calibration.

Recalibrate the TDS/Conductivity at Set Point once the boiler has settled down (after a few days in most cases).

Check the calibration (as close to the Set Point as practical) weekly to ensure optimum performance.

Take a sample of the boiler water and measure its conductivity (in µS/cm) using a meter such as the Spirax Sarco MS1. If the controller is required to be calibrated as neutralised conductivity or TDS, neutralise the sample and measure again using the meter.

6.9.5 Calibration with probe in the boiler (with no purge time)

Press the CAL button and enter the measured value using the numberpad. The calculated probe factor (K) will be displayed for confirmation. Press the "return" button to accept calibration or the "X" button to cancel calibration. If the probe factor is out-of-range (0.005 - 5.000 1/cm), the probe factor value will change to red and only the cancel option will be available.

The normal range for the probe factor is between 0.20- 0.70. If the value is outside this range the system may not work correctly. See Section 7: Fault Finding.

Note: If the system is operated without temperature compensation, the probe factor will not be calculated correctly.

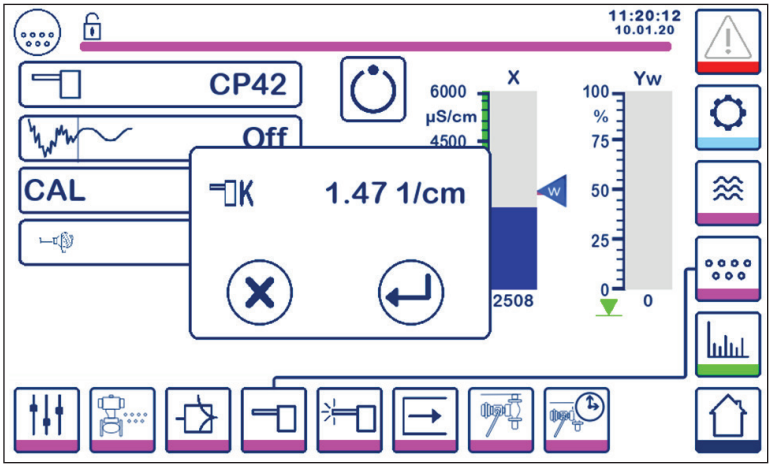


Fig. 35 Calibration with probe in boiler

6.9.6 Calibration with probe in the blowdown line (with purge time)

By pressing the CAL button, when purge time is set greater then zero a purge pulse is initiated. The current measured value is displayed as “x” in the top line. In the line below the elapsed purge time is counted. Observe the elapsed purge time that is necessary for the actual value to stabilise and use value for the purge time setting.

Warning: the purge time during calibration is not limited.

When the actual value “x” has stabilised, a calibration can be initiated by pressing the CAL button in the pop-up window. A confirmation window will appear to accept or reject the calculated probe factor.

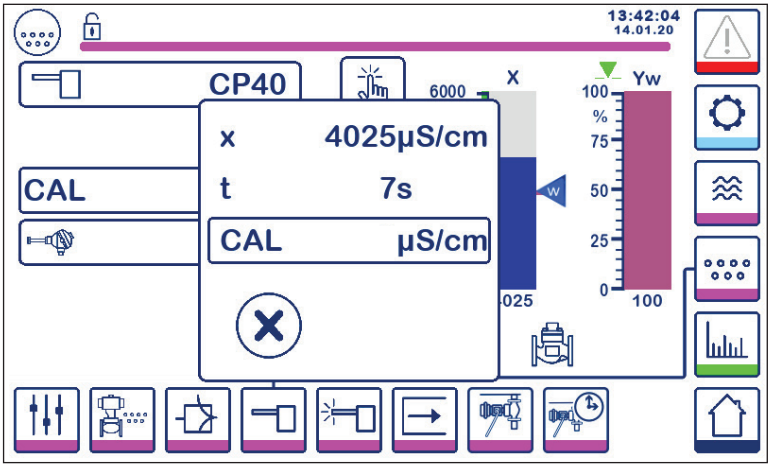


Fig. 36 Calibration with probe in blowdown line

6.9.7 Calibration procedure for probe in a CCD system:

We recommend that a competent water treatment company be consulted to establish the most suitable conductivity level for individual plant. Conditions vary widely, as do the chemical properties and conductivity of contaminants.

In many cases, the normal measured value of 'clean' condensate will be very low, perhaps only 1 or 2 µS/cm in some cases, whereas the set point may be much higher perhaps 30 or 40 µS/cm.

To calibrate a CCD system, a liquid at approximately the maximum allowable conductivity is introduced into the system. Use a mixture of tap water and condensate, to simulate condensate at approximately the maximum allowable conductivity level (the set point). 5 litres (1.3 US gallons) will be plenty for most systems. Use the Spirax Sarco MS1 conductivity meter to check the conductivity. Close both stop valves and open the drain valve and 'water for flushing and calibration' valve. Pour in the prepared water, and let it run through the system until bubble free. Close the drain valve. Allow the display to settle for two minutes.

Calibrate the controller as described in the main text. It is advisable to check calibration after the system has been running for a few days, then periodically depending on the individual plant conditions. Consult your water treatment specialist if in any doubt.

Note: Ensure purge time is set to zero and a temperature sensor is installed.

6.10 Setting the probe cleaning parameters

Press the  button to open the probe cleaning parameter setting window.

For each parameter press the corresponding button. Use the numberpad to enter the desired probe cleaning duration, probe cleaning interval and scale fault management action (available for CP32/CP42 only).

6.10.1 Probe cleaning duration

A typical probe cleaning period would be 20 seconds. Increase it if the scaling on the probe (and in the boiler) is causing frequent recalibration to be needed. Set the duration to zero if the feature is not required. If the purge time is set to any figure other than zero the controller will automatically limit the cleaning time to 9 seconds (max.) to avoid bubbles forming on the probe during purge and causing an inaccurate reading.

6.10.2 Probe cleaning interval

Enter a interval time from 1 to 99 hours in 1 hour steps to set how often a cleaning cycle should occur.

During a cleaning cycle the current TDS/conductivity display will not change. Normal control will return 20 seconds after cleaning. This is to allow for any bubble is dissipate.

Certain probe or wiring faults will also trigger the probe scale detect feature.

Power cycling the controller will start a cleaning cycle.

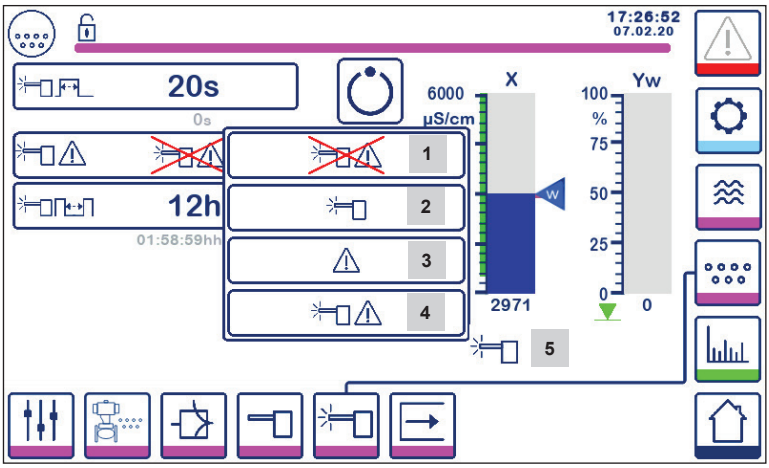


Fig. 37 Probe cleaning parameters

6.10.3 Probe scale fault management (CP32/CP42 only)

The scale fault management is the action the controller takes when scale is detected.

Item	Probe scale fault management (CP32/CP42)
1	**No probe cleaning and no alarm.**
2	**Probe cleaning without alarm** If the probe is scaled then the time between probe conditioning cycles will change from the clean interval time set to 10 minutes, until the probe is clean. The cleaning icon will be displayed. Note: The probe may be damaged if 'cleaning every 10 minutes' is allowed to continue for long periods. The probe should be examined and mechanically cleaned after 12 hours of 'fault condition'.
3	**No probe cleaning but alarm activated** MAX alarm relay will be released and an error will occur (see errors list).
4	**Probe cleaning and alarm activated.** Recommended setting – MAX alarm relay will be released, an error will occur, and the probe cleaning circuit is activated.
5	**Icon indicates probe cleaning in progress.**

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

Press the  button to open the output window

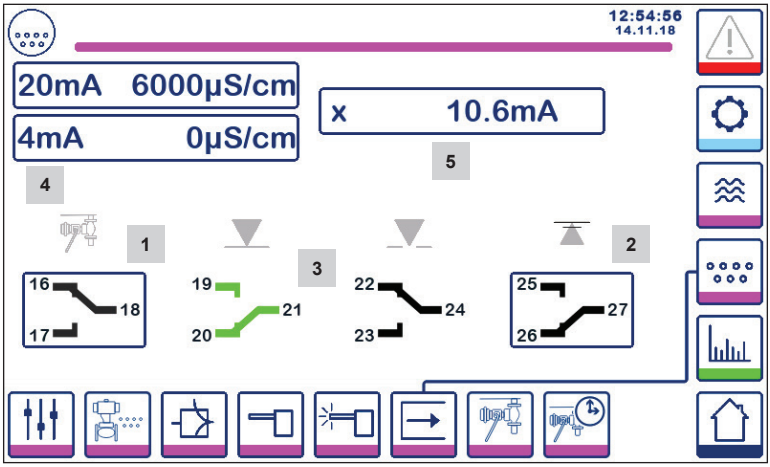


Fig. 38 Output window

Item	
1	Test button for MIN alarm or BB valve (depending on the function selected)
2	Test button for MAX alarm
3	Valve output status
4	Actual value output ranging (4-20mA)
5	Actual value output reading (4-20mA)

1 Testing MIN alarm or BB Valve

Press button **1** to open output contacts 17-18 and the respective contact icon turns red.

Note: If the MIN alarm is set to 0, test activation is not possible.

2 Testing MAX alarm

Press button **2** to open output contacts 26-27 and the respective contact icon turns red.

3 Valve output status

The window shows the valve control relay contact status. The contact colours change to green to indicate that they are energised.

4 Actual value output ranging (4-20mA)

Select the 4mA button and use the numberpad to set the TDS/Conductivity value to represent 4mA.
Select the 20mA button and use the numberpad to set the TDS/Conductivity value to represent 20mA.
The bargraph on the home window will be adjusted to this range.

5 Actual value output reading (4-20mA)

Shows the current 4-20mA output value.

6.12 Setting the bottom blowdown valve parameters

Press the  button to open the bottom blowdown window

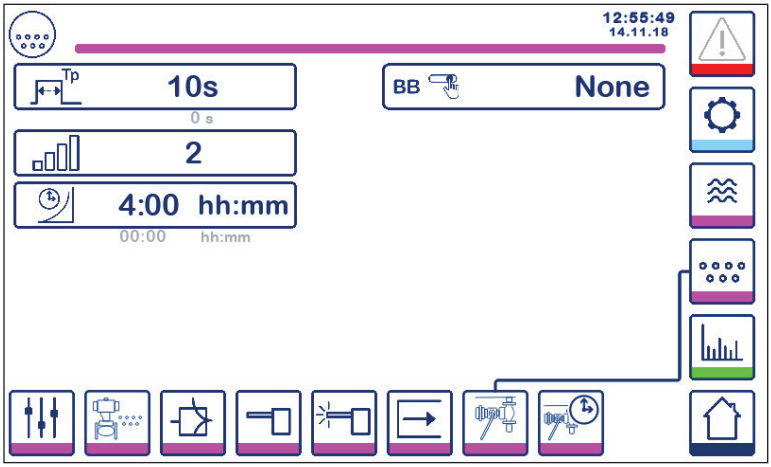


Fig. 39 Bottom blowdown valve parameters

6.12.1 Bottom blowdown duration

Select the bottom blowdown duration and use the numberpad to enter a suitable valve open time.

The duration depends on the installation and water condition, but 5 seconds is the recommended maximum initially.

6.12.2 Bottom blowdown priority

To prevent more than one boiler blowing down at the same time, set the priority greater than zero and connect the link between the controllers. The number prioritises which boiler opens the bottom blowdown valve first.

Select the priority number:
9 = highest priority and 1 = lowest priority
If the blowdown timer is not linked to other timers, set priority to '0'.

Up to nine blowdown timers can be installed and linked for multi-boiler installations, preventing more than one boiler blowing down at a time. This feature avoids the possibility of overloading a blowdown vessel, which could lead to water being discharged to drain at a too high temperature.

6.12.3 Bottom blowdown recovery time

Select the Recovery Time and use the numberpad to enter a suitable blowdown vessel cooling time. If the blowdown priority is zero, the Recovery Time is not available.

The recovery time is restarted every time a bottom blowdown is initiated (link line is pulled low). It is suggested to set the recovery time similar in all linked controllers.

6.12.4 Bottom blowdown limit switch

If the bottom blowdown valve is fitted with a limit switch, press the switch button and selected "fitted" More parameters will appear. See Figure 40.

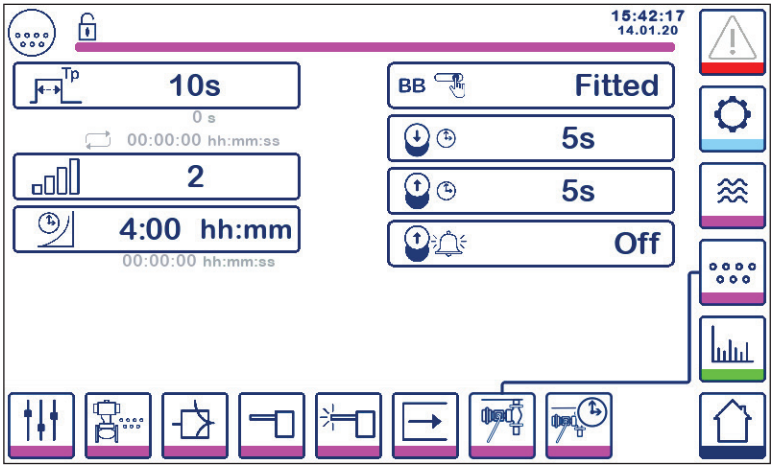


Fig. 40 Bottom blowdown limit switch parameters

Select the opening and lift times, using the numberpad.

If the valve fails to close within the "closing" time, the MAX alarm will be de-energised.

WARNING - Recommend maximum 5 seconds.

If the valve fails to lift off the seat within the predetermined lift time, the MAX alarm will be de-energised (if the alarm function is activated).

Set the "BB alarm" to "on" to activate the lift alarm function.

The bottom blowdown limit switch alarms are quit by pressing the acknowledge button on the alarm page.

6.13 Setting the bottom blowdown timer parameters

Press the  button to open the bottom blowdown timer window.

The controller can be configured for one or more bottom blowdowns each day.

Press the ⏻ button to enable or disable the bottom blowdown timer for each day. The "on" icon will change to green to indicate the timer for this day has been enabled.

Select a start time, a finish time and a repeat time. If only one blowdown is required, set the repeat time to zero and a "-" will appear.

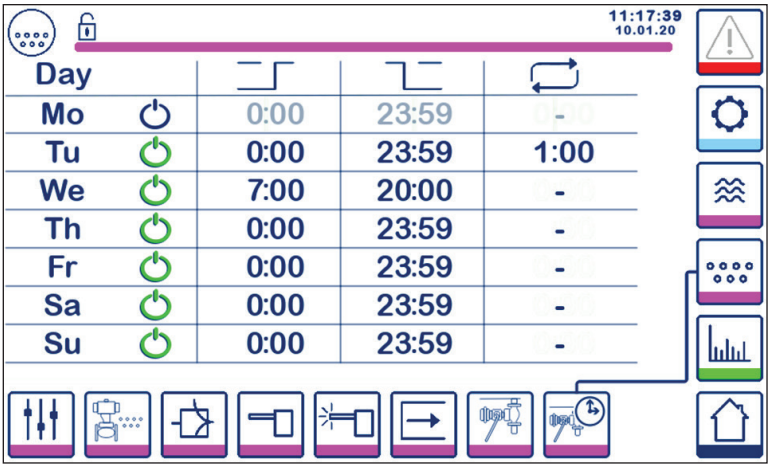


Fig. 41 Bottom blowdown timer parameters

6.14 Setting the set up parameters

Press the  button to open the set up window

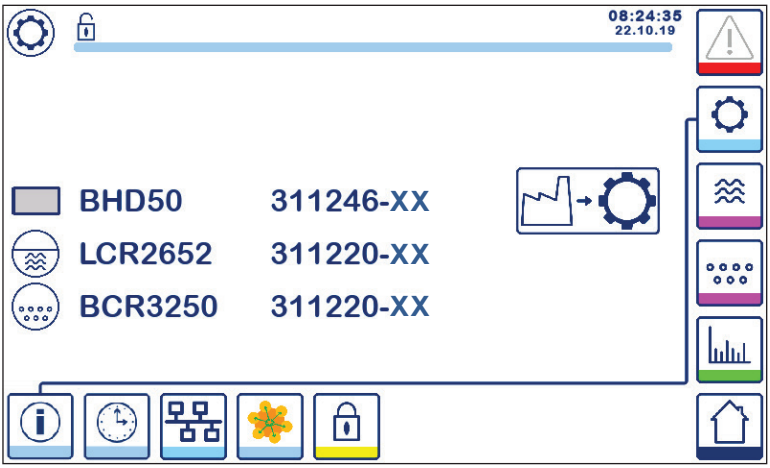


Fig. 42 Setup window

Figure 42 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.

6.15 Setting the time and date parameters

Press the  button to open the time and date window

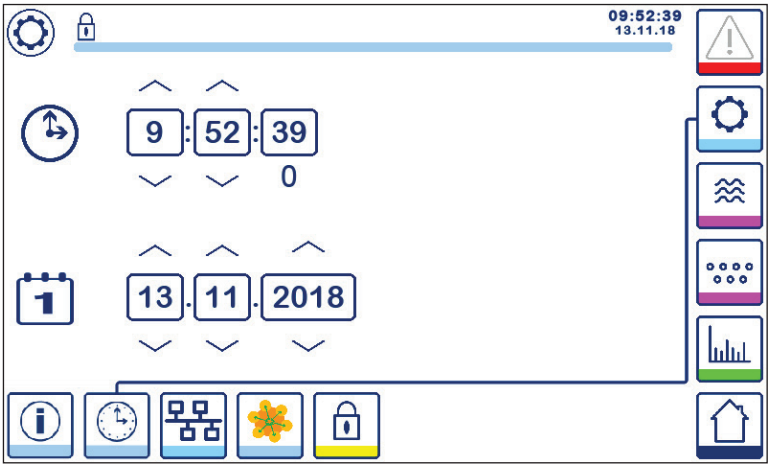


Fig. 43 Time and date window

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

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

6.16 Setting the network parameters

Press the  button to open the network window

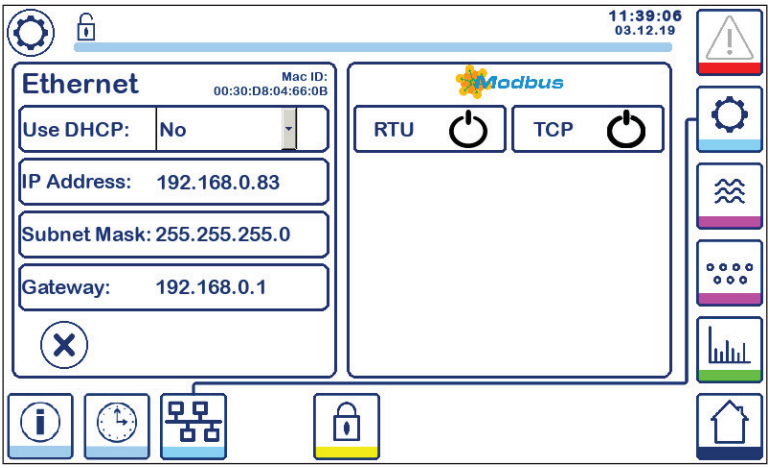


Fig. 44 Network settings

6.16.1 Ethernet

The settings of the Ethernet port can be configured on the left side of the window (See Figure 44).

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  button to confirm or the  button to cancel the network settings.

6.16.2 Modbus TCP protocol

Press the 

button to enable/disable the Modbus TCP protocol

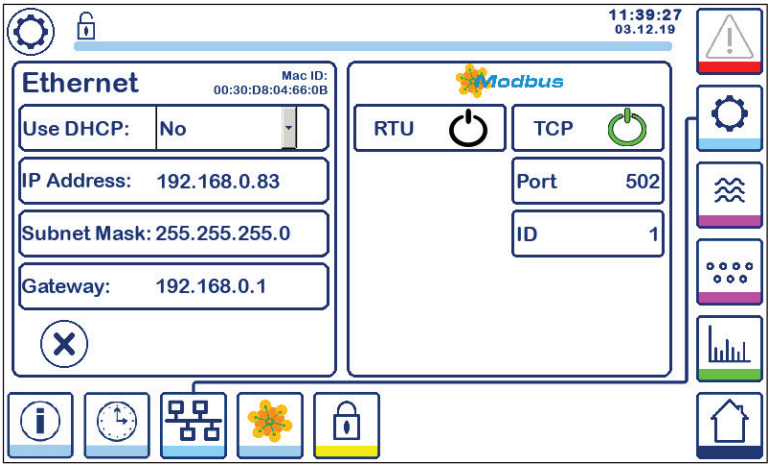


Fig. 45 Modbus TCP settings

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 then enter the required value.

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

See Figure 47

6.16.3 Modbus RTU protocol

Press the 

to enable/disable the Modbus RTU protocol

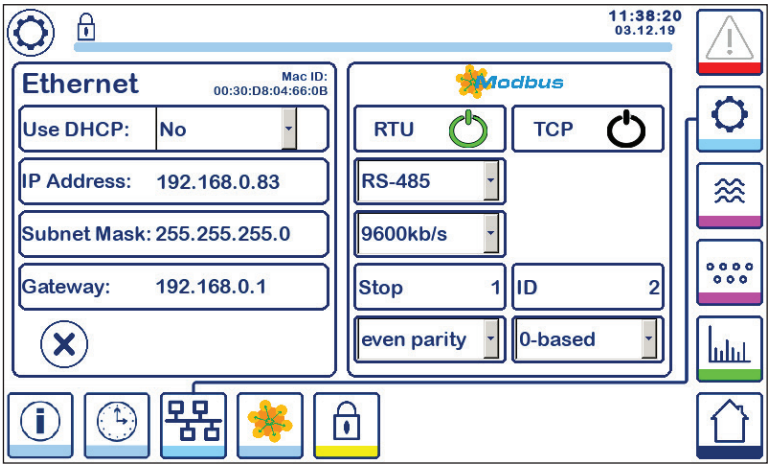


Fig. 46 Modbus RTU protocol

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  button will appear to allow the user to see the content of the modbus registers.

See Figure 47

6.16.4 Modbus registers

Press the  button to open the modbus register window

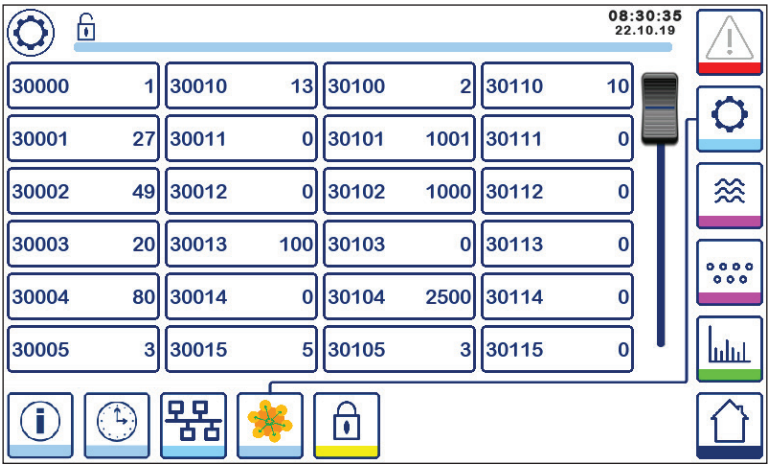


Fig. 47 Modbus register data

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

See appendix to see the register allocations.

6.17 Setting up a security protection

Press the  to open the security protection window

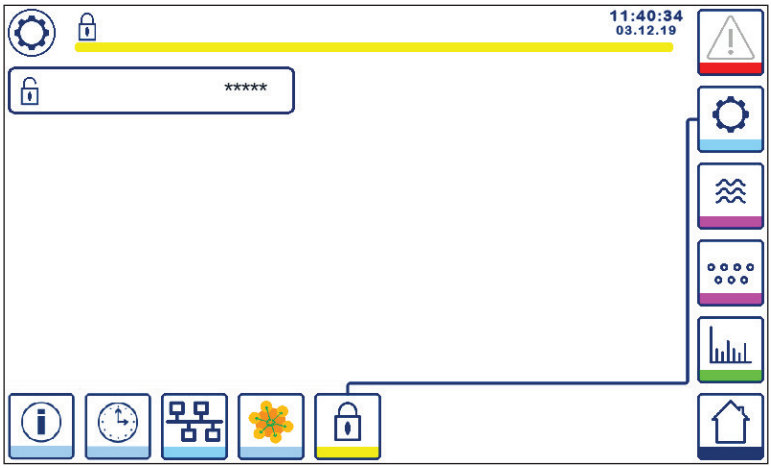


Fig. 48 Security protection window

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. Figure 49

To lock the system, press the  button **B**.

Item	
A	Lock/unlock status
B	Lock system button

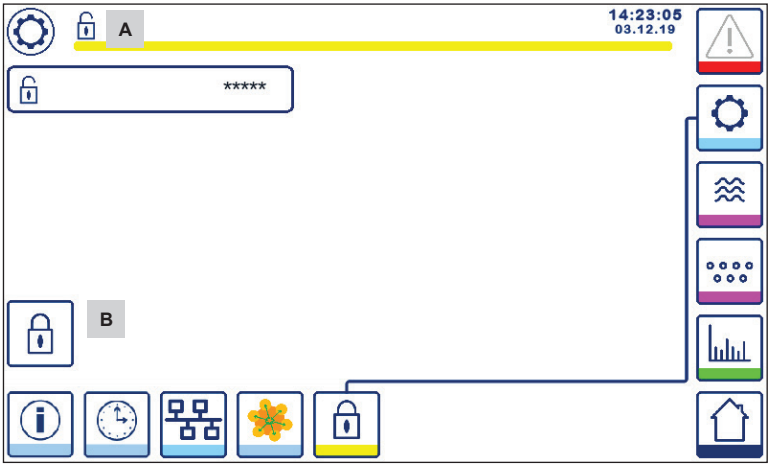


Fig. 49 Security protection unlock

Item	
A	Lock/unlock status
B	Lock system button

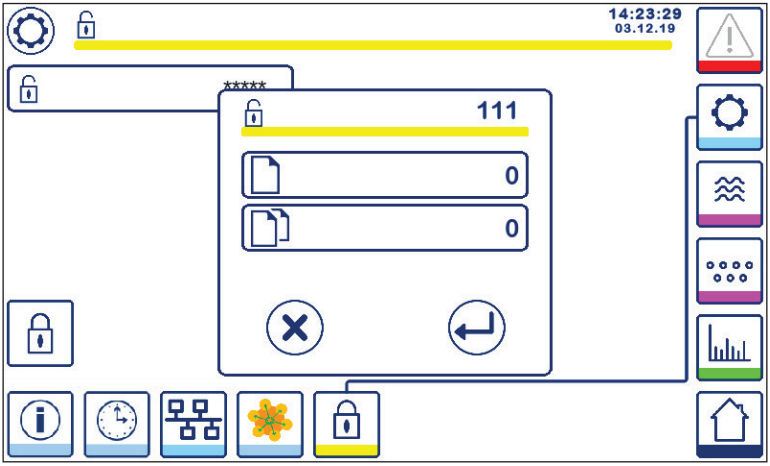


Fig. 50 Security password change

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. See Figure 48.

Pressing the button or entering two different/incorrect passwords, cancels the password change and returns back. See Figure 48.

6.18 Operation

Press the  button to open the TDS/Conductivity start window

6.18.1 MIN Alarm

If the TDS/Conductivity drops below the “MIN” TDS/Conductivity value, the alarm button **B** will flash yellow/red, MIN alarm symbol **C** and the bar graph (x) will change to a red colour. MIN alarm is only available if configured using the code switch.

The valve will close in an attempt to increase the TDS/Conductivity Symbol **A** will appear. See Figure 51.

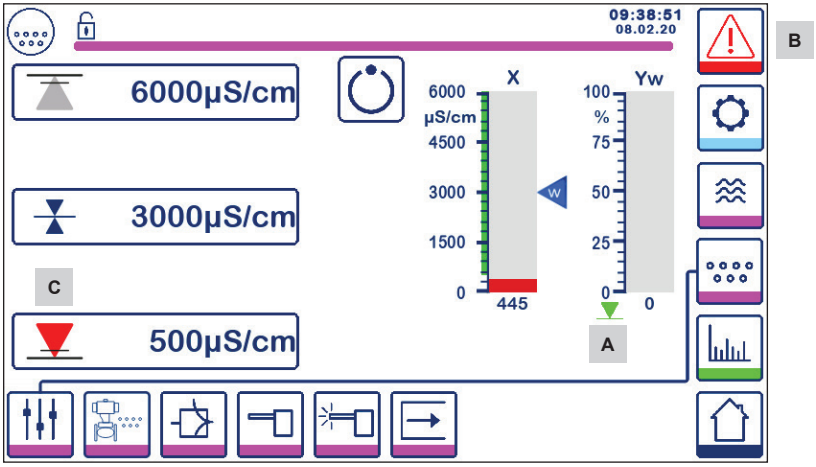


Fig. 51 TDS/Conductivity MIN alarm

6.18.2 MAX Alarm

If the TDS/Conductivity increases above the “MAX” TDS/Conductivity value, the alarm button **B** will flash yellow/red, MAX alarm symbol **D** and the bar graph (x) will change to a red colour.

The valve will open in an attempt to decrease the TDS/Conductivity. Symbol **E** will appear. See Figure 52

If an error is detected by the controller, a MIN and MAX alarm will be triggered..

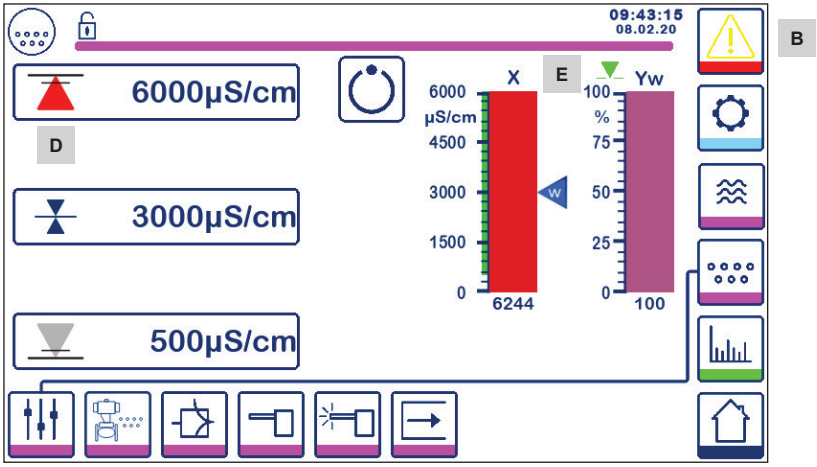


Fig. 52 TDS/Conductivity MAX alarm

Item	
A	Valve closing indicator
B	Active alarm button flashing red and yellow, indicating an alarm or error
C	MIN alarm active (red)
D	MAX alarm active (red)
E	Valve opening indicator

6.18.3 Control valve position

The bar chart (Yw) indicates the position of the valve.

For modulating control (VMD) with integral action time set to zero and the TDS/Conductivity value matching set-point, the valve will actuate to 50% position. See Figure 53 If the integral time is greater than zero, the valve will be controlled (0 - 100%) to maintain the setpoint.

For ON/OFF control the valve will open when the TDS/Conductivity value exceeds the setpoint. The valve will remain open until the TDS/Conductivity drops below the hysteresis.

The valve opening symbol  will be displayed above bar chart (Yw) to show the valve is opening.

The valve closing symbol  will be displayed below bar chart (Yw) A, to show the valve is opening.

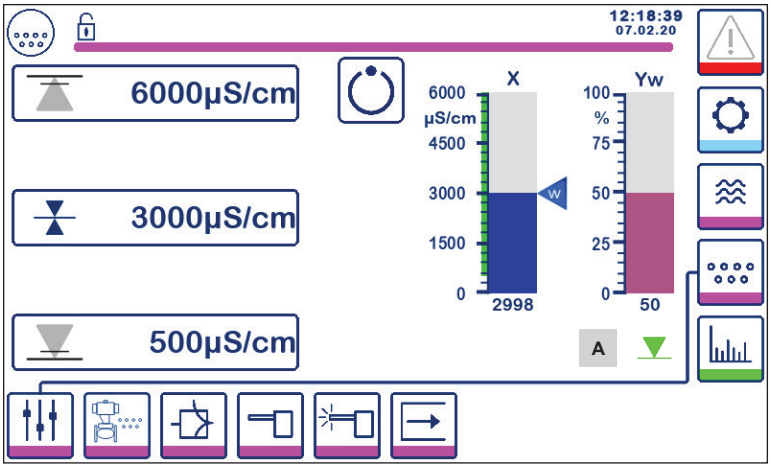


Fig. 53 Valve position

6.18.4 Standby operation

The controller can be configured for standby operation using the code switch. If the standby input is driven high (24Vdc) the controller will enter the standby state, closing the control valve and indicating " ". See Figure 54.

During standby operation the MIN/MAX limits and the monitoring function remain active. If purge time is set > 0 (probe in pipeline) then no monitoring is possible during standby operation.
When returning back to normal operation, the blowdown valve is motored back into control position. In addition a bottom blowdown pulse is triggered (if configured).

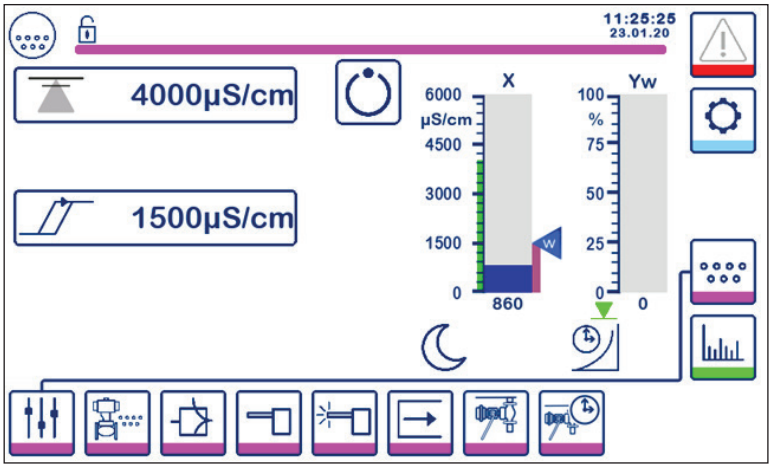


Fig. 54 Standby indication

6.18.5 Dual Control Window

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

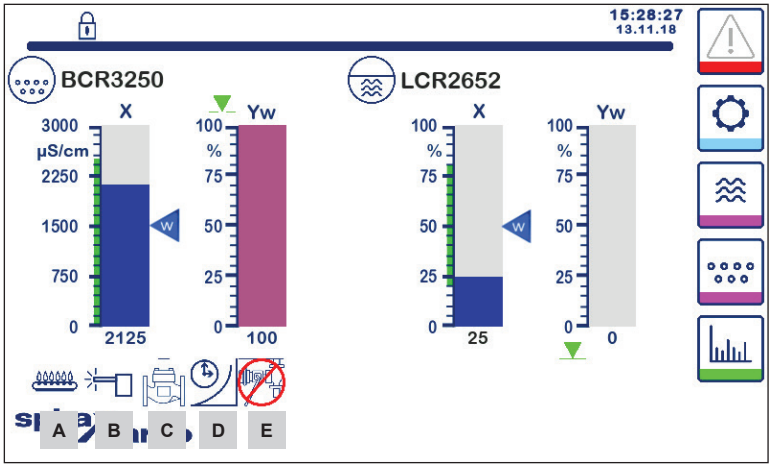


Fig. 55 Dual Control Window (with both BCR3250 and LCR2652 fitted)

Item	
A	Indicates the burner is on.
B	Indicates the probe is being cleaned.
C	Indicated the valve is being rinsed.
D	Indicates the bottom blowdown recovery time is running.
E	Indicates another boiler is blowing down (link is low). Same symbol without the red crossing indicates this boiler is blowing down.
Note: Some of these indicator will not appear, if the function is not configured.	

6.18.6 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.

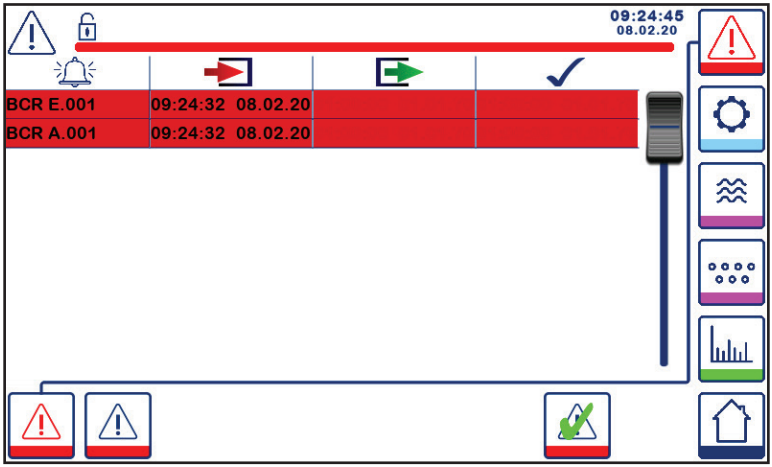


Fig. 56 Active alarms window

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  is pressed.

Use the scroll tool to view earlier entries.

Press the  button to open the historic alarm window

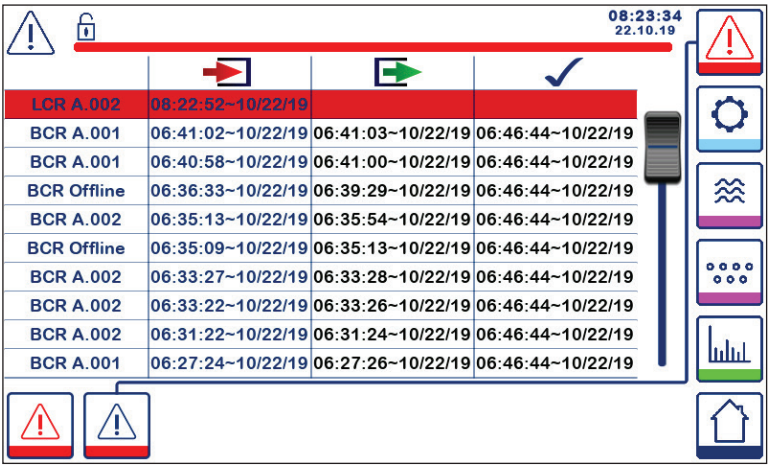


Fig. 57 Historic alarm window

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

See active alarms page above (for entry explanation see page 57).

6.19 Trending

Press the  button to open the trend window

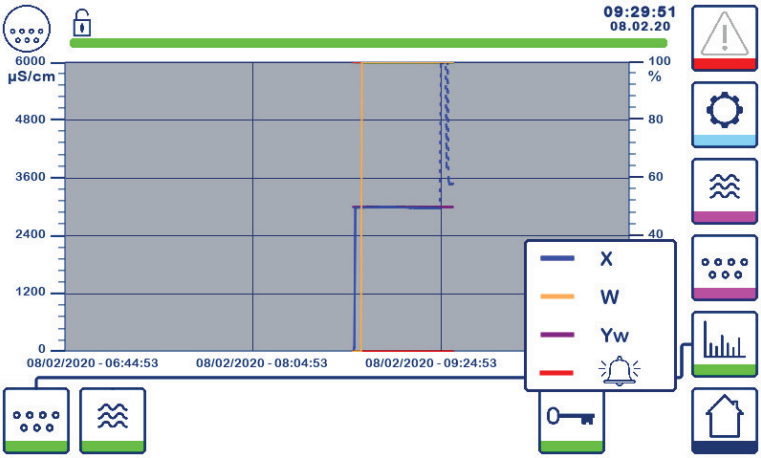


Fig. 58 TDS/Conductivity trending window

Pressing the  button shows the input and output trend graphs for BCR3250 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  button shows the colour key for each TDS/Conductivity trend

X = TDS/Conductivity value, W = TDS/Conductivity setpoint, Yw = valve position,  = Alarm and Errors.

The level trend button  will be shown, if a LCR2652 is also fitted.

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**
BCR offline	Communication with BCR/BHD disrupted	Check electrical connection. Switch supply voltage off and on again to re-start the equipment.
A.001	MAX switchpoint exceeded	Check TDS/Conductivity controller is working correctly. Recalibrate if necessary. Check blowdown valve operation and feedwater conditioning regime. Check probe wiring.
A.002	Value below MIN switchpoint	
A.003	Bottom Blowdown Switch Alarm	Check lift/close time has been set correctly. Check wiring between BB switch and the controller. Check the correct operation of the valve. Check and replace the switch and/or valve if necessary.
A.004	Probe scaled Alarm	Probe drive voltage has increased to the maximum voltage. The probe tip may be scaled. Ensure the correct water treatment is used. Ensure the boiler water is not been contaminated. Check probe wiring. Inspect the probe tip for damage.
A.005	Bottom Blowdown not executed Alarm	Bottom Blowdown was delayed by more than 24h due to link line being low. Check priority and recovery time settings on all linked controllers. Check BB link wiring.
E.001	Temperature sensor defective (value too low)	Check temperature sensor for correct readings and, if necessary, replace it. Check sensor wiring (open/short circuit).
E.002	Temperature sensor defective (value too high)	
E.005	TDS/Conductivity probe defective (open circuit)	Check conductivity probe and, if necessary, replace it. Check electrical connection
E.006	TDS/Conductivity probe defective (short circuit)	
E.007	Walkthrough test	Error
E.008	Walkthrough application	Error
E.009	Internal test	Error
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 persistent contact customer support and replace the device if necessary.

Important

Please follow the instructions given in the installation and operating manual for the CP10, CP30/CP40, CP32/CP42 and TP20 for further fault finding and troubleshooting.

Note

If a malfunction occurs in the blowdown controller, MIN (if selected) 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 Determining the probe condition

The probe condition can be checked without removing it from the boiler.
From the probe parameter page, compare the displayed probe factor with the following table:

Probe factors	Typical
BCS1, BCS2 and BCS4	0.2 - 0.6
BCS3	0.3 - 0.7

A low probe factor indicates that the probe is able to conduct well, whereas a high probe factor indicates that the probe tip has become less conductive, perhaps due to a build-up of scale.

A very low probe factor, however, could indicate an internal short circuit. The further the probe tips from any part of the boiler, the higher the probe factor.

Note: If the system is operated without temperature compensation, the probe factor will not be calculated correctly.

7.3 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 sensors 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.

7.4 Decommissioning/replacing the blowdown controller BCR3250

- Switch off supply voltage and cut off power supply to the equipment.
- Unscrew the left and right fixing screws. See Figure 59.
- 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.

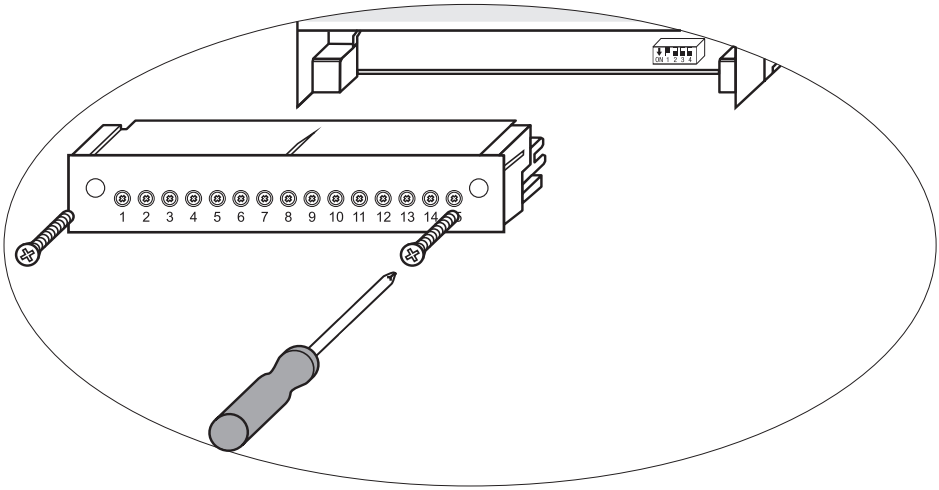


Fig. 59

7.5 Decommissioning/replacing the operating and display unit BHD50

- Switch off supply voltage and cut off power supply to the equipment.
- Unplug the connectors. See Figures 9, 10, 11 and 12.
- Unscrew screws (Figure 2d) and remove fixing elements.
- Push the equipment out of the control cabinet panel cut-out.

7.6 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 authorised agency in your country.

8. Technical information

BCR3250	
Supply voltage	24 Vdc +/– 20%
Fuse	external 0.5 A (semi-delay)
Power consumption	5 W
Inputs	1 five-wire connection to CP32/CP42 or three-wire connection to CP30/CP40 and two-wire connection to the CP10 (Drive+Sense bridged at controller) 1 two-wire Pt100 temperature sensor (range 0 - 250°C) 1.two-wire bottom blowdown valve switch 1.two-wire bottom blowdown link (blowdown valve interlocking) 1 two-wire standby or Burner connection (24Vdc +/– 20%, 10mA)
Outputs	1 or 2 volt-free change-over contacts, 8 A 250 Vac/30 Vdc cos ϕ = 1 (valve control). 2 volt-free change-over contacts, 8 A 250 Vac/30 Vdc cos ϕ = 1, (MIN/MAX alarm). 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. ∅ 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-energised equipment before it can be put into operation: 24 hours.
Storage temperature	–20 ... +70 °C, defrosting time of the de-energised equipment before it can be put into operation: 24 hours.
Relative humidity	max. 95%, no moisture condensation
Approvals:	TÜV certificate VdTÜV Bulletin "Water Monitoring 100" (Water Monitoring 100): Requirements made on water monitoring and control equipment. Type approval no. TÜV · WR · XX-XXX (see name plate).

BHD50	
Supply voltage	24 Vdc +/– 20%
Fuse	internal automatic
Power consumption	14.4 W
User interface	5" color display with 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

BCR3250
1 x Blowdown controller BCR3250
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
1 x 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.

Appendix

1. Modbus register allocation

Register	Parameter
30000	**See LCR2652 IMI**
30001	
30002	
30003	
30004	
30005	
30006	
30007	
30008	
30009	
30010	
30011	
30012	
30013	
30014	
30015	

Register	Parameter
30100	1 - Identifier
30101	TDS or Conductivity
30102	Setpoint
30103	µS/cm (0) or ppm (1)
30104	MAX Limit
30105	Absolute range
30106	Probe factor (x1000)
30107	Line Temperature (x100)
30108	Purge time (s)
30109	Clean duration (s)
30110	Output state (relay 1-4)
30111	Status 1 (alarms and errors)
30112	Status 2 (alarms and errors)
30113	VMD Valve position (%)
30114	VMD Ti (s)
30115	VMD Dead Band (%)

BCR3250 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	A.005	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*	-	-	-	-

* 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
-	-	A.004	E.001	E.002	-	-	-
Bit 8	**Bit 9**	**Bit 10**	**Bit 11**	**Bit 12**	**Bit 13**	**Bit 14**	**Bit 15**
-	-	-	-	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)

2. Icon explanation

Home window	
Icon	**Description**
	Level controller
	Blowdown 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 (Modulating control)
	Setpoint (ON/OFF control)
	MIN switchpoint (if selected using the code switches)
	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 purge and rinsing
	Go to parameter setting window for control
	Go to parameter setting window for TDS/Conductivity probe
	Go to parameter setting window for probe cleaning
	Go to parameter setting window for the outputs

Home window (continued)

Icon	Description
	Go to bottom Blowdown setup window (visible if configured by dip switch)
	Go to blowdown timer window (visible if configured by dip switch)
	Control valve closing indicator
	Control valve opening indicator
	Shows the SP graphically on the bar graph
	Go to home window
	Indicates burner is firing/on
	Indicates standby operation is active.
	Indicates valve is being rinsed
	Indicates the bottom blowdown recovery time is running
	Indicates this boiler is blowing down. Same symbol with the red crossing indicates another boiler is blowing down (link is low)
	Indicates probe cleaning in progress. Icon located outside options list.
	Manually close valve
	Manually open valve

Valve purging and rinsing window

Icon	Description
	Rinsing or purge duration (pulse)
	Rinsing or purge interval. When the burner icon is displayed beside the interval icon, it indicates the code switch is selected for the burner input. (purge interval dependent on cumulative boiler firing time)

Control (modulating) window

Icon	Description
	Proportional band, based on the setpoint
	Neutral band, based on the setpoint
	Integral action time
	Valve travel time

Control (ON/OFF) window

	Set-point (ON/OFF control)
	Hysteresis (ON/OFF control)

TDS/Conductivity probe window

Icon	Description
	Used to reduce the affects of turbulent conductivity measuring location (not available if purge time is greater than zero
	Probe selection
	Temperature compensation selection

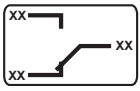
TDS/Conductivity probe window (continued)

Icon	Description
	Temperature compensation adjustment
	Calculated probe factor
	Save new TDS/Conductivity calibration value and accept probe factor
	Exit without saving new TDS/Conductivity calibration value and close window.

Probe cleaning window

Icon	Description
	Probe cleaning duration (period)
	Probe cleaning interval
	No probe cleaning and no alarm (CP32/CP42 only). Icon located inside options list.
	Probe cleaning without alarm (CP32/CP42 only). Icon located inside options list.
	No probe cleaning but alarm activated (CP32/CP42 only). Icon located inside options list.
	Probe cleaning and alarm activated (CP32/CP42 only). Icon located inside options list.

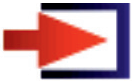
Output window

Icon	Description
	Alarm status. Press the button to de-energise the relays
	Valve contact status (green when energised).

Bottom blowdown set up/timer window

Icon	Description
	Bottom blowdown duration (pulse). The time the valve is open for.
	Bottom blowdown priority (0 = no controllers are linked and 9 being the highest priority)
	Bottom blowdown recovery time is running. This is the time it takes for the blowdown vessel to cool down enough for another bottom blowdown to occur.
	Bottom blowdown limit switch. If a switch is fitted to the bottom blowdown valve, select "fitted"
	Bottom blowdown closing time. This is the time it takes the valve to close fully.
	Bottom blowdown lift time. This is the time it takes the valve to lift off it's seat
	Bottom blowdown lift alarm. This is used to signal an alarm (MAX) if the bottom blowdown valve does not lift off the seat within the bottom blowdown lift time. Only available if timer switch is fitted and selected.
	enable or disable the bottom blowdown timer for each day. The "on" icon will change to green to indicate the timer for this day has been enabled.
	Bottom blowdown start time.
	Bottom blowdown stop time.
	Bottom blowdown repeat time. The time for the next repeated blowdown. If zero then only one blowdown will occur at start.

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 (if LCR2652 is fitted)
	Go to two or three-element trend window (appear if LCR2652 is fitted and three-element control is selected).
	Go to trend key window
	Go to TDS trend window.

3. Glossary

TDS/conductivity boiler blowdown

As the boiler water evaporates, the concentration of non-volatile dissolved solids (TDS) left behind in the boiler increases over time as a function of steam consumption. If the TDS (= total dissolved solids) concentration exceeds the limit defined by the boiler manufacturer, foaming and priming occurs as the density of the boiler water increases, resulting in a carry-over of solids with vapour into steam lines and superheaters.
As a consequence, the operational safety is impaired and severe damage to boiler and tubes may occur.

To keep the TDS concentration within admissible limits, a certain portion of boiler water must be removed continuously or periodically (by means of a blowdown valve) and fresh make-up water must be added to the boiler feed to compensate for the water lost through blowdown.

Electrical conductivity - here as a result of the TDS content of boiler water - is measured in microSiemens/cm (µS/cm). However, in some countries ppm (parts per million) is used for the readings. Conversion: 1µS/cm = 0.5 ppm.

Bottom blowdown (BB)

During the evaporation process fine sludge deposits settle on heating surfaces and in the lowest part of the steam boiler. Boiler sludge is caused e. g. by oxygen-scavenging agents. The accumulated sludge sediments form a thermally insulating layer and can damage the boiler walls due to excessive heat.

To perform a bottom blowdown the valve must be opened abruptly. The resulting suction effect occurs only at the moment when the valve is being opened. The opening time should therefore be set rather short and the bottom blowdon procedure repeated more often.

Temperature compensation

The TDS/Conductivity changes as the temperature falls or rises. To obtain meaningful readings it is therefore necessary that the measurements are based on the reference temperature of 25 °C and that the measured TDS/Conductivity values are corrected by the temperature coefficient factor tC.

Probe factor, K

The probe factor is a geometric quantity characteristic of the conductivity probe and is taken into account when calculating the TDS/Conductivity. However, in the course of time this factor may change, e. g. due to dirt deposits accumulated on the measuring probe. Deviations can be compensated by calibrating the probe.

Rinsing of the blowdown valve

To prevent the blowdown valve (VMD) from getting stuck the valve can be rinsed automatically. At regular intervals (purging interval Ti) the blowdown valve is motored into the open position and rinsed (rinsing time). After rinsing the valve is motored back into the required control position.

Standby operation (TDS/Conductivity control)

To avoid loss of water, the blowdown control and the timer-controlled bottom blowdown (if activated) can be de-activated during standby operation or when the burner is switched off. An external control command will be triggered and, as a result, the blowdown valve will be closed. During standby operation the MIN/MAX limits and the monitoring function remain active.
After the equipment switches back to normal operation, the blowdown valve is motored back into control position. In addition an bottom blowdown pulse is triggered (provided that bottom blowdown has been activated and an interval period and pulse duration has been set).

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