

Level Control Unit

LevelControl Basic 2

Signalling Module
Current Measuring Module

Supplementary Operating Manual



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Supplementary Operating Manual LevelControl Basic 2

Original operating manual

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1 General

This supplementary operating manual accompanies the installation/operating manual. All information contained in the installation/operating manual must be observed.

Table 1: Relevant operating manuals

Type series	Reference number of the installation/operating manual
LevelControl Basic 2	4041.80

2 Safety

2.1 General

This supplementary operating manual contains additional applicable information. General installation, operating and maintenance instructions that must be observed to ensure safe operation and prevent personal injury and damage to property are given in the installation/operating manual.

The safety information in all sections of this supplementary operating manual and in the relevant installation/operating manual must be complied with.

The supplementary operating manual must be read and completely understood by the responsible specialist personnel/operators.

The contents of this supplementary operating manual must be available to the specialist personnel at the site at all times.

The operator is responsible for ensuring compliance with all local regulations which are not taken into account in this supplementary operating manual.

3 Transport/Temporary Storage/Disposal

3.1 Condition upon delivery

	NOTE
	<p>Prior to shipping, the accessories were tested to ensure full compliance with the specifications. They should, therefore, be in perfect electrical and mechanical condition upon arrival.</p> <p>It is recommended that the accessories be inspected for in-transit damage immediately upon receipt. If there are any complaints or objections, the recipient and carrier must jointly draw up a damage report.</p>

3.2 Transport

	CAUTION
	<p>Improper transport</p> <p>Damage to the accessories!</p> <ul style="list-style-type: none"> ▷ Always transport the accessories properly and in their original packaging. ▷ During transport, observe the transport instructions on the original packaging.

Transport the accessories as specified.

3.3 Storage

If the ambient conditions for storage are met, the accessories will give reliable service even after a prolonged period of storage.

Table 2: Ambient conditions for storage

Ambient conditions	Value
Relative humidity	Max. 85% (no condensation)
Ambient temperature	- 10 °C to + 70 °C

- Store the accessories in dry, vibration-free conditions and, if possible, in their original packaging.
- Store the accessories in a dry room in which the atmospheric humidity is maintained at a constant level (as far as this is possible).
- Prevent excessive fluctuations in atmospheric humidity (see table "Ambient conditions for storage").

If stored properly, the accessories will be protected for a maximum of 12 months.

4 Description

4.1 Compatibility

	NOTE
	<p>The KSB Service Tool can be downloaded free-of-charge from the KSB web site. The web site also contains further information on how to order the additional parameterisation cable required.</p>

Signalling module and current measuring module can be used with device firmware version 1.2 or higher. Devices with earlier firmware versions must be updated using the KSB Service Tool.

4.2 General description

Signalling module

The signalling module is an extension module for LevelControl Basic 2. It features:

- Six volt-free signals:
 - Fault at pump 1
 - Fault at pump 2
 - High water
 - Sensor fault
 - Pump 1 in operation (not available for lifting units with single-phase motor and cutter)
 - Pump 2 in operation (not available for lifting units with single-phase motor and cutter)
- Analog output (level-proportional current signal, type 4–20 mA)
- ModBus RTU interface (direct connection or field bus module connection)
- System bus interface (currently no function)
- Connection option for one current measuring module per pump
- Depending on the version, the device is fitted with a pressure sensor for redundant pneumatic level measurement (without compressor) or for setting up a partially redundant bubbler system

	NOTE
	<p>The assignment of the volt-free signals and the measured values provided via the analog output can be modified using the ServiceTool.</p>

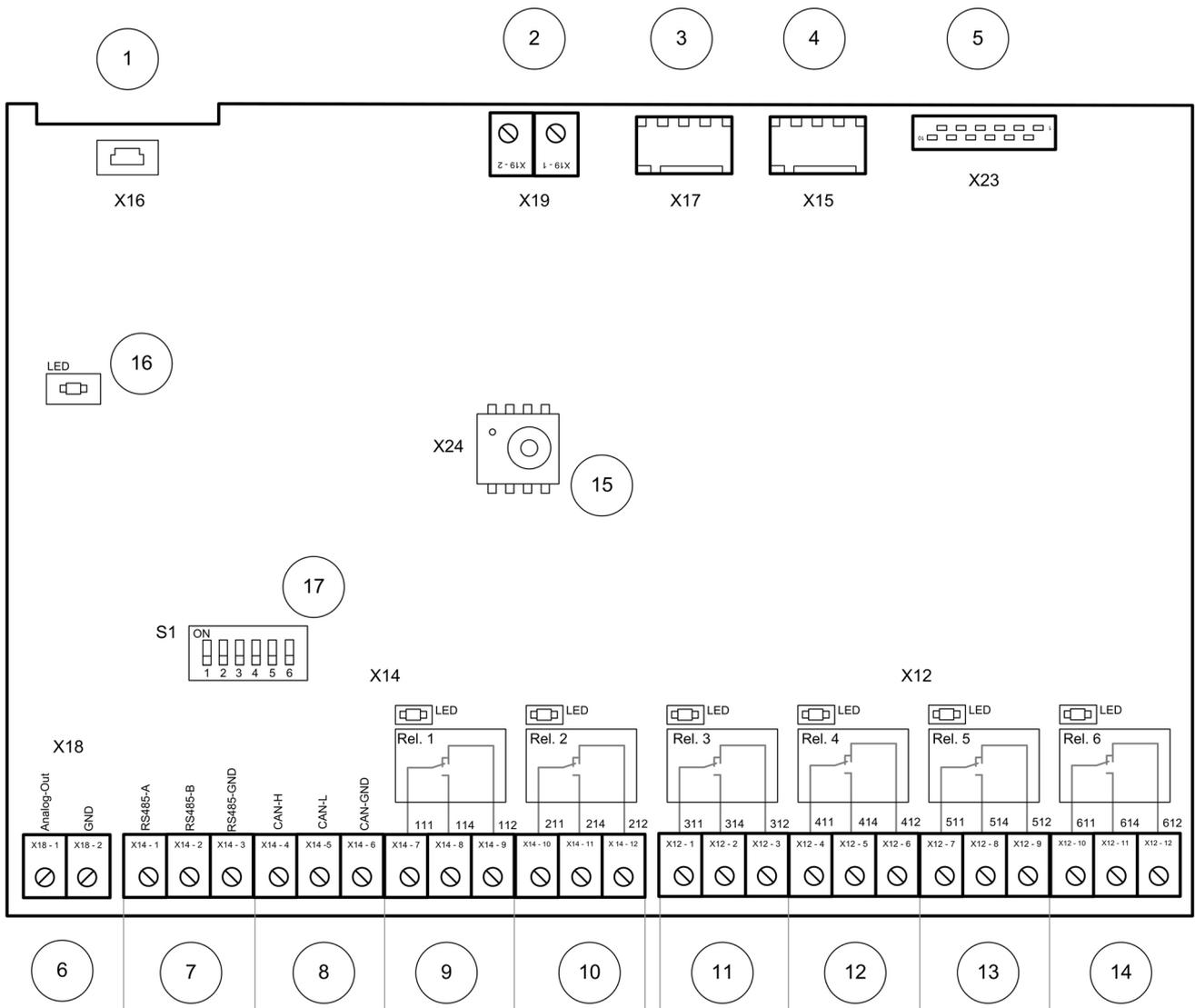


Fig. 1: Description of signalling module

1	Service interface (for production only - parameterisation takes place via the service interface on the LevelControl Basic 2 printed circuit board)	2	Power supply for PCB (optional, 9–30 V)
3	Current measuring module connection, pump 2	4	Current measuring module connection, pump 1
5	Signalling module connection to LevelControl Basic 2	6	Analog output (4–20 mA)
7	ModBus-RTU connection	8	system bus connection (no function)
9	Volt-free signal 1 (default: Pump 1 fault)	10	Volt-free signal 2 (default: Pump 2 fault)
11	Volt-free signal 3 (default: High water)	12	Volt-free signal 4 (default: External fault)
13	Volt-free signal 5 (default: Pump 1 in operation)	14	Volt-free signal 6 (default: Pump 2 in operation)
15	Redundant pressure sensor	16	Status LED
17	Terminating resistors for ModBus RTU and system bus connection		

Current measuring module

The current measuring module measures the pump current in the motor power cable in the control unit.
 Up to 10 A, the pump current is measured directly, over 10 A, it is measured via an upstream current transformer.
 The current measuring module is connected to LevelControl Basic 2 via the signalling module.

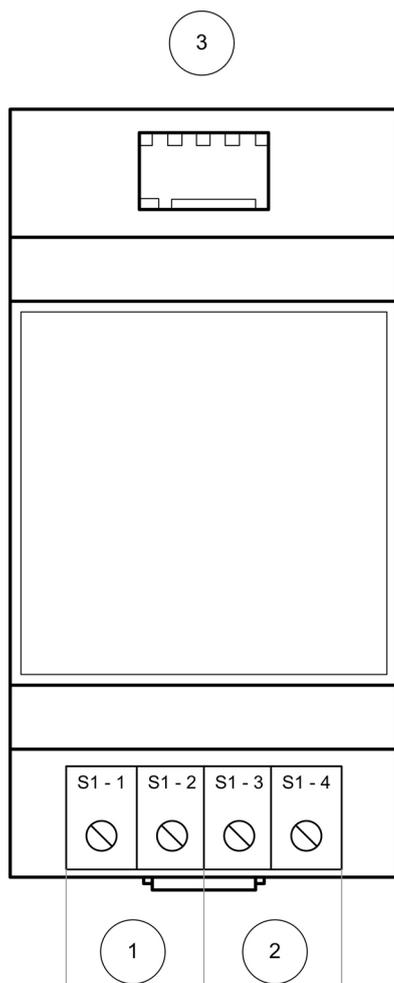


Fig. 2: Description of current measuring module

1	Phase L2	2	Phase L3
3	Connection to signalling module		

	NOTE
	<p>The current measuring module measures the currents in phases L2 and L3 (three-phase motor) or L (single-phase motor) of the connected pumps. (⇒ Section 10.1, Page 30)</p>

4.3 Technical data

Signalling module

Table 3: Technical data

Characteristic	Value
Power supply	9–30 V DC via LevelControl Basic 2
Enclosure	BC version: IP00 BS version: IP20
Switching capacity of individual signals	30 V, 1 A
Analog output	0/4-20 mA
Housing version	BC version: without housing BS version: top hat rail housing

Characteristic	Value
Design variants	Signalling module Signalling module with pressure sensor, 3 mlc Signalling module with pressure sensor, 10 mlc
Weight	0.3 kg


NOTE

The signalling module can be used with device firmware version 1.2 or higher.

Current measuring module

NOTE

LevelControl Basic 2 is only fitted with current measuring module(s) ex works. Current measuring modules cannot be retrofitted!

The current measuring modules are connected to LevelControl Basic 2 via the signalling module. This means that the current measuring module can be used only in combination with the signalling module!

Table 4: Technical data

Characteristic	Value
Power supply	Supply via signalling module
Enclosure	IP20
Maximum supply voltage	500 V AC
Measuring range	10 (15) A ¹⁾
Measuring ranges for indirect measurement via transformer	10 to 20 A (30 A) 20 to 40 A (60 A) 40 to 75 A (110 A) ²⁾
Weight	0.2 kg


NOTE

The current measuring module can be used with device firmware version 1.2 or higher.


NOTE

One current measuring module is required for each pump. For dual-pump control, the signalling module offers connection options for two current measuring modules.

1) Larger currents can be measured via upstream transformers
2) Measurement of larger currents possible on request

5 Installation at Site

5.1 Connecting the signalling module

	<p style="background-color: #e67e22; color: white; padding: 5px;">⚠ DANGER</p> <p>Exposed live parts Danger of death from electric shock!</p> <ul style="list-style-type: none"> ▷ Separate the control unit from the power supply before installing the signalling module.
	<p style="background-color: #f1c40f; padding: 5px;">CAUTION</p> <p>Improper handling of the control unit and its built-in components Defective control unit!</p> <ul style="list-style-type: none"> ▷ Handle the control unit and its built-in components carefully.
	<p style="background-color: #f1c40f; padding: 5px;">CAUTION</p> <p>Incorrect handling of the rechargeable battery Electrical damage to the control unit!</p> <ul style="list-style-type: none"> ▷ If the battery installation option is used, disconnect one of the battery's connectors before connecting the signalling module. This ensures that the control unit is completely de-energised. ▷ Do not re-connect the battery connector until the connection has been made.

BC version

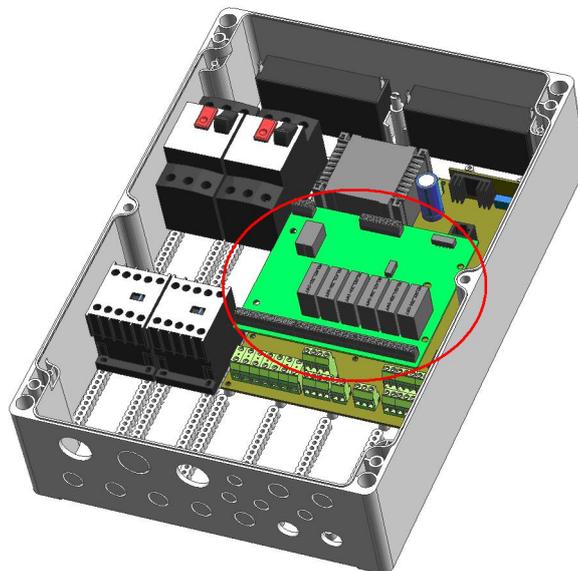
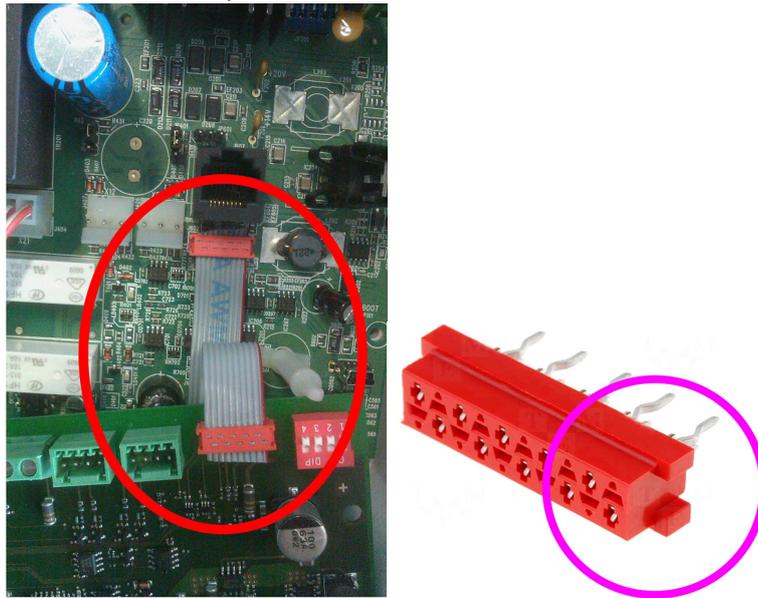


Fig. 3: Position of signalling module in BC version

- ✓ The place of installation conforms to the requirements.
- 1. Separate the control unit from the power supply and verify that it is de-energised.
- 2. Open the control unit using a suitable tool.
- 3. Carefully detach the BC PCB cover plate from the spacers.
- 4. Connect the signalling module to the BC PCB using the connection cable supplied.
 Make sure the connector is correctly positioned! When attaching the connection cable, observe the mechanical coding on the connectors!

(The connector has a pin that has to engage in the hole in the PCB next to the PCB-side connector.)



5. Snap the signalling module for the BC version onto the spacers and check that it is firmly seated.
6. Close the control unit again properly.
7. Reconnect the power supply.

When the device is switched on, the green status LED on the signalling module lights up continuously. This means that the signalling module is functioning correctly. If the green status LED on the signalling module does not illuminate, the correct seating of the cable connecting the signalling module and the LevelControl Basic 2 PCB must be checked again. If the green status LED on the signalling module flashes, the signalling module has not been detected by LevelControl Basic 2. In this case, check the firmware version of the control unit, which is displayed at parameter 4-1-1. Firmware version 1.2 or higher is required.

	NOTE
	<p>To set up a redundant pneumatic level measurement system, observe (⇒ Section 10.1.6, Page 33) .</p> <p>To set up a partially redundant bubbler system, observe (⇒ Section 10.1.7, Page 35) .</p>

BS version

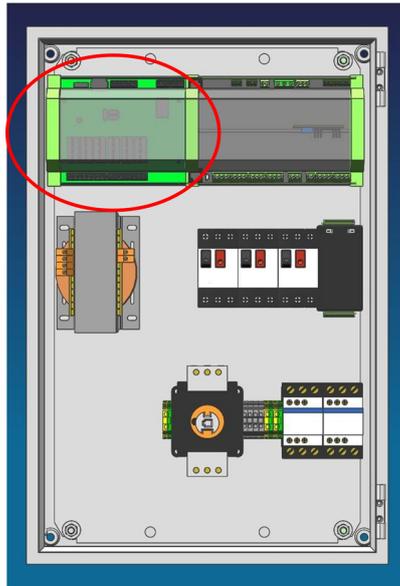


Fig. 4: Position of signalling module in BS version

- ✓ The place of installation conforms to the requirements.
- 1. Separate the control unit from the power supply and verify that it is de-energised.
- 2. Open the control unit.
- 3. Snap the signalling module for the BS version onto a free top hat rail slot and check that it is firmly seated.
- 4. Connect the signalling module to the BS PCB using the connection cable supplied.
Make sure the connector is correctly positioned! When attaching the connection cable, observe the mechanical coding on the connectors!
(The connector has a pin that has to engage in the hole in the PCB next to the PCB-side connector.)
- 5. Close the control unit again properly.
- 6. Reconnect the power supply.

When the device is switched on, the green status LED on the signalling module lights up continuously. This means the signalling module is functioning correctly. If the green status LED on the signalling module does not illuminate, the correct seating of the cable connecting the signalling module and the LevelControl Basic 2 PCB must be checked again. If the green status LED on the signalling module flashes, the signalling module has not been detected by LevelControl Basic 2. In this case, check the firmware version of the control unit, which is displayed at parameter 4-1-1. Firmware version 1.2 or higher is required.

	NOTE
	<p>To set up a redundant pneumatic level measurement system, observe (⇒ Section 10.1.6, Page 33) .</p> <p>To set up a partially redundant bubbler system, observe (⇒ Section 10.1.7, Page 35) .</p>

5.2 Connecting the current measuring module

	NOTE
	<p>LevelControl Basic 2 is only fitted with current measuring module(s) ex works. Current measuring modules cannot be retrofitted!</p>

Connect the current measuring module in accordance with the wiring diagram.
(⇒ Section 10.1.3, Page 31) / (⇒ Section 10.1.4, Page 32)

6 Commissioning/Start-up/Shutdown

6.1 Commissioning/start-up

- ✓ The supplementary operating manual and the installation/operating manual have been read.
- ✓ The device variant conforms to the requirements.
- ✓ The control unit has been assembled as per operating instructions and connected to the power supply in accordance with the wiring diagram.
- ✓ The signalling module has been installed as per operating instructions (⇒ Section 5.1, Page 11) and connected in accordance with the terminal diagram.
- ✓ The current measuring module has been installed as per operating instructions and connected in accordance with the terminal diagram.
 1. Re-tighten the connection terminals (individual signals, analog output, field bus connection and current measuring modules).
 2. Connect the power cable.
 3. Connect the sensors.
 4. Insert the motor protection device and fuses.
 5. Set the manual-0-automatic switches for both pumps to "0".
 6. Switch on the power supply.
 7. Check that the green status LED is continuously ON.
 8. Check that the parameters are set as required and adapt if necessary.
 9. Carry out test run for several start/stop cycles.
 10. Check alarm devices, including the individual signals, for proper function.
 11. Set the manual-0-automatic switches for both pumps to "Automatic".
 - ⇒ Both pumps can now be started/stopped by the control unit as required.
 12. Provide support and/or training for operating personnel.
 13. File a copy of the supplementary operating manual with the installation/operating manual.

6.2 Shutdown

Short-term shutdown

1. Set the manual-0-automatic switches for both pumps to "0".
 - ⇒ Both pumps are switched off.
 - ⇒ The control unit remains operational.

Short-term shutdown for work on the pump

1. Set the manual-0-automatic switches for both pumps to "0".
 - ⇒ Both pumps are switched off.
 - ⇒ The control unit remains operational.
2. Open the control unit.
3. For 400V variants:
Switch off motor protection switch for both pumps and secure to prevent restart.
For 230V variants:
Pull pump mains plug. If the pumps are connected directly to the terminals in the device, the device must be disconnected from the power supply.
4. Close the control unit again.

Long-term shutdown

1. Set the manual-0-automatic switches for both pumps to "0".
2. Switch off the power supply.

⇒ This disables all control and signalling functions.

7 Operation

7.1 Extensions with signalling/current measuring module

	NOTE
	Additional parameters available are documented on the enclosed parameter label.

If signalling module and, where applicable, current measuring module are installed, additional parameters appear in the display. These can be selected as usual using the arrow keys.

The selectable parameters depend on the operating mode and measurement method. Only parameters that are relevant to the current operating mode and measurement method are displayed.

7.1.1 Menu extension

7.1.1.1 Measured values menu

If the signalling module and current measuring module are used, parameters indicating the current values for each pump are added to the measured values menu.

Table 5: Additional parameters in measured values menu

Parameter		Description	Single-pump station	Dual-pump station
1-2-3	Current, pump 1	Current of pump 1 in ampere	x	-
1-3-3	Current, pump 2	Current of pump 2 in ampere	x	x

7.1.1.2 Settings menu

If a signalling module with redundant pressure measurement is used, the parameter indicating the installation height of the second open or closed pressure bell is added to the settings menu. (⇒ Section 10.1.6, Page 33)

Table 6: Additional parameter in settings menu

Parameter		Description	Values
3-4-5-1	Level of bell 2	Distance of the second pressure bell (lower edge) from the bottom of the tank (offset). Factory setting: 200 mm	200 mm (factory setting)

7.1.1.3 Signalling module fault

If a fault occurs at the signalling module during operation, this is indicated by fault - A17 - in the display.

Table 7: Signalling module fault message

Message	Description
- A17 -	Signalling module fault

7.1.2 Additional functions

7.1.2.1 Volt-free signals

If the signalling module is used, six volt-free signals are provided:

- Switching capacity: 30 V, 1 A
- Type: Change-over contact.

The signal relays are energised in the good or idle state and de-energise in the event of a signal.

Table 8: Volt-free signals

Volt-free signal	Standard assignment	Description	Signal status
Signal relay 1	Fault pump 1	Pump 1 is blocked due to a fault and cannot be started upon demand.	de-energised
Signal relay 2	Fault pump 2	Pump 2 is blocked due to a fault and cannot be started upon demand.	de-energised
Signal relay 3	High water (A9)	The high water switching point has been reached	de-energised
Signal relay 4	Sensor fault (A11)	Fault of the level measurement sensors used	de-energised
Signal relay 5	Pump 1 in operation	Pump 1 running	energised
Signal relay 6	Pump 2 in operation	Pump 2 running	energised

The state of the signal relays is also indicated by the yellow LEDs positioned above the relays on the PCB. An illuminated LED indicates an energised relay.

	NOTE
	In the case of lifting units with single-phase motor and cutter, signal relays 5 and 6 are used to control the start capacitors required for operation and are not available for volt-free signals.

	NOTE
	For single-pump systems, the signal relays normally assigned with signals for pump 2 do not carry any standard settings. These can be assigned using the ServiceTool.

The signal relays can be assigned with the following functions using the ServiceTool:

Table 9: Assignment of the signal relay

Signal	Description	Signal status
Message A1	Motor protection pump 1 (winding protection or motor protection switch tripped)	de-energised
Message A2	Motor protection pump 2 (winding protection or motor protection switch tripped)	de-energised
Message A3	Motor 1 temperature too high	de-energised
Message A4	Motor 2 temperature too high	de-energised
Message A5	Power failure	de-energised
Message A6	Phase error (phase failure)	de-energised
Message A7	Leakage at motor 1	de-energised
Message A8	Leakage at motor 2	de-energised
Message A9	High water alert	de-energised
Message A10	External alarm	de-energised
Message A11	Sensor fault	de-energised
Message A12	Incorrect rotary field of mains supply (phase sequence)	de-energised
Message A13	Undervoltage (-15 % of rated voltage)	de-energised
Message A14	Overvoltage (+15 % of rated voltage)	de-energised
Message A15	Flat battery	de-energised
Message A16	Service interval (activation via parameter 3-7-1)	de-energised
Fault pump 1	Pump 1 is blocked due to a fault and cannot be started upon demand.	de-energised
Fault pump 2	Pump 2 is blocked due to a fault and cannot be started upon demand.	de-energised
Pump 1 operational	No fault at pump 1, the manual-0-automatic switch is in "Auto" position	energised

Signal	Description	Signal status
Pump 2 operational	No fault at pump 2, the manual-0-automatic switch is in "Auto" position	energised
Pump 1 in operation	Pump 1 running	energised
Pump 2 in operation	Pump 2 running	energised
Pump 1 in automatic mode	Manual-0-automatic switch of pump 1 in "Auto" position	energised
Pump 2 in automatic mode	Manual-0-automatic switch of pump 2 in "Auto" position	energised
Check run pump 1	Check run of pump 1 in progress	energised
Check run pump 2	Check run of pump 2 in progress	energised

7.1.2.2 Analog output

The signal module offers an analog output with the following specifications:

Table 10: Analog output specifications

Specification	Value
Type	0/4–20 mA
External working resistance	Mains operation: max. 500 Ω Battery operation: max. 300 Ω

The analog output signals the measured fill level as standard.

The analog output can optionally be assigned with the following values using the ServiceTool:

Table 11: Analog output assignment

Parameter	Value	Display
	Level	(\Rightarrow Section 7.1.2.2.1, Page 19) to (\Rightarrow Section 7.1.2.2.4, Page 22)
1-1-3	Mains voltage of the system	0 mA = fault 4 mA \rightarrow 180 V 20 mA \rightarrow 500 V
None	System current - single-pump: current of pump 1 - dual-pump: current of pumps 1+2	0 mA = fault 4 mA \rightarrow 0 A 20 mA \rightarrow 30 A



NOTE

For current measurement > 10 (15) A, please note the following transformer factors:

10–20 (40) A: 4 mA \rightarrow 0 A, 20 mA \rightarrow 40 A

20–40 (60) A: 4 mA \rightarrow 0 A, 20 mA \rightarrow 60 A

40–75 (110) A: 4 mA \rightarrow 0 A, 20 mA \rightarrow 110 A

7.1.2.2.1 Level measurement using float switches or digital sensors

When digital level measuring methods are employed (floats, digital switches), a step signal corresponding to the switching status is displayed.

The allocation of the switching states is shown in the table below:

Table 12: Allocation of switching states for level measurement with float switches or digital sensors

Display	Level	Analog signal	Switching state	
			When draining	When filling
	Sensor fault	0 mA	-	-
	Very low	4 mA	Pumps OFF	Peak load pump ON
	Low	7 mA	Peak load pump OFF (irrelevant)	Base load pump ON
	Medium	10 mA	-	-
	High	13 mA	Base load pump ON	Peak load pump OFF (irrelevant)

Display	Level	Analog signal	Switching state	
			When draining	When filling
	Very high	16 mA	Peak load pump ON	Pumps OFF
	High water	20 mA	All pumps ON	All pumps OFF

	NOTE
	If sensor fault and high water are present at the same time, the high water level is output in accordance with the priority of the pending faults.

7.1.2.2.2 Level measurement using an analog sensor

If a 4–20 mA analog sensor is used for level measurement, the input signal of the sensor is duplicated.

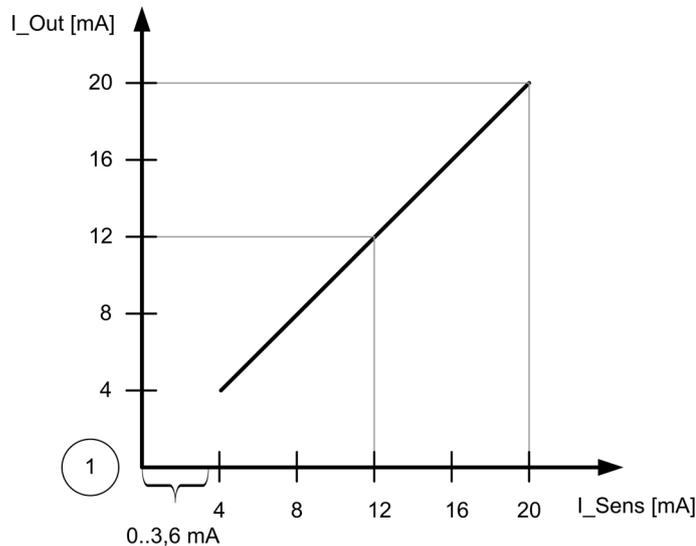


Fig. 5: Level measurement with analog sensor

1	0 mA = fault
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A sensor signal of between 0 and 3.6 mA indicates a broken wire, and sensor fault - A11- is output.

7.1.2.2.3 Level measurement using a bubbler system or pneumatic measurement

If pneumatic measurement (without compressor) or a bubbler system is used for level measurement, the analog output provides a level-proportional current signal, i.e. the measured value is converted into an output current from 4 to 20 mA, depending on the measuring range of the pressure sensor used in the signalling module.

If a control unit with pressure sensor for up to 3 metres of water is used, the fill level in the range of 0–4 mlc is converted into a signal of 4 to 20 mA.

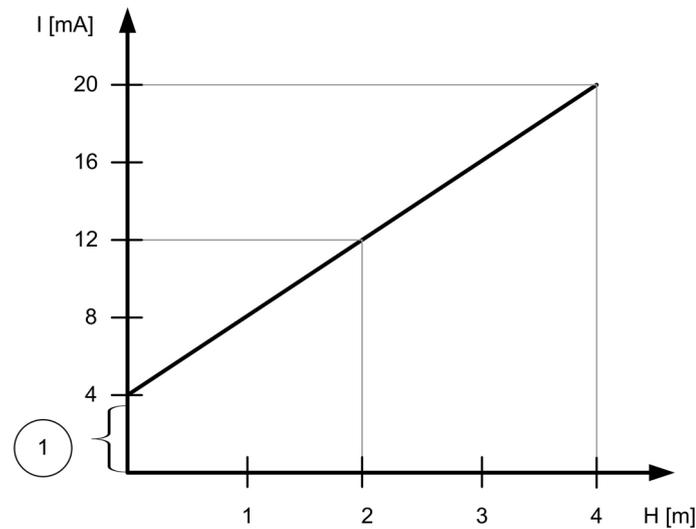


Fig. 6: Pneumatic measurement up to 3 mlc

1	0 mA = fault
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If a control unit with pressure sensor for up to 10 mlc is used, the fill level in the range of 0–12 mlc is converted into a signal of 4 to 20 mA.

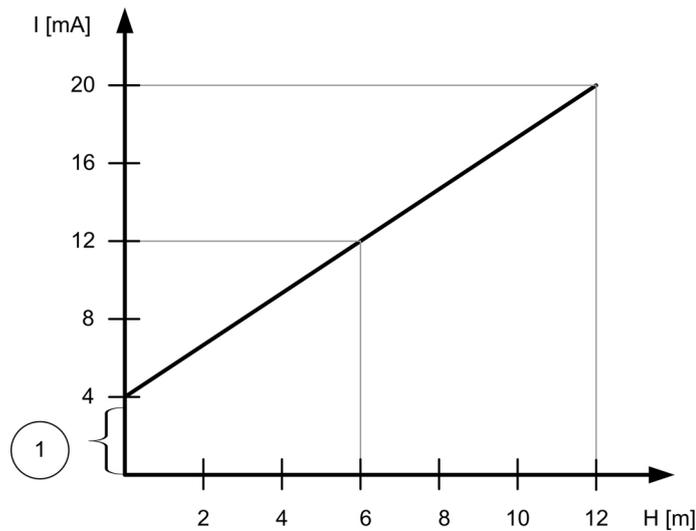


Fig. 7: Pneumatic measurement up to 10 mlc

1	0 mA = fault
---	--------------

If there is a sensor fault, it will always be indicated by 0 mA at the analog output.

7.1.2.2.4 Level measurement for lifting units

On control units for lifting units of the MiniCompacta/Compacta series, the analog output provides a level-proportional current signal, i.e. the values measured in the range of 0 to 1 mlc are converted into output currents from 4 to 20 mA, regardless of any settings made.

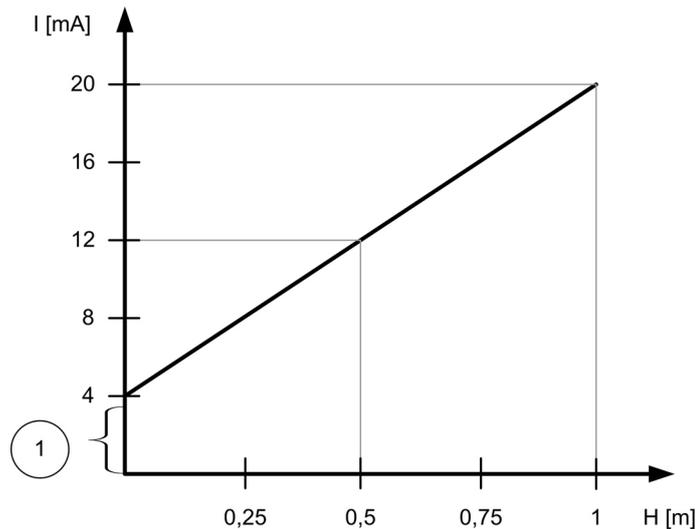


Fig. 8: Level measurement for lifting units

1	0 mA = fault
---	--------------

If there is a sensor fault, it will always be indicated by 0 mA at the analog output.

7.1.2.2.5 Level measurement using a partially redundant bubbler system or redundant pneumatic measurement

	<p>NOTE</p> <p>To set up a redundant pneumatic level measurement system or a partially redundant bubbler system, a signalling module with pressure sensor is required.</p>
	<p>NOTE</p> <p>Redundant arrangement of the sensors enables redundant minimum level monitoring as stipulated by the Atex directives.</p>
	<p>NOTE</p> <p>If the power supply fails and the unit is operated on battery power, level measurement will be non-redundant. The redundant pressure sensor is deactivated during battery operation.</p>
	<p>NOTE</p> <p>To set up a redundant pneumatic level measurement system or a redundant bubbler system, observe the wiring diagram/terminal diagram. (⇒ Section 10.1, Page 30)</p>

The signalling module provides the option of setting up a redundant pneumatic level measurement system or partially redundant bubbler system.

If a redundant level measurement system is used, the mean value of the two measured values is used for level measurement and pump control.

In the event of a fault in one of the two level measurement systems,

- for non-Atex applications (3-6-1 Atex-Mode = "0", deactivated), the higher of the measured values is used for controlling the pumps
- for Atex applications (3-6-1 Atex-Mode = "1", activated), the higher of the measured values is used as long as at least one of the two level measurement systems ensures sufficient submergence of the pump.

If a pump that represents a potential ignition source in a potentially explosive atmosphere can no longer be guaranteed to be sufficiently submerged, all running pumps will be stopped.

In the event of a fault, message "A11 – Sensor fault" is output.

7.1.2.3 Field bus connection

The extension module for LevelControl Basic 2 offers a Modbus-(RTU) interface which is galvanically isolated from the control unit.

The ModBus interface can be used directly for integration into a ModBus network and provides the option of connecting corresponding field bus gateways.

The ModBus interface is implemented as a RS485 interface with ModBus-(RTU) protocol in accordance with Specification v1.1b.

Table 13: Characteristics of the field bus connection

Characteristic	Description/value
Communication protocol	Modbus-RTU
Bus terminator	220 Ω (fixed, implemented internally, switchable)
Interface	EIA-485 (RS485)
Transmission rate	38400 bit/s (adjustable)
Data bits	8
Parity	Even
Stop bits	1
Device type	Slave
Bus access	Polling between master and slave
Pre-set device address	0xF7 (247)

7.1.2.3.1 Measured values and parameters

Various measured values and parameters are provided as device information via the field bus system. They can be accessed with function code 03 (read holding registers). Modbus-RTU only uses 16-bit coils. For values logged as 32-bit numbers, two coils therefore need to be read out.

To show numerals after the decimal point, the read value is to be moved to the right by the number of decimal places illustrated under "Type/Format".

Function code, coil and length are shown as hexadecimals and can be transferred directly to the Modbus-RTU protocol in this format.

Table 14: Measured values and parameters

Function code	Coil	Length	Type/Format	Parameter	Designation	Description
03	00 01	00 01	16 Bit "signed" #	1-1-1	Level (analog)	Displays the level in mm (analog level measurement)
03	00 02	00 01	16 Bit "signed" #	1-1-2	Level (digital)	Displays the level as status diagram (digital measurement)
03	00 03	00 01	16 Bit "signed" #	1-1-3	Line Voltage	Displays the mains voltage in volts
03	00 04	00 01	16 Bit "signed" #,#	1-1-4	Battery Voltage	Displays the battery voltage in volts
03	00 05	00 02	32 Bit "unsigned" #	1-1-5	System Operating Hours	Operating hours of the system
03	00 07	00 02	32 Bit "unsigned" #	1-2-1	Operating Hours Pump 1	Operating hours of pump 1
03	00 09	00 02	32 Bit "unsigned" #	1-2-2	Start Count Pump 1	Number of start-ups of pump 1
03	00 0b	00 02	32 Bit "unsigned" # ,0	1-2-3	Current Pump 1	Current of pump 1

Function code	Coil	Length	Type/Format	Parameter	Designation	Description
03	00 0d	00 02	32 Bit "unsigned" #,###	1-2-4	Effective Power Pump 1	Effective power of pump 1 in kW
03	00 0f	00 02	32 Bit "unsigned" #,##	1-2-5	Power Factor Pump 1	Power factor $\cos \varphi$ of pump 1
03	00 11	00 02	32 Bit "unsigned" #	1-3-1	Operating Hours Pump 2	Operating hours of pump 2
03	00 13	00 02	32 Bit "unsigned" #	1-3-2	Start Count Pump 2	Number of start-ups of pump 2
03	00 15	00 02	32 Bit "unsigned" #,#	1-3-3	Current Pump 2	Current of pump 2
03	00 17	00 02	32 Bit "unsigned" #,###	1-3-4	Effective Power Pump 2	Effective power of pump 2 in kW
03	00 19	00 02	32 Bit "unsigned" #,##	1-3-5	Power Factor Pump 2	Power factor $\cos \varphi$ of pump 2
03	00 1b	00 02	32 bit bit mask (\Rightarrow Section 7. 1.2.3.2, Page 25)	2-1-1	Pending Messages	Displays all active messages
03	00 1d	00 01	32 bit bit mask (\Rightarrow Section 7. 1.2.3.2, Page 25)		Further messages	

7.1.2.3.2 Message transfer

Device messages and other messages are transferred as bit masks with a width of 32 bits. Bit 31 is the highest-value bit (left), bit 0 is the lowest-value bit (right). Device messages are read out via coil "52 1c", all other messages via coil "52 1e".

Table 15: Device messages, coil 52 1c

Bit	Code	Designation	Description
Bit 0	- A1 -	Motor protection pump 1	Thermal circuit breaker or motor protection switch of pump 1 has triggered
Bit 1	- A2 -	Motor protection pump 2	Thermal circuit breaker or motor protection switch of pump 2 has triggered
Bit 2	- A3 -	Motor 1 temperature too high	Motor 1 temperature too high, thermal circuit breaker has triggered alert
Bit 3	- A4 -	Motor 2 temperature too high	Motor 2 temperature too high, thermal circuit breaker has triggered alert
Bit 4	- A5 -	Power failure	Power supply has been interrupted
Bit 5	- A6 -	Phase error	Phase error (phase failure)
Bit 6	- A7 -	Leakage at motor 1	Leakage at motor 1 — Leakage sensor has triggered
Bit 7	- A8 -	Leakage at motor 2	Leakage at motor 2 — Leakage sensor has triggered
Bit 8	- A9 -	High water alert	High water alert — tank is full
Bit 9	- A10 -	External alarm	External alarm – Device at the external input has been triggered
Bit 10	- A11 -	Sensor fault	Sensor fault (float switch fault, broken wire, short circuit)

Bit	Code	Designation	Description
Bit 11	- A12 -	Incorrect rotary field	Incorrect rotary field of mains supply (phase sequence)
Bit 12	- A13 -	Undervoltage	Undervoltage (-15 % of rated voltage)
Bit 13	- A14 -	Overvoltage	Overvoltage (+15 % of rated voltage)
Bit 14	- A15 -	Flat battery	Flat battery – Device will go into sleep mode soon
Bit 15	- A16 -	Service interval system	Service interval system, the service interval has expired, servicing required
Bit 16	- A17 -	Signalling module fault	A fault has occurred at the signalling module

Table 16: Device messages, coil 52 1e

Bit	Code	Designation	Description
Bit 0	# 0	General fault message	General fault message relay has switched
Bit 1	# 1	Fault pump 1	Pump 1 is blocked due to a fault and cannot be started upon demand.
Bit 2	# 2	Fault pump 2	Pump 2 is blocked due to a fault and cannot be started upon demand.
Bit 3	# 3	Pump 1 operational	No fault at Pump 1, the manual-0-automatic selector switch for Pump 1 is in "Auto" position
Bit 4	# 4	Pump 2 operational	No fault at pump 2, the manual-0-automatic selector switch for pump 2 is in "Auto" position
Bit 5	# 5	Pump 1 in operation	Pump 1 is running
Bit 6	# 6	Pump 2 in operation	Pump 2 is running
Bit 7	# 7	Pump 1 in automatic mode	Manual-0-automatic switch of pump 1 in "Auto" position
Bit 8	# 8	Pump 2 in automatic mode	Manual-0-automatic switch of pump 2 in "Auto" position
Bit 9	# 9	Check run pump 1	Check run of pump 1 in progress
Bit 10	# 10	Check run pump 2	Check run of pump 2 in progress

7.1.2.3.3 Functions

Various device functions of LevelControl Basic 2 can be executed via field bus. They can be accessed using function code 05 (Write Single Coil). Function code, coil and value are shown as hexadecimals and can be transferred directly to the Modbus-RTU protocol in this format.

Table 17: Field bus functions

Function code	Coil	Value	Designation	Description
05	f5 01	ff 00	Remote acknowledgement	Remote acknowledgement of all current fields
05	f5 02	ff 00 00 00	External fault	Set/delete the external alarm (A10) (Standard setting: both pumps OFF)

7.1.2.3.4 Termination

	NOTE
	The terminating resistors for ModBus RTU and field bus connection are set at the factory. If the signalling module is not the end device, remove the terminating resistors.

If LevelControl Basic 2 is operated as the end device in the field bus system or if a point-to-point connection with a field bus gateway is made, the terminating resistors must be set on the PCB in order to guarantee correct operation. This can be achieved easily via DIL switch S1.



Fig. 9: DIL switch S1

Table 18: DIL switch assignment

DIL switch	Connection	Description	Factory setting
1	ModBus RTU	RS485 termination	ON
2		RS485 termination	ON
3		Galvanically isolated GND (connecting RS485 GND with common GND)	OFF
4	System bus	CAN termination	ON
5		CAN termination	ON
6	Not used		OFF

8 Servicing/Maintenance

8.1 Maintenance/inspection measures

KSB recommends regular inspection/maintenance according to the following schedule:

Table 19: Maintenance/inspection measures

Measure	Inspection	Maintenance
Read the supplementary operating manual and the installation/operating manual	x	x
Check cable connection between signalling module and LevelControl Basic 2 PCB for correct installation	x	x
Check cable connection between current measuring module and signalling module for correct installation	x	x
Re-tighten connection terminals (individual signals, analog output, field bus connection, current measuring modules)	x	x
Check that the green status LED on the signalling module is continuously ON	x	x
Check parameters	x	
Carry out a test run for several start/stop cycles	x	x
Check alarm devices, including the individual signals, for proper function	x	x
Determine the spare parts requirements, if any.		x
Provide support and/or training for operating personnel	x	x
Supply new installation/operation manual if required	x	x

9 Trouble-shooting

Table 20: Trouble-shooting

Faults	Causes	Remedy
Control unit showing fault -A17-	A fault has occurred at the signalling module	<ul style="list-style-type: none"> ▪ Check signalling module connection ▪ Switch power supply off and then back on again ▪ Replace signalling module
Green status LED on signalling module not lit	Signalling module is not correctly connected to the PCB or is defective	<ul style="list-style-type: none"> ▪ Check signalling module connection ▪ Replace signalling module
Green status LED on signalling module flashes	Signalling module not detected	<ul style="list-style-type: none"> ▪ Check firmware version of the control unit and update if necessary
Individual signals are not output as required	Setting and/or connection fault	<ul style="list-style-type: none"> ▪ Check control unit setting ▪ Check signalling module terminal connection
Analog output delivering a faulty signal	Setting and/or connection fault	<ul style="list-style-type: none"> ▪ Check control unit setting ▪ Check signalling module terminal connection
Analog output delivering no signal	Setting and/or connection fault Level measurement faulty (message -A11-)	<ul style="list-style-type: none"> ▪ Check control unit setting ▪ Check signalling module terminal connection ▪ Check level measurement
Faulty behaviour during pneumatic measurement or bubbler control	Setting and/or connection fault Tubing is leaking	<ul style="list-style-type: none"> ▪ Check control unit setting ▪ Check tubing connections ▪ Check tubing for leakage
Parameters 1-2-3, Current Pump 1, and/or 1-3-3, Current Pump 2, are not shown or are shown interchanged in the display	Signalling or current measuring module connection fault Current measuring module connections to signalling module interchanged	<ul style="list-style-type: none"> ▪ Check connections of signalling and current measuring module
Communication via ModBus RTU faulty	Connection fault Communication fault Communication interrupted	<ul style="list-style-type: none"> ▪ Check connection ▪ Check settings ▪ Switch power supply off and then back on again ▪ Reset control unit
Communication with field bus system faulty	Connection fault Communication fault Communication interrupted	<ul style="list-style-type: none"> ▪ Check connection ▪ Check settings ▪ Switch power supply off and then back on again ▪ Reset control unit
Incorrect parameter settings after field bus access	Undocumented parameters can also be changed via field bus	<ul style="list-style-type: none"> ▪ Restore parameter settings ▪ Check script for field bus access and correct

10 Related Documents

10.1 Wiring diagram/terminal diagram

10.1.1 Individual signals - control board display (example)

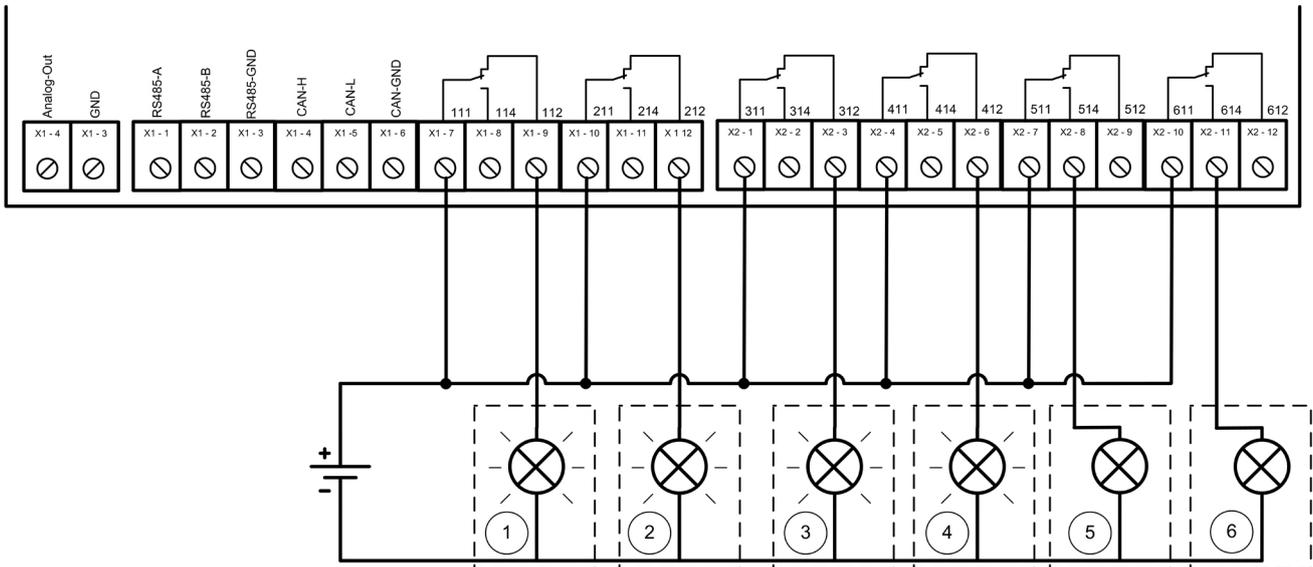


Fig. 10: Individual signals - control board display

1	Fault pump 1	2	Fault pump 2
3	High water	4	Sensor fault
5	Pump 1 in operation	6	Pump 2 in operation



NOTE

The assignment of the signal relays can be altered using the service tool.

10.1.2 Analog output

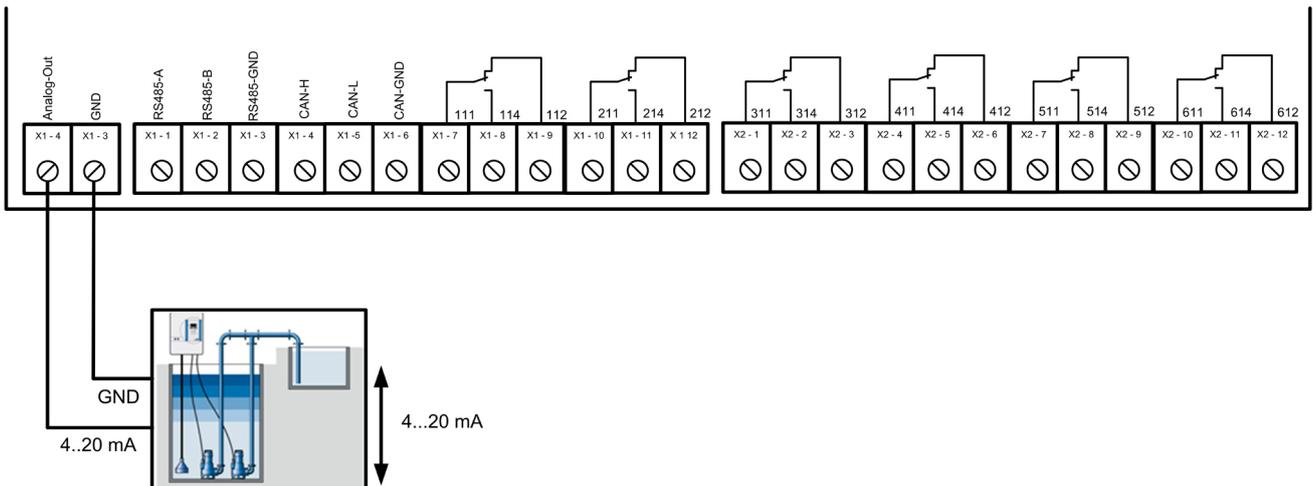


Fig. 11: Analog output



NOTE

The analog output provides a level-proportional 4–20 mA signal. The assignment can be altered using the service tool.

10.1.3 Three-phase current measurement

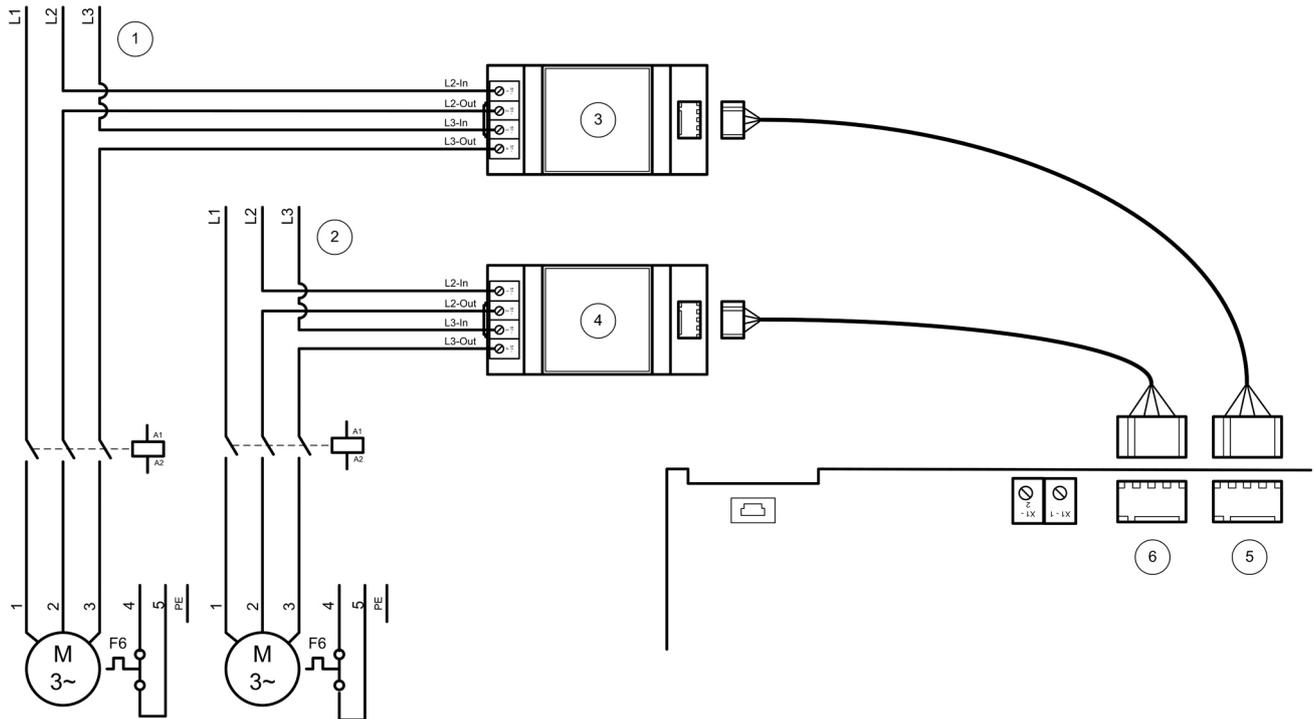


Fig. 12: Three-phase current measurement

1	Power supply to pump 1	2	Power supply to pump 2
3	Pump 1 current measuring module	4	Pump 2 current measuring module
5	Pump 1 current measurement connection to signalling module	6	Pump 2 current measurement connection to signalling module

10.1.4 Single-phase current measurement

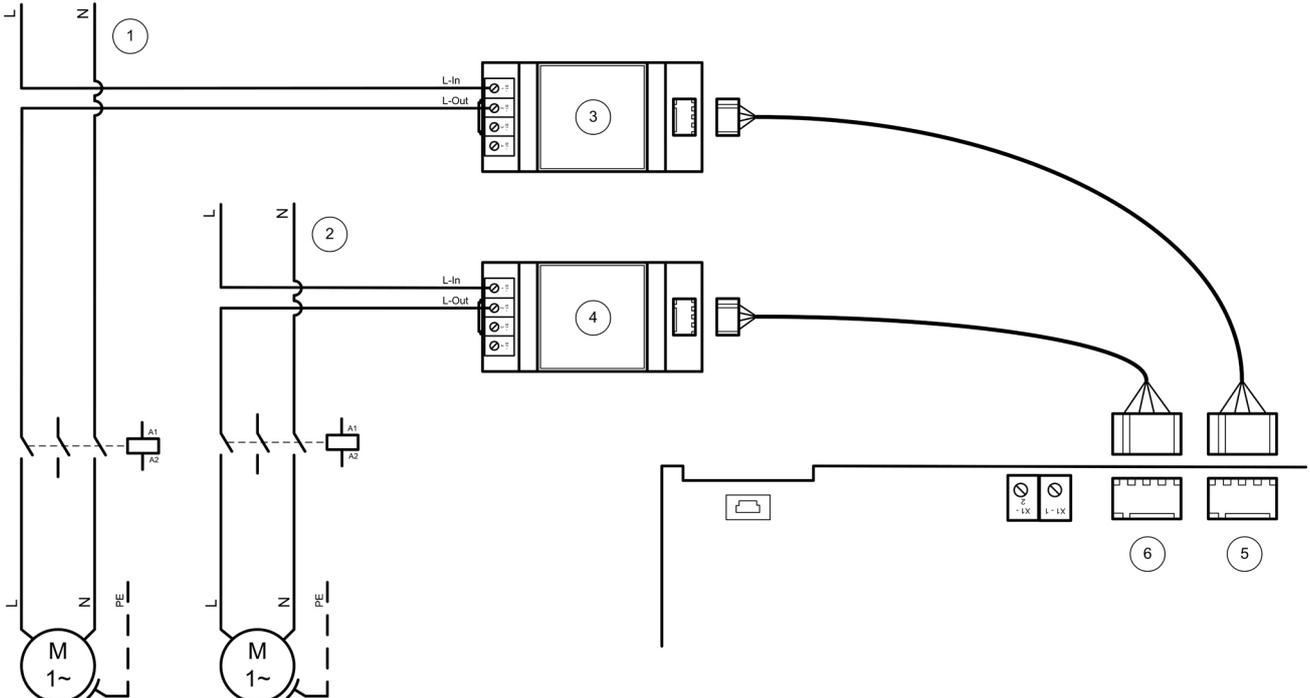


Fig. 13: Single-phase current measurement

1	Power supply to pump 1	2	Power supply to pump 2
3	Pump 1 current measuring module	4	Pump 2 current measuring module
5	Pump 1 current measurement connection to signalling module	6	Pump 2 current measurement connection to signalling module

10.1.5 Field bus connection

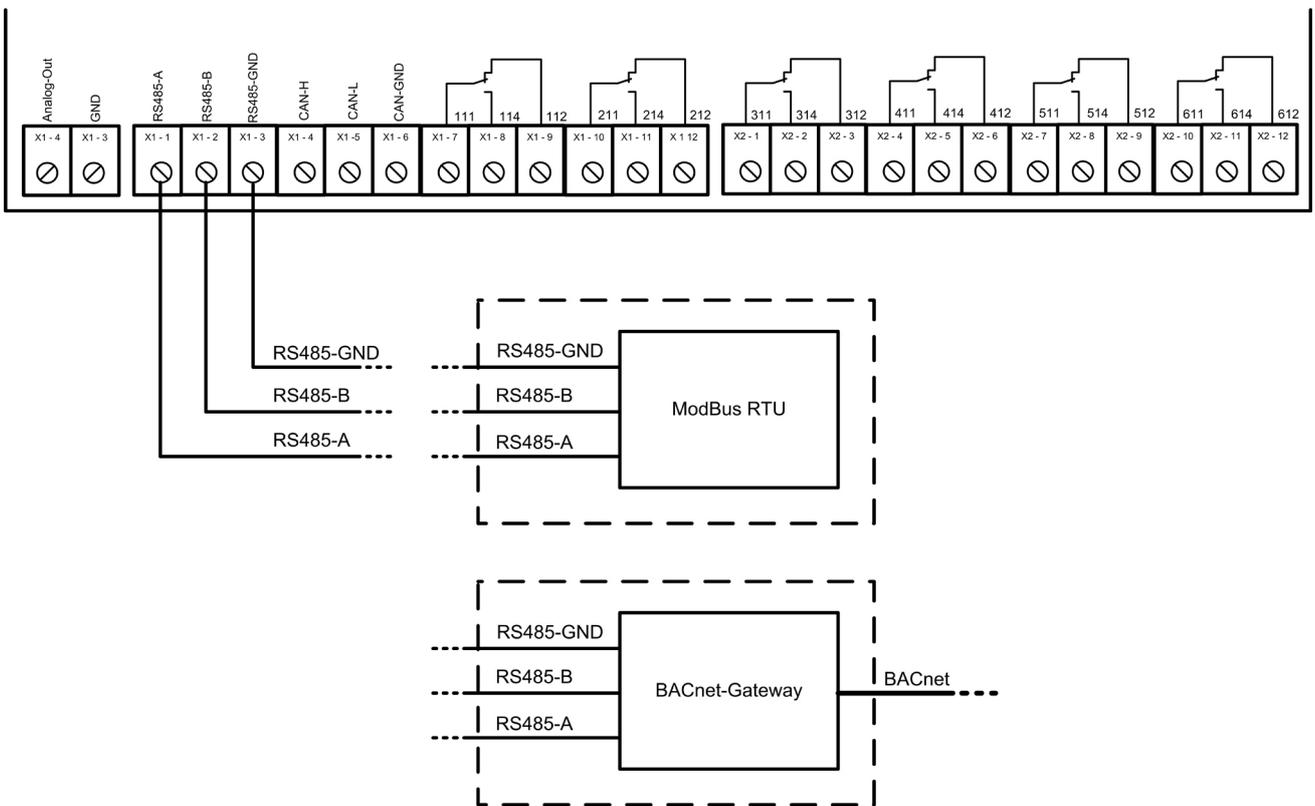


Fig. 14: Field bus connection

10.1.6 Redundant pneumatic level measurement



NOTE

The use of a redundant pneumatic system (without compressor) offers redundant level measurement and also, when ATEX mode is activated, redundant minimum level monitoring.

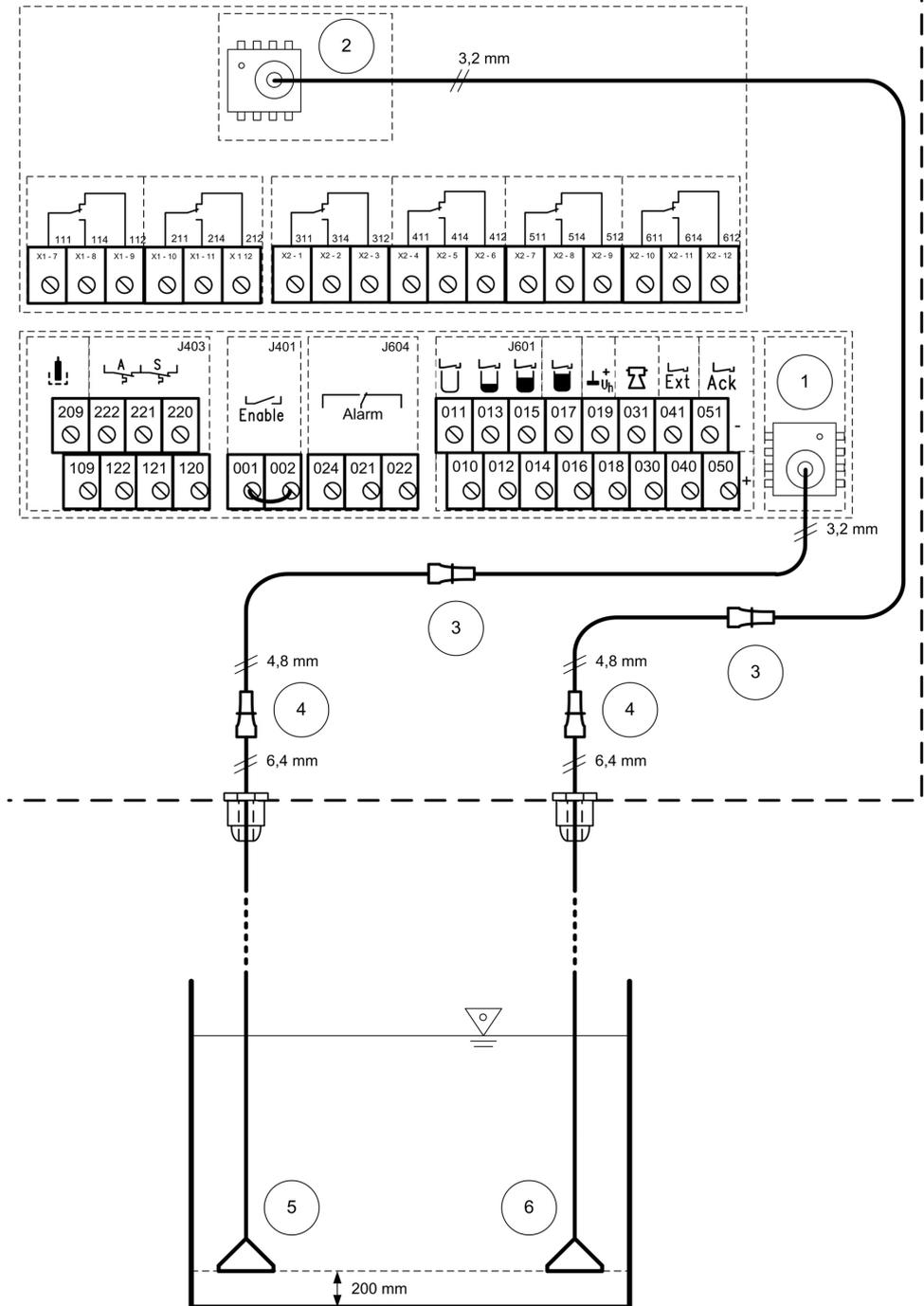


Fig. 15: Redundant pneumatic level measurement

1	LevelControl Basic 2 pressure sensor	2	Redundant pressure sensor on signalling module
3	Reducer	4	Reducer
5	Open or closed pressure bell	6	Redundant open or closed pressure bell

To set up a redundant pneumatic measurement system (without compressor), two sets of closed pressure bells or two sets of open pressure bells are required.

Both closed or open measuring bells must be mounted at a distance of 200 mm (bottom edge of bell) from the tank floor. If they are installed at a different installation height, this must be configured in the control unit.

Table 21: Parameter

Parameter	Designation
3-4-4-1	Level of bell 1
3-4-5-1	Level of bell 2

	<p>NOTE</p> <p>To relieve the strain on the plug-type connectors in the control unit, run the tubes of both closed or open measuring bells through cable glands and tighten firmly.</p>
	<p>NOTE</p> <p>To ensure the control unit is functioning correctly, the air supply tubes of both closed or open measuring bells must be routed with a continuously falling slope to prevent the formation of water pockets as a result of condensation. Tubes which are too long must be cut to length during installation.</p>

10.1.7 Partially redundant bubbler system

!

NOTE

If the compressor fails due to a fault, both level measurement systems continue to operate as redundant pneumatic level measurement systems (without compressor).

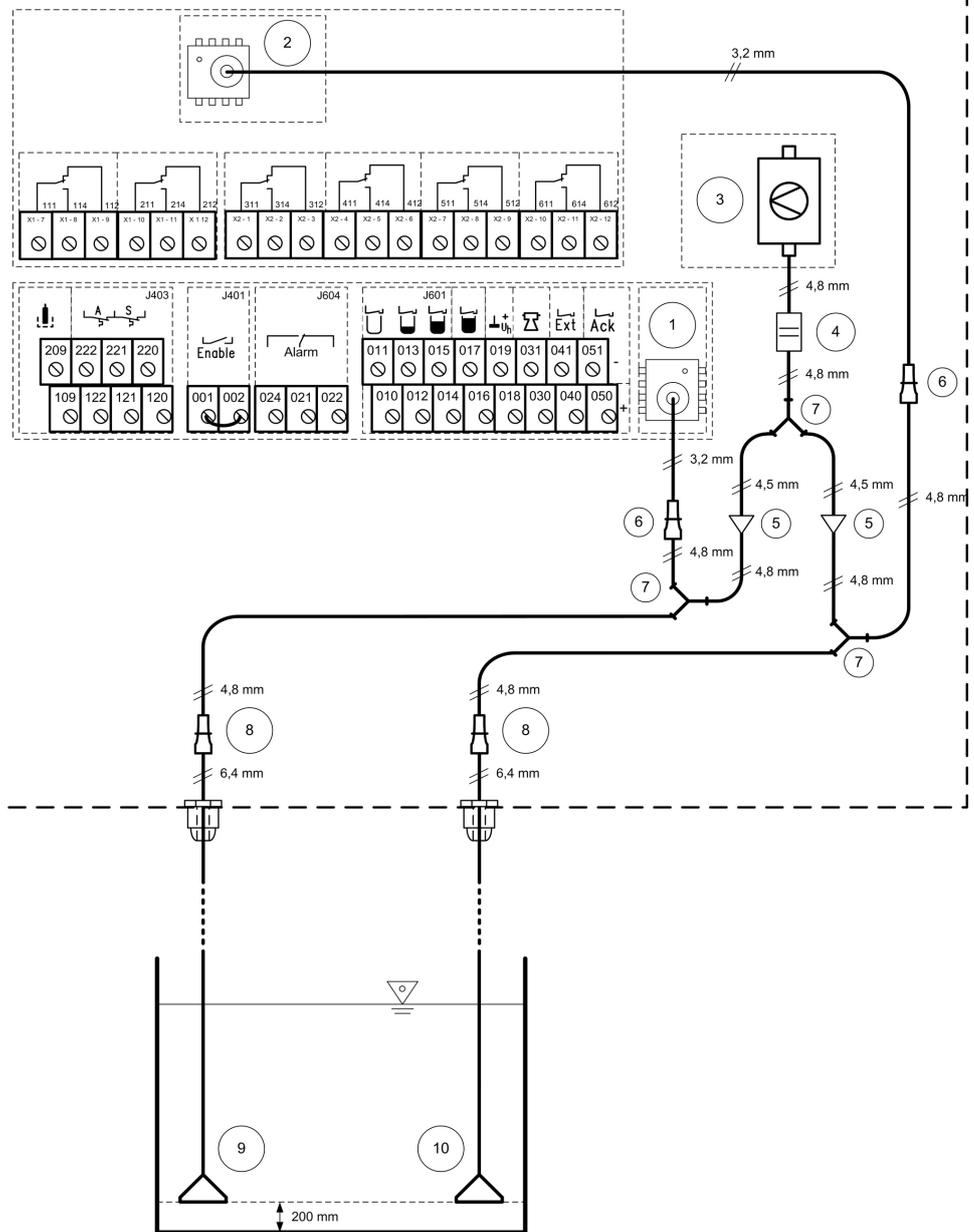


Fig. 16: Partially redundant bubbler system

1	LevelControl Basic 2 pressure sensor	2	Redundant pressure sensor on signalling module
3	Compressor for bubbler system	4	Orifice
5	Valve	6	Reducer
7	Y-piece	8	Reducer
9	Open pressure bell	10	Redundant open pressure bell

To set up a redundant pneumatic measurement system (without compressor), two sets of closed pressure bells or two sets of open pressure bells are required.

A set of two closed or open measuring bells must be mounted at a distance of 200 mm (bottom edge of bell) from the tank floor. If they are installed at a different installation height, this must be configured in the control unit.

Table 22: Parameter

Parameter	Designation
3-4-4-1	Level of bell 1
3-4-5-1	Level of bell 2

	NOTE
	To relieve the strain on the plug-type connectors in the control unit, run the tubes of both closed or open measuring bells through cable glands and tighten firmly.

	NOTE
	To ensure the control unit is functioning correctly, the air supply tubes of both closed or open measuring bells must be routed with a continuously falling slope to prevent the formation of water pockets as a result of condensation. Tubes which are too long must be cut to length during installation.

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