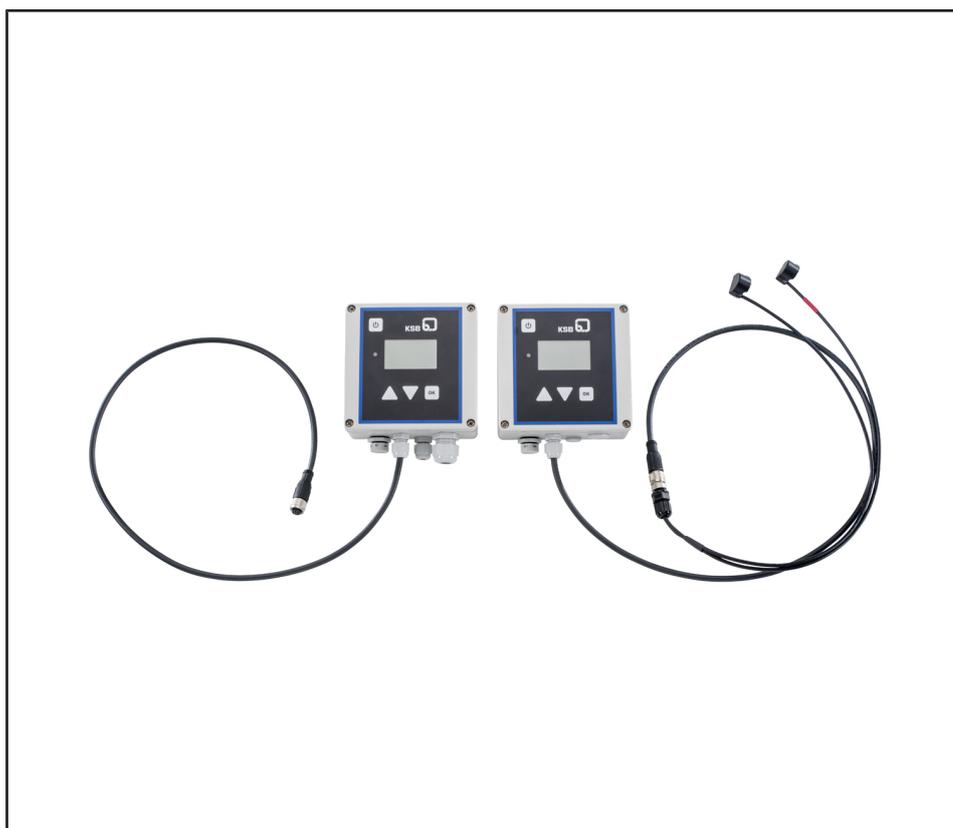


Measuring Computer

BOATRONIC MS / BOATRONIC MS-420

Operating Manual



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Operating Manual BOATRONIC MS / BOATRONIC MS-420

Original operating manual

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1 General

1.1 Principles

This operating manual is supplied as an integral part of the type series and variants indicated on the front cover. The manual describes the proper and safe use of this equipment in all phases of operation.

This product has been developed in accordance with state-of-the-art technology; it is manufactured with utmost care and subject to continuous quality control. This operating manual is intended to help you familiarise yourself with the device and its intended use. The operating manual contains important information for reliable, safe, proper and efficient operation. Compliance with the operating manual is of vital importance to ensure reliability and a long service life of the device and to avoid any risks. The operating manual does not take into account local regulations; the operator must ensure that such regulations are strictly observed by all, including the personnel called in for installation. The BOATRONIC measuring computers must not be operated beyond the limit values for the supply voltage, ambient temperature and safety class specified in the technical product literature. Make sure that operation is in accordance with the instructions laid down in this operating manual. The name plate indicates the type series, the material number and the series number; please quote this information in all queries, repeat orders and particularly when ordering spare parts. You will also find specifications regarding the power supply as well as the enclosure here.

In the event of damage, immediately contact the KSB sales organisation responsible in order to maintain the right to claim under warranty.

1.2 Target group

This operating manual is aimed at the target group of trained and qualified specialist technical personnel.

1.3 Symbols

Table 1: Symbols used in this manual

Symbol	Description
✓	Conditions which need to be fulfilled before proceeding with the step-by-step instructions
▷	Safety instructions
⇒	Result of an action
⇄	Cross-references
1. 2.	Step-by-step instructions
	Note Recommendations and important information on how to handle the product



2 Safety

All the information contained in this section refers to hazardous situations.

In addition to the present general safety information the action-related safety information given in the other sections must be observed.

2.1 Key to safety symbols/markings

Table 2: Definition of safety symbols/markings

Symbol	Description
 DANGER	DANGER This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.
 WARNING	WARNING This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.
 CAUTION	CAUTION This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.
	General hazard In conjunction with one of the signal words this symbol indicates a hazard which will or could result in death or serious injury.
	Electrical hazard In conjunction with one of the signal words this symbol indicates a hazard involving electrical voltage and identifies information about protection against electrical voltage.
	Machine damage In conjunction with the signal word CAUTION this symbol indicates a hazard for the machine and its functions.

2.2 General

This operating manual contains general installation, operating and maintenance instructions that must be observed to ensure safe product operation and prevent personal injury and damage to property.

The safety information in all sections of this manual must be complied with.

The operating manual must be read and fully understood by the specialist personnel/operators responsible prior to installation and commissioning.

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

Instructions and information attached directly to the product must always be complied with and kept in a perfectly legible condition at all times. This applies to the manufacturer and type designation, for example.

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

This operating manual does not take into account:

- Any eventualities or incidents which may occur during installation performed by the customer, operation and maintenance.
- Local regulations; the operator must ensure that such regulations are strictly observed by all, including the personnel called in for installation.

2.3 Personnel qualification and training

All personnel involved must be fully qualified to install, operate, maintain and inspect the equipment this manual refers to.

The responsibilities, competence and supervision of all personnel involved in installation, operation, maintenance and inspection must be clearly defined by the operator.

Deficits in knowledge must be rectified by means of training and instruction provided by sufficiently trained specialist personnel. If required, the operator can commission the manufacturer/supplier to train the personnel.

2.4 Consequences and risks caused by non-compliance with this operating manual

- Non-compliance with this operating manual will result in loss of warranty and forfeiture of any and all rights to claims for damages.
- Non-compliance can, for example, have the following consequences:
 - Hazard to persons by electrical and mechanical effects
 - Failure of important product functions
 - Failure of prescribed maintenance and servicing practices

2.5 Safety awareness

In addition to the safety information contained in this manual and the intended use, the following safety regulations shall be complied with:

- Accident prevention, health and safety regulations
- Applicable standards, directives and laws

2.6 Safety information for the operator/user

Eliminate all electrical hazards. (In this respect, refer to the applicable national safety regulations and/or regulations issued by the local energy supply companies.)

2.7 Safety information for maintenance, inspection and installation

- Modifications or alterations are only permitted with the manufacturer's prior consent.
- Use only original spare parts or parts authorised by the manufacturer. The use of other parts can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that maintenance, inspection and installation is performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.
- Any work on the product shall only be performed when it has been disconnected from the power supply (de-energised).
- As soon as the work has been completed, re-install and/or re-activate any safety-relevant and protective devices. Before returning the product to service, observe all instructions on commissioning.

2.8 Unauthorised modes of operation

Never operate the product outside the limits stated in the type series booklet and in this operating manual.

The warranty relating to the operating reliability and safety of the product supplied is only valid if the product is used in accordance with its intended use.

3 Transport/Temporary Storage/Disposal

3.1 Checking the condition upon delivery

1. On transfer of goods, check each packaging unit for damage.
2. In the event of in-transit damage, assess the exact damage, document it and notify KSB or the supplying dealer (as applicable) and the insurer about the damage in writing immediately.

3.2 Transport

Transport of the equipment requires proper preparation and handling. Prior to dispatch, the equipment was tested and inspected to ensure full compliance with specifications. Consequently, the equipment should be in perfect electrical and mechanical condition upon arrival at its destination.

3.3 Storage

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

	CAUTION
	<p>Damage during storage due to humidity, dirt or vermin Corrosion/contamination of the measuring computer!</p> <ul style="list-style-type: none"> ▸ For outdoor storage, package the measuring computer or packaged measuring computer with waterproof material.

Table 3: Ambient conditions for storage

Ambient condition	Value
Relative humidity	85 % max. (non-condensing)
Ambient temperature	-20 °C to +50 °C

- Store the measuring computer under dry and vibration-free conditions, if possible in its original packaging.
- Store the measuring computer in a dry room where the level of atmospheric humidity is as constant as possible.
- Prevent excessive fluctuations in atmospheric humidity (see table on ambient conditions for storage).

3.4 Disposal

Due to some components, the product is classified as special waste:

1. Dismantle the product.
2. Remove batteries.
3. Dispose of materials in accordance with local regulations or in another controlled manner.
PCBs, power electronics, capacitors and electronic components are all hazardous waste.

4 Product Description

4.1 General description

BOATRONIC measuring computers are used to measure the flow rate and temperature in conjunction with balancing and measurement valves of the BOA-Control, BOA-Control IMS or BOA-CVE IMS series. The "BOATRONIC S" PC software, available as a free download, can be used to transfer measurement logs to BOATRONIC measuring computers as well as to edit and read them.

The "BOATRONIC S" software can be downloaded from the KSB product catalogue at: <http://shop.ksb.com/catalog/k0/en/product/ES000464>

Table 4: Overview of BOATRONIC measuring computers

Type	BOATRONIC MS	BOATRONIC MS-420
Function	<ul style="list-style-type: none"> ▪ Short-term measurement ▪ Mobile device ▪ USB interface ▪ Compatible with the BOATRONIC S software 	<ul style="list-style-type: none"> ▪ Permanent measurement set-up ▪ Current output 4 - 20 mA for Q and T
Supply	4x 1.5 V batteries	24 V DC

4.2 Configuration and function

To determine the flow rate and temperature with the BOATRONIC measuring computer, the computer must be connected to a BOA-Control or BOA-Control IMS balancing and measurement valve. In the case of the BOA-Control valve, which is supplied prepared for taking measurements, the ultrasonic sensors that ship with the BOATRONIC MS must be coupled with the measurement cams on the BOA-Control valve (⇒ Section 5.1, Page 13) . On the BOA-Control IMS balancing and measurement valve, these sensors are already affixed to the valve. The BOATRONIC MS measuring computer is a mobile battery-powered device. The BOATRONIC MS-420 measuring computer must be installed on site and connected to a voltage source.

4.3 Display/indicator and operating elements



Fig. 1: BOATRONIC display overview

The device is switched on by briefly by pressing the Power/Off key. Press the Power/Off key for 3 or more seconds to switch the unit off (BOATRONIC MS only).

Table 5: Operating elements: Sealed tactile keys

Key	Function
▲▼ keys	Select a row [menu levels]
▲▼ keys	Toggle physical units for volume flow rate Q or display flow velocity V [measurement screen]
OK key	Confirm a row/entry or continue in menu [menu levels]
OK key > 3 seconds	Select or deselect project name / measuring point designation for editing
⏻ key < 3 seconds	Display backlight on/off (in operation)
⏻ key > 3 seconds	Switch off (in operation)
⏻ key	Switch on

Display/indicator elements:

- Two-tone LED display (green, red)
- Various error messages/information are shown on the LCD display

Table 6: LEDs

LED	Description
Green	Measuring or data logger active
Flashing green	Calibration active
Red	Fault
Flashing red	Incorrect direction of flow

Display

Measuring	17:22	
	40 °C	DN
5 m³/h		50
Glykosol N (MEG)		25 %

The following information is displayed:

- Volume flow rate Q in [m³/h], [l/min] or [l/s] OR flow velocity V in [m/s] (measured value)
- Temperature T in [°C] or [°F] (measured value)
- Q_REF (Measuring/Save, black background)
- Valve position in % (verification screen)
- Battery status/error code (optional: active USB interface)
- Menu level designation or measuring point designation
- Selected fluid including concentration
- Selected nominal size DN
- Time/date

4.4 Technical data of BOATRONIC MS, BOATRONIC MS-420

Table 7: Technical data of BOATRONIC MS, BOATRONIC MS-420

Characteristic		Measuring computer	
		BOATRONIC MS	BOATRONIC MS-420
Power supply		1.5 volt batteries, 4 pcs, AA Mignon	24 V DC \pm 25 %
Output Q [m ³ /h]		Display Q in m ³ /h, alternatively in [l/s] or [l/min] OR V in [m/s]	Current output 4 - 20 mA (0 m ³ /h = 4 mA) (max. m ³ /h "depending on DN" = 20 mA)
Output T (-10 to +120 °C)		Display T in [°C], alternatively in [°F]	Current output 4 - 20 mA (-10 °C = 4 mA) (+120 °C = 20 mA)
Current requirement [mA]		150	190
Low voltage detection		Battery status icon flashes when battery is very low (7.2 V) 1. Under 10 % voltage, error F16: Measuring still possible 2. Under 5 % voltage, message "Please change batteries": No measurement possible 3. Under 1 % voltage, message "Low battery": Device switches off.	-
Terminals: Output/power supply		-/2 battery holder	Spring-type
Enclosure to EN 60529		IP54	IP54
Safety class		III	III
Shock test, drop from 1 m		Passed	Passed
In-service ambient temperature		-20 to +50 °C	
In-storage ambient temperature		-20 to +50 °C	
Measuring range	Temperature	-10 to +120 °C	
	Flow velocity	0.1 to 4 m/s	
Measurement accuracy ¹⁾	Flow rate	\pm 5 % of actual value	
Measurement cable	Sensor connection	1 m in length (cannot be changed)	

4.5 USB interface (BOATRONIC MS only)

Measurement logs can be transferred using the "BOATRONIC S" PC software.

Required cable: USB to mini-USB²⁾

The "BOATRONIC S" software can be downloaded from the KSB product catalogue at: <http://shop.ksb.com/catalog/k0/en/product/E5000464>

More information on the USB interface upon request.

1) Applies to BOA-Control IMS with H₂O at 20 °C, v \geq 0.5 m/s with manual zero point calibration
 2) Not included in the scope of supply.

5 Preparing for Measurement

	CAUTION
	<p>Incorrect installation position and upstream stabilisation distances Measurements only possible to a limited extent or not possible at all!</p> <ul style="list-style-type: none"> ▸ Maintain the defined installation positions, upstream stabilisation distances and flow direction of the valve. Refer to operating manual 0570.88/14.

	CAUTION
	<p>Changing the cable length at the measuring computer or at the sensor system Measuring no longer possible!</p> <ul style="list-style-type: none"> ▸ The connection cable of the BOATRONIC measuring computer and the cable from the ultrasonic transducers to the connector have a fixed length and must not be changed! An extension cable of 1.2 m length is available as an accessory.

To take correct measurements, the measuring section of the BOA-Control and/or BOA-Control IMS must be free of deposits before installing the valve. Deposits such as grease or dust can be removed with a dry, grease-free cloth.

	NOTE
	<p>If the difference in temperature between the fluid and the environment is > 20 K, insulate the valves to ensure optimum accuracy.</p>

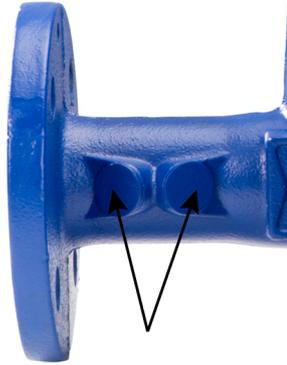
	NOTE
	<p>When installing the BOATRONIC MS-420 measuring computer, the connectors for the sensor cable and the BOATRONIC MS-420 must be firmly screwed together.</p>

	NOTE
	<p>For greater ease of handling, magnets are fitted in the transducers of the sensor system. Direct contact with storage media or other electrical devices sensitive to magnetic fields should be avoided.</p>

	NOTE
	<p>For optimum measurement results with the highest possible degree of accuracy the operating software must be up to date. To this end KSB regularly provides the latest software for updating the BOATRONIC MS/MS-420 operating software at the following link: http://shop.ksb.com/catalog/k0/en/product/ES000464</p>

5.1 BOA-Control

BOA-Control, which is supplied prepared for taking measurements, comes with protective nubs placed on the measuring cams to protect the surface. The following steps must be carried out in order to take a measurement:



1. Remove the protective nubs from the measuring cams.



2. Apply coupling grease to the measuring cams. Make sure to apply a sufficient quantity of grease to prevent air pockets from forming when positioning the sensor. Mineral oil-based greases without fillers, such as Klüberlub PHB 71-461 or Addinol LM 2 EP, can be used for coupling grease.
3. Couple the ultrasonic sensors to the measuring cams, ensuring that the sensor with the red marking is affixed "downstream" of the black sensor (on the right in the direction of flow).



4. After the measurement has been taken, clean the measuring cams and re-affix the protective nubs or leave the grease on the measuring cams for corrosion protection.



NOTE

The coupling process should last for more than one minute to ensure a more exact temperature measurement.

	<p>NOTE</p> <p>Measuring cams and sensors must be free of dirt and paint residues. Clean the measuring cams if necessary.</p>
	<p>NOTE</p> <p>The mobile sensors must be protected from metallic particles.</p>
	<p>NOTE</p> <p>For insulated BOA-Control valves, the insulation material must be removed before the ultrasonic sensors are coupled. Suitable insulating boxes are available as accessories.</p>

5.2 BOA-Control IMS

The sensors for the BOA-Control IMS valve are permanently bonded to the measuring cams. BOATRONIC MS and BOATRONIC MS-420 measuring computers can be connected.

6 Fluids Handled

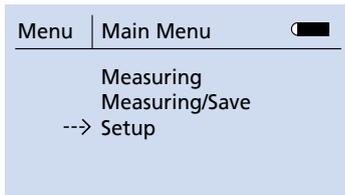
The most commonly used fluids and their sound velocities are defined in the BOATRONIC measuring computers. "Water" always appears as the default setting. If the fluid is not known, "Unnamed liquid" can be selected. Lower measurement accuracy is the consequence.

Table 8: Available fluids

Fluid index	Fluid name
1	Pekasol L
2	Glykosol N (MEG ³⁾)
3	Pekasol 2000
4	Antifrogen N (MEG ³⁾)
5	Ethylene glycol
6	Propanediol
7	Glythermin NF (MEG ³⁾)
8	Antifrogen L (1,2-PLG ⁴⁾)
9	Glyther2.P44 (1,2-PLG ⁴⁾)
10	Solotherm WT (1,2-PLG ⁴⁾)
11	Varidos FSK (ethanediol)
12	Water (default setting/factory setting)
13	Unnamed liquid

3) Monoethylene glycol
4) Glythermin

7 Setup



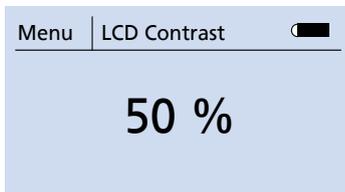
1. Select the "Setup" menu item with the ▲ ▼ keys in the main menu and confirm with the **OK** key.

Date/Time



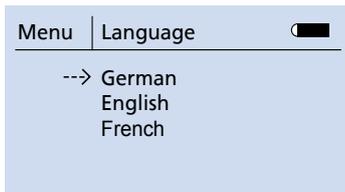
1. Select the "Date/Time" menu item with the ▲ ▼ keys in the Setup menu and confirm with the **OK** key.
2. Set day/month/year and hours/minutes with the ▲ ▼ keys and confirm each with the **OK** key.

LCD Contrast



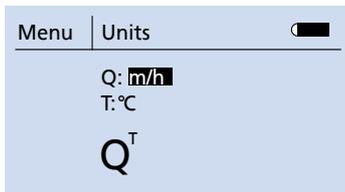
1. Set the contrast in percent with the ▲ ▼ keys and confirm with the **OK** key.

Language

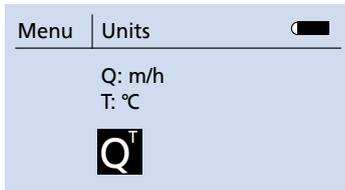


1. Set the language (German, English, French) with the ▲ ▼ keys and confirm with the **OK** key.

Units



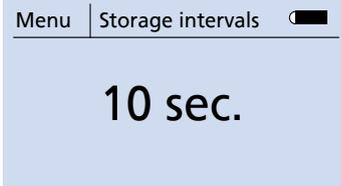
1. Select the units for volume flow rate "Q" and temperature "T" with the ▲ ▼ keys and confirm with the **OK** key. As an alternative, flow velocity V can be selected instead of volume flow rate Q.
2. Q = [m³/h], [l/s]; [l/min] / V = [m/s]
3. T = [°C]; [°F]



1. Select the primary measurement and secondary measurement configurations Q^(T) or V^(Q) and T^(Q) or T^(V) with the ▲ ▼ keys and confirm with the **OK** key.

The units can also be toggled on the measurement screen. The primary/secondary measurement configuration can only be changed in this menu. Both measurements can always be viewed on the measurement screen.

The flow velocity V can also be displayed on this screen.

Data Logger


The data logger can save up to 500 measured values per measuring point in individual storage intervals. The data log can only be read with the BOATRONIC S PC software.

✓ The plug-type connection between the measuring computer and the sensor set must be established.

1. Select the "Data Logger" menu item in the Setup menu with the ▲▼ keys and confirm with the  key.
2. Enter the measuring point designation. Select the individual letters with the ▲▼ keys and confirm with the  key. To close the name editor press the  key for more than 3 seconds. Then press the  key again to access the next menu level.
3. Select "Select DN" (see handwheel cap) with the ▲▼ keys in the "Select the nominal size DN" selection menu and confirm with the  key.
4. Select "Select Fluid" with the ▲▼ keys in the "Select Fluid" selection menu and confirm with the  key.
 - ⇒ If the fluid is not known, "Unnamed liquid" can be selected. Lower measurement accuracy is the consequence.
 - ⇒ The "Set concentration" step is not required for the "Unnamed liquid" or "Water" selections.
5. Select the concentration with the ▲▼ keys in the "Concentration" selection menu and confirm with the  key.
 - ⇒ The specification in percent defines the percentage of the fluid selected in water (e.g. 25 % Glykosol N in the available water-glycol mixture).
6. Select "Valve position" with the ▲▼ keys and confirm with the  key.
7. Select the required storage interval for the measured values with the ▲▼ keys and confirm with the  key.
8. Select the quantity of measured values to be stored with the ▲▼ keys and confirm with the  key. A maximum of 500 measured values can be stored.
9. Zero point calibration starts automatically after the concentration has been confirmed with the  key. The display then shows "Calibration" and a percentage as well as the loading symbol. If a valid zero point calibration has already been performed/stored, the measurement starts directly without repeating the calibration step.
 - ⇒ After successful calibration (100 %), the measurement starts automatically. Unless configured otherwise, volume flow rate Q and temperature T are displayed in standard units $Q = [m^3/h]$ and $T = [^{\circ}C]$.

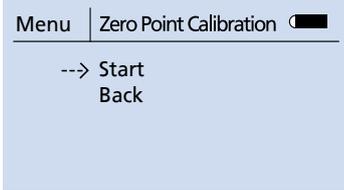
▲▼: Change physical unit of primary measurement on measurement screen

: End measurements --> Main menu

If the "No signal" message appears, the measurement must be repeated by pressing the  key.

After the measurement process has been either completed or cancelled, the following prompts are displayed: "Continue Measuring" (repeat), "Exit With Save" or "Exit Without Save". Select the required option with the ▲▼ keys and confirm with the  key.

Zero Point Calibration



Zero point calibration is recommended for a more accurate measurement. The valve must be closed for this purpose. The measuring computer calibrates only when the fluid is stationary. The nominal size and the fluid including concentration must be entered.⁵⁾

	NOTE
Only close the valve when the measuring computer specifically prompts you to do so.	

1. In the "Zero Point Calibration" selection menu, select "Start" with the keys ▲▼ and confirm with the key.
 2. In the following selection menus enter the nominal size DN, the fluid and the concentration with the ▲▼ keys and confirm each with the key.
 3. Follow the prompt on the display: Close the valve and confirm with the key.
 4. To start the zero point calibration, choose "Run" in the "Zero Point Calibration" selection menu and confirm with the key.
 - ⇒ The calibration starts.
 - ⇒ When the calibration successfully concludes, the display reads "Initialisation Successful" and the measuring computer goes back to the "Setup selection menu."
- ⇒ The measurement procedure can now be started.

	CAUTION
<p>Zero point calibration still active Incorrect measured values or no measurement possible!</p> <ul style="list-style-type: none"> ▷ Manual zero point calibration always applies exclusively to the valve it has been performed on. For a different valve a new calibration is required. For safety reasons the current calibration is always deleted if one of the measurement parameters (DN, fluid, concentration) has been changed, if no sensor is connected (F01), if the error message "No signal" has been displayed for more than 20 seconds (F02) or if a loss of voltage has occurred (BOATRONIC MS only). The error message F09 indicates that the calibration is not valid. ▷ On BOATRONIC MS-420 the manual zero point calibration is not deleted in the case of loss of voltage (device switched off, power cut, etc). Once the voltage returns, BOATRONIC MS-420 re-starts in measuring mode with the manual zero point calibration saved. 	

Time Out Backlight



1. Set the duration of the backlighting with the ▲▼ keys and confirm with the key.
2. "Off" = Backlighting remains on.

5) This procedure may take up to one minute.

Auto Power Off



1. Activate automatic deactivation of the BOATRONIC measuring computer and define the time window.
2. Make your selection with the ▲ ▼ keys and confirm with the **OK** key.

Memory

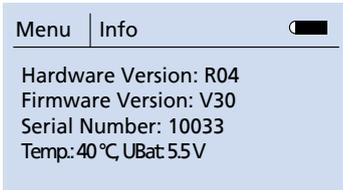


1. Information about available and assigned memory.
2. Option of restoring the factory settings of the BOATRONIC measuring computer.

	NOTE
The memory is cleared completely and all parameters are reset to default (measurement logs, zero point calibrations, etc. will be lost).	

3. Make your selection with the ▲ ▼ keys and confirm with the **OK** key.

Info



- Information about the firmware and hardware versions
- Serial number
- Temperature
- Sound velocity of the fluid handled
- Battery voltage

8 Taking Measurements

- ✓ Power supply must be provided. For BOATRONIC MS, insert four AA Mignon batteries (1.5 V); for BOATRONIC MS-420, apply 24 V DC.
- ✓ The plug-type connection between the measuring computer and the sensor set must be established.

1. Briefly press the key.
 - ⇒ The BOATRONIC measuring computer starts automatically.



Fig. 2: Welcome screen

2. Set the language with the key on the welcome screen.
 - ⇒ The main menu appears.

	NOTE
	For optimum measuring accuracy, a manual zero point calibration should be carried out prior to each measurement procedure (⇒ Section 7, Page 16) . This especially applies to small nominal sizes.

Perform a manual zero point calibration prior to using BOATRONIC MS-420 (⇒ Section 7, Page 16) .

	NOTE
	If the "Low battery" or "Power off" messages appear on the display immediately after switching on, the batteries are too weak and must be replaced (⇒ Section 9.1, Page 30) .

8.1 Measuring

1. Select "Measuring" with the keys in the main menu and confirm with the key.

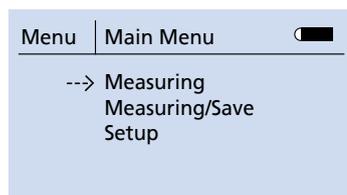


Fig. 3: Main menu

2. Select "Select DN" (handwheel cap) with the keys in the "Select DN" selection menu and confirm with the key.

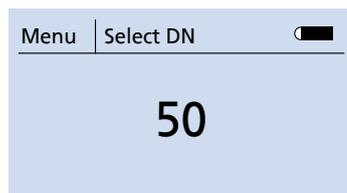


Fig. 4: Selecting DN

3. Select the fluid with the keys in the "Select Fluid" selection menu and confirm with the key.

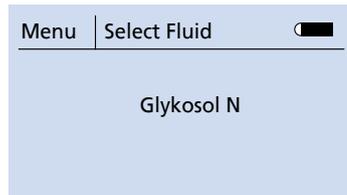


Fig. 5: Selecting a fluid

- ⇒ If the fluid is not known, "Unnamed liquid" can be selected. Lower measurement accuracy is the consequence.
- ⇒ The "Set concentration" step is not required for the "Unnamed liquid" or "Water" selections.

4. Select the concentration with the ▲ ▼ keys in the "Concentration" selection menu and confirm with the OK key.

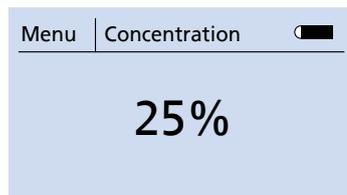


Fig. 6: Setting the concentration

- ⇒ The specification in percent defines the percentage of the fluid selected in water (e.g. 25 % Glykosol N in the available water-glycol mixture).

5. Zero point calibration starts automatically after the concentration has been confirmed with the OK key. The display then shows "Calibration" and a percentage as well as the loading symbol.

	NOTE
	If a valid zero point calibration has already been performed/stored, the calibration step is skipped and measurement starts directly.

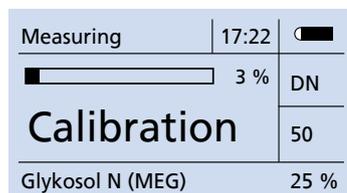


Fig. 7: Calibration

- ⇒ After successful calibration (100 %), the measurement starts automatically. Unless configured otherwise, volume flow rate Q and temperature T are displayed in standard units Q = [m³/h] and T = [°C].



Fig. 8: Measurement

- ⇒ ▲ ▼ Change physical unit of primary measurement on measurement screen
- ⇒ OK End measurements --> Main menu
- ⇒ If the "No signal" message appears, the measurement must be repeated by pressing the OK key (also see information on error messages).

Measuring	17:22	<input type="checkbox"/>
No T° Signal		DN
No Signal		50
Glykosol N (MEG)	25 %	

Fig. 9: No signal during measurement

8.2 Measuring/Save

Menu	Main Menu	<input type="checkbox"/>
Measuring		
--> Measuring/Save Setup		

Fig. 10: Main menu

The BOATRONIC MS product allows you to record, save and read out measured values. A project with measuring points must exist for this purpose. A project can either be created with BOATRONIC MS or uploaded with the "BOATRONIC S" PC software and transferred to BOATRONIC MS. It can be used for up to 100 measuring points.

8.2.1 Creating a project

If there is no saved project with measuring points available on the BOATRONIC MS, a prompt is automatically displayed so that you create a project.

1. Select the "Measuring/Save" menu item with the ▲▼ keys in the main menu and confirm with the **OK** key.

Menu	Main Menu	<input type="checkbox"/>
Measuring		
--> Measuring/Save Setup		

Fig. 11: Main menu

2. Select characters with the ▲▼ keys and go to the next character with the **OK** key.

Menu	Create Project	<input type="checkbox"/>
t		
Sample Project		

Fig. 12: Creating a project

3. To close or open the name editor press the **OK** key for more than 3 seconds. Then press the **OK** key again to access the next menu level.
 - ⇒ At least one measuring point must be defined for the project.
4. Select the "New Measuring Point" menu item with the ▲▼ keys in the "Select Measuring Point" selection menu and confirm with the **OK** key.

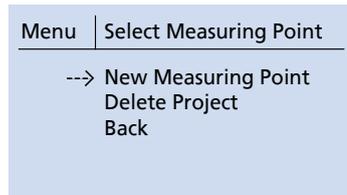


Fig. 13: Selecting a measuring point

5. Select characters with the ▲ ▼ keys and go to the next character with the OK key.

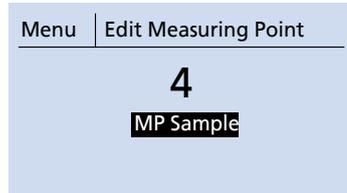


Fig. 14: Entering a measuring point designation

6. To close or open the name editor press the OK key for more than 3 seconds. Then press the OK key again to save the measuring point and access the next menu level.
7. The DN, fluid and concentration must be entered for every measuring point (⇒ Section 8.1, Page 20) .
8. Check the following measurement parameters on the verification screen and confirm with the OK key: DN, fluid, concentration and the measured value if required.

MP Sample 1	17:22	█
Check entries and press OK!	DN	
	50	
Glykosol N (MEG)	25 %	

Fig. 15: Verification screen, measuring point

⇒ The measurement process can now be started or additional measuring points created.

8.2.2 Project available

If there is already a project saved with measuring points available on the BOATRONIC MS, you can measure and save the existing measuring points as well as create new ones.

1. Select the "Measuring/Save" menu item with the ▲ ▼ keys in the main menu and confirm with the OK key.

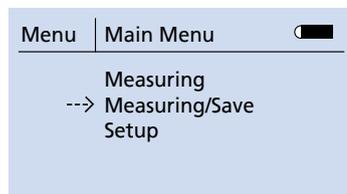


Fig. 16: Main menu

2. Select the measuring point in the "Select Measuring Point" selection menu with the ▲ ▼ keys and confirm with the OK key.

Menu	Select Measuring Point
--> MP Sample 1	
MP Sample 2	
MP Sample 3	

Fig. 17: Selection menu, measuring point

3. Check the following measurement parameters on the verification screen and confirm with the **OK** key: DN, fluid, concentration and possibly Q_REF, valve position and measured value.

MP Sample 1	17:22	<input type="checkbox"/>
Check entries and press OK!	DN	
	50	
Glykosol N (MEG)	25 %	

Fig. 18: Verification screen, measuring point

4. Select the "Start Measuring" menu item with the **▲** **▼** keys in the submenu and confirm with the **OK** key.

Menu	Next Step	<input type="checkbox"/>
--> Start Measuring		
Edit		
Back		

Fig. 19: Starting the measurement process

5. Automatic zero point calibration starts automatically after the concentration has been confirmed with the **OK** key. The display then shows "Calibration" and a percentage as well as the loading symbol.

MP Sample 4	17:22	<input type="checkbox"/>
<input type="checkbox"/> 3 %	DN	
Calibration	50	
Glykosol N (MEG)	25 %	

Fig. 20: Calibration of the measuring point

- ⇒ After successful automatic calibration (100 %), the measurement starts automatically. Unless configured otherwise, volume flow rate Q and temperature T are displayed in standard units $Q = [m^3/h]$ and $T = [^{\circ}C]$.

MP Sample 4	17:22	<input type="checkbox"/>
40 °C	DN	
5 m/h	50	
Glykosol N (MEG)	25 %	

Fig. 21: Measurement screen, measuring point

6. **▲** **▼**: Change physical unit of primary measurement on measurement screen
OK: End measurements --> Main menu
 ⇒ If the "No signal" message appears, the measurement must first be stopped by pressing the **OK** key and then repeated.

A checkmark next to a measuring point means that a measured value is defined. If a measured value is assigned to the measuring point, it is deleted when a new measurement is started.

8.2.3 Adding a measuring point

New measuring points can be added to a project at any time.

1. Select the "Measuring/Save" menu item with the ▲ ▼ keys in the main menu and confirm with the **OK** key.

Menu	Main Menu	
	Measuring	
	--> Measuring/Save	
	Setup	

Fig. 22: Main menu

2. Select the "New Measuring Point" menu item with the ▲ ▼ keys in the "Select Measuring Point" selection menu and confirm with the **OK** key.

Menu	Select Measuring Point
	--> New Measuring Point
	Delete Project
	Back

Fig. 23: Selecting a measuring point

3. Select characters with the ▲ ▼ keys and go to the next character with the **OK** key.

Menu	Edit Measuring Point
	4
	MP Sample

Fig. 24: Entering a measuring point designation

4. To close or open the name editor press the **OK** key for more than 3 seconds. Then press the **OK** key again to save the measuring point and access the next menu level.
5. The DN, fluid and concentration must be entered for every measuring point (⇒ Section 8.1, Page 20) .
6. Check the following measurement parameters on the verification screen and confirm with the **OK** key: DN, fluid and concentration.

MP Sample 1	17:22	
Check entries and press OK!	DN	
	50	
Glykosol N (MEG)	25 %	

Fig. 25: Verification screen, measuring point

⇒ The measurement process can now be started or additional measuring points created.

8.2.4 Editing a measuring point

The data defined for a measuring point can be changed at any time.

1. Select the "Measuring/Save" menu item with the ▲ ▼ keys in the main menu and confirm with the **OK** key.

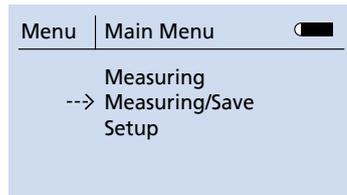


Fig. 26: Main menu

2. Select the measuring point in the "Select Measuring Point" selection menu with the ▲ ▼ keys and confirm with the OK key.

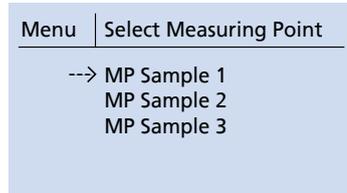


Fig. 27: Selection menu, measuring point

3. Check the following measurement parameters on the verification screen and confirm with the OK key: DN, fluid, concentration and possibly Q_REF, valve position and measured value.

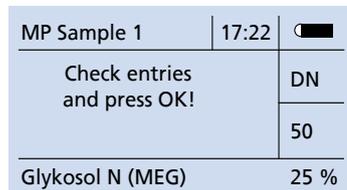


Fig. 28: Verification screen, measuring point

4. Select the "Edit" menu item with the ▲ ▼ keys in the "Next Step" selection menu and confirm with the OK key.

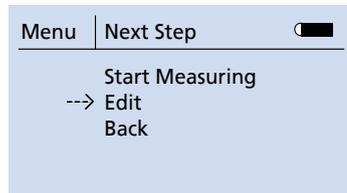


Fig. 29: Editing a measuring point

⇒ Now all data such as the designation, fluid, DN and concentration of the measuring point can be changed (⇒ Section 8.2.1, Page 22) .

	NOTE
	Any changes to the parameters will inevitable lead to the measured value being deleted.
	NOTE
	Q_REF can only be changed using the BOATRONIC S software.

8.2.5 Deleting a project

Projects that have been created can be deleted. All measuring points along with the measured values saved are then irreversibly deleted.

1. Select the "Measuring/Save" menu item with the ▲ ▼ keys in the main menu and confirm with the **OK** key.

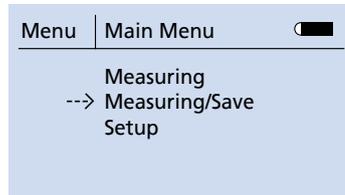


Fig. 30: Main menu

2. Select the "Delete Project" menu item with the ▲ ▼ keys in the "Select Measuring Point" menu and confirm with the **OK** key.

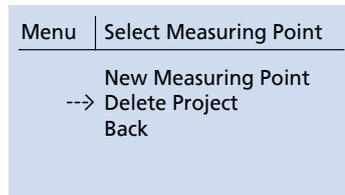
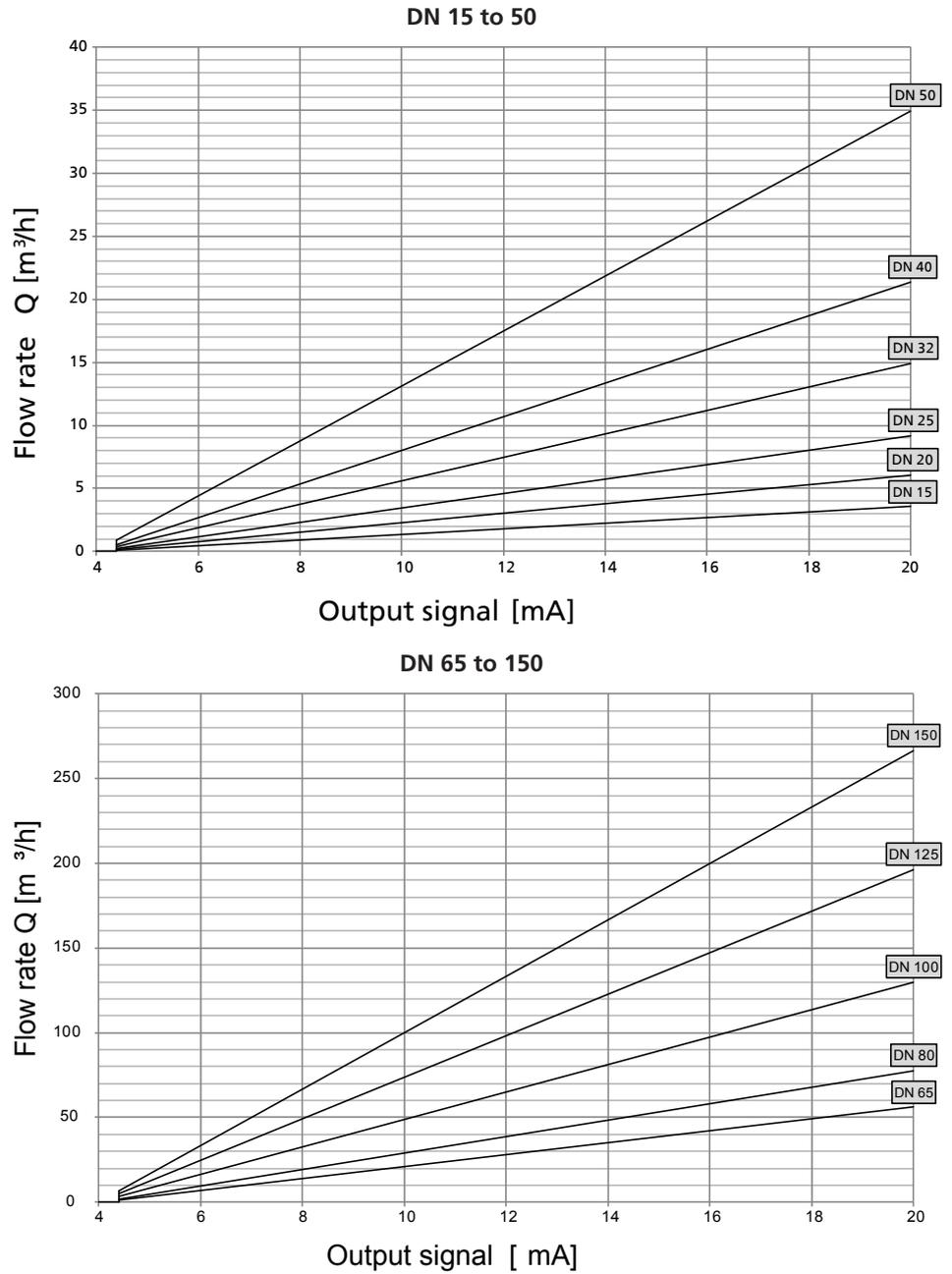


Fig. 31: Deleting a project

8.3 Characteristic curves of BOATRONIC MS-420

Table 9: Correlation between volume flow rate and output signal for BOATRONIC MS-420



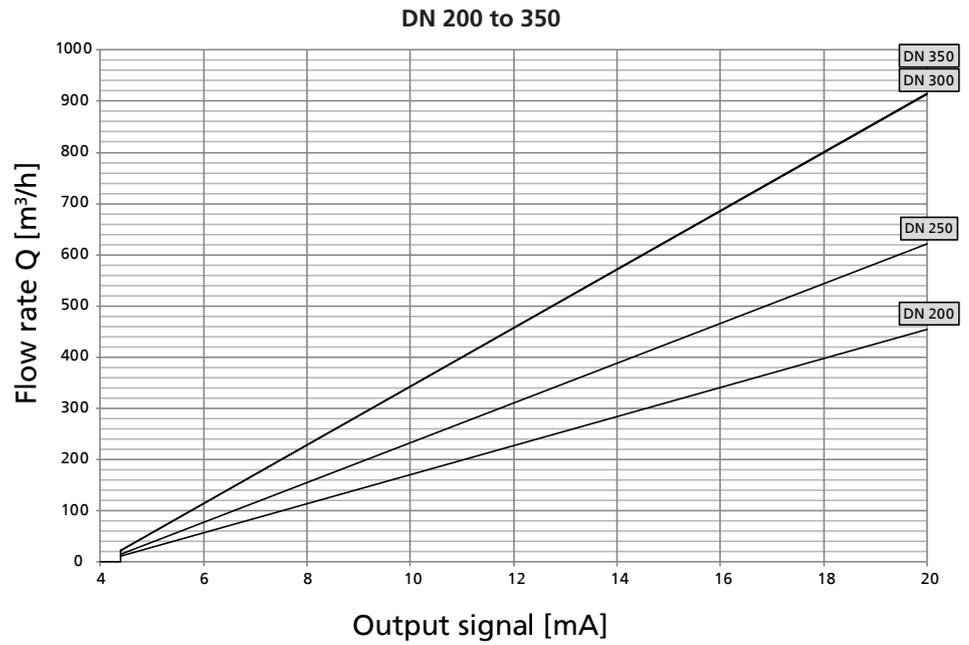


Table 10: Data table

DN	[mA]	[m ³ /h]	[mA]	[m ³ /h]	[mA]	[m ³ /h]
15	4,4	0,09	12	1,80	20	3,61
20	4,4	0,15	12	3,01	20	6,02
25	4,4	0,23	12	4,59	20	9,17
32	4,4	0,37	12	7,46	20	14,93
40	4,4	0,53	12	10,67	20	21,33
50	4,4	0,87	12	17,46	20	34,93
65	4,4	1,41	12	28,24	20	56,48
80	4,4	1,93	12	38,69	20	77,37
100	4,4	3,24	12	64,85	20	129,70
125	4,4	4,90	12	98,08	20	196,17
150	4,4	6,65	12	133,08	20	266,16
200	4,4	11,37	12	227,33	20	454,65
250	4,4	15,51	12	310,17	20	620,33
300	4,4	22,84	12	456,74	20	913,48
350	4,4	22,87	12	457,38	20	914,77

9 Electrical Connection

9.1 Terminal configuration

BOATRONIC MS-420

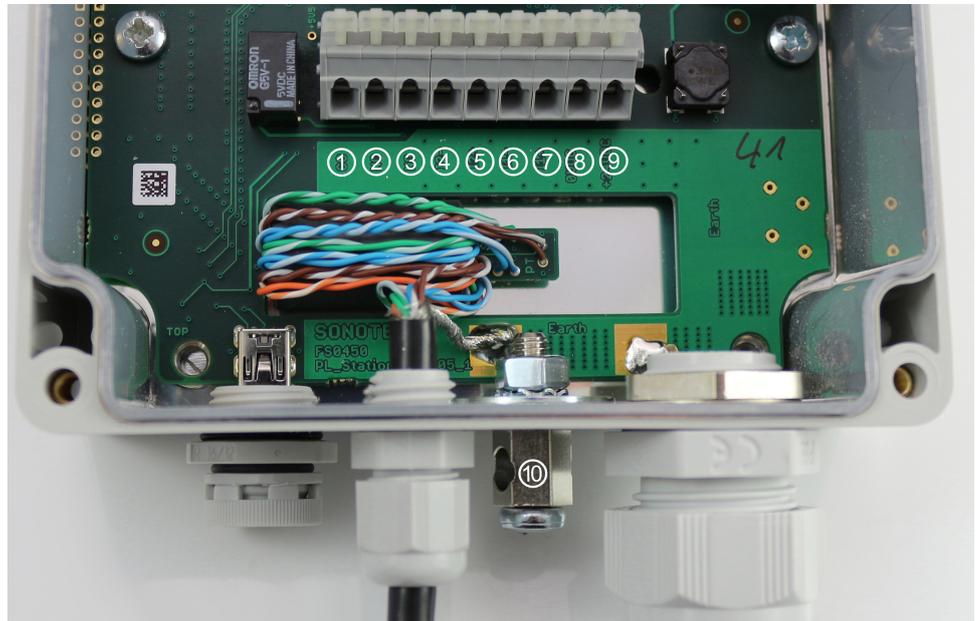


Fig. 32: Terminal configuration, variant A

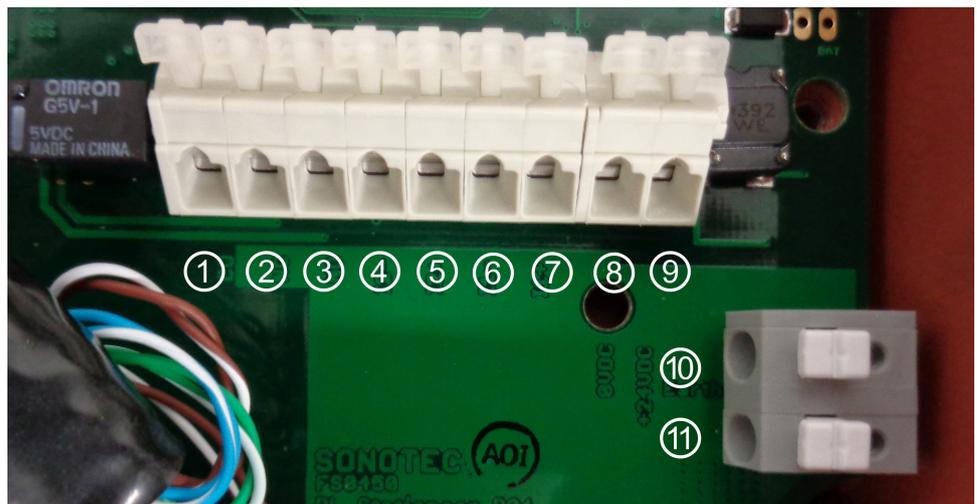


Fig. 33: Terminal configuration, variant B

Fault reporting relay	①	Relay CO
	②	Relay NC
	③	Relay NO
4-20 mA signal (fluid temperature) (⇒ Section 4.4, Page 11)	④	I2-
	⑤	I2+
4-20 mA signal (volume flow rate) (⇒ Section 8.3, Page 28)	⑥	I1-
	⑦	I1+
Power supply	⑧	-0 V DC
	⑨	+24 V DC
Functional earth connection	⑩	"FE" functional earthing
	⑪	

Shield connection

- A shielded power cable is required for BOATRONIC MS-420.

	CAUTION
	<p>Electrical interference in industrial plants Incorrect measurement!</p> <ul style="list-style-type: none"> ▸ Connect the power cable shield in the control cabinet to the functional earth (FE) connection provided. Do not connect the shield inside the BOATRONIC MS-420. The shield ends inside the housing, downstream of the cable gland.

Functional earth connection

	NOTE
	<p>In the event that interferences from electrical cables compromise measuring despite properly connected cable shielding, additional earthing must be provided as described below.</p>

- Connect a potential equalisation conductor with a minimum cross-section of 4 mm² to the functional earth connection (Ⓢ / Ⓢ) and connect the opposite end to the system's functional earth connection (maximum cable length: 3 m).
- Also fit a further potential equalisation conductor with a minimum cross-section of 4 mm² from the functional earth connection (Ⓢ / Ⓢ) to a flange bolt of the valve (BOA-Control IMS) whose data is being collected. Keep the cable length as short as possible.
- A fine-stranded potential equalisation conductor is required.

BOATRONIC MS

BOATRONIC MS operates using four 1.5 V AA Mignon batteries. The battery status is indicated by the  symbol on the measurement screen. Replace the batteries as soon as possible if error message F16 (10 % voltage) is displayed. No further measurements can be taken if the power supply is at 5 percent.

Unscrew and remove the four screws to replace the batteries. While doing this, ensure that the cable connection between the upper and lower housing parts is not damaged. Batteries are not included in the scope of supply.

	CAUTION
	<p>Leaky batteries Damage to the measuring computer!</p> <ul style="list-style-type: none"> ▸ The batteries must be removed from the device if it will not be used for an extended period of time.

10 Servicing/Maintenance

The BOATRONIC measuring computer requires no maintenance. Observe the information that applies to extended periods of non-use of the measuring computer (⇒ Section 9.1, Page 30) (⇒ Section 3.3, Page 7) .



NOTE

All maintenance, service and installation work can be carried out by KSB Service or authorised workshops. For contact details please refer to the enclosed "Addresses" booklet or visit "www.ksb.com/contact" on the Internet.

11 Trouble-shooting

Table 11: LEDs

LED	Description
Green	Measuring or data logger active
Flashing green	Calibration active
Red	Fault
Flashing red	Incorrect direction of flow

Table 12: Trouble-shooting

Fault message	Display (measurement screen)	I1 (Q)	I2 (T)	LED steady red	LED flashing red	Cause	Solution
F01	"No signal"	1 mA	1 mA	X		No connection to the sensor	<ul style="list-style-type: none"> Connect the sensor. Check plug-type connection.
F02	"No signal"	1 mA	-	X		The sensor cannot locate a signal.	<ul style="list-style-type: none"> Recouple the sensor (BOA-Control). Apply coupling grease (BOA-Control). Repeat measurement. Vent system.
F03	-	-	-	X		Function error, BOATRONIC	Contact the customer service department.
F04	-Q	2 mA	-		X	Incorrect direction of flow	<ul style="list-style-type: none"> Check the direction of flow in the system. Connect sensors correctly.
F05	"No signal"	-	1 mA	X		No temperature sensor signal	<ul style="list-style-type: none"> Check plug-type connection. Contact the customer service department.
F06	-	-	2 mA		X	Maximum temperature (120 °C) exceeded Temperature outside the measuring range	<ul style="list-style-type: none"> Permissible operating range: -10 °C to 120 °C. Risk of sensor equipment failure. Do not use BOA-Control/BOA-Control IMS outside the measuring range.
F07	-	-	2 mA		X	Minimum temperature (-10 °C) undershot Temperature outside the measuring range	
F08	-	-	-		X	Excessive flow velocity	

Fault message	Display (measurement screen)	I1 (Q)	I2 (T)	LED steady red	LED flashing red	Cause	Solution
F09	-	-	-	X		Invalid calibration	<ul style="list-style-type: none"> Repeat manual calibration. Reset BOATRONIC to factory settings.
F16	-	-	-	X		Low battery (10 %)	<ul style="list-style-type: none"> Replace battery.
F17	-	-	-	X		Transmission error log	
F19	-	-	-	X		Memory full	<ul style="list-style-type: none"> Download or delete log.

12 EU Declaration of Conformity for BOATRONIC MS, MS-420

Herewith we,

KSB SE & Co. KGaA
Johann-Klein-Straße 9
67227 Frankenthal (Germany)

declare that **the product:**

BOATRONIC MS
BOATRONIC MS-420

in its standard design meets the provisions of the below Directives, including any amendments in force at the time of this Declaration:

2011/65/EU Restrictions of the use of certain hazardous substances in electrical and electronic equipment (RoHS)
2014/30/EU Electromagnetic compatibility
2014/35/EU Low-voltage Directive

and complies with the following standards:

DIN EN 61326-1:2013 Electrical equipment for measurement, control and laboratory use: EMC requirements - Part 1: General requirements
DIN EN 61140:2007 Protection against electric shock (SELV III)

The EU Declaration of Conformity was issued in/on:

Frankenthal, 1 February 2018



Wolfgang Glaub
Vice President Integrated Management Germany



Dieter Hanewald
Head of Development, Low-pressure Valves

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KSB SE & Co. KGaA

Johann-Klein-Straße 9 • 67227 Frankenthal (Germany)

Tel. +49 6233 86-0

www.ksb.com