Rexroth
Bosch Group

Float switch

Type ABZMS-41

RE 50222-B/03.12
Replaces: -
English

Operating instructions

The data specified above only serve to describe the product. No statements concerning a certain condition or suitability for a certain application can be derived from our information. The information given does not release the user from the obligation of own judgment and verification. It must be remembered that our products are subject to a natural process of wear and aging.

The cover page shows an example configuration. The product supplied may therefore differ from the photo shown.

The original operating instructions were prepared in German.

Content

1 Introduction

Read the operating instructions carefully before using the device. Particularly observe the notes in chapter 2. Otherwise, injuries or damage to property may result. Bosch Rexroth AG will not accept any liability for unauthorized changes in the device or for improper use.

1.1 Configuration

The sensors of the ABZMS41 series serve the monitoring of the filling level and/or the temperature in fluid systems, if applicable. From pure switches to the continuous filling level and temperature measurement and/or indication, this specification comprises all options.

The following models are available:

ABZMS... float switch	
M1 to M4	1 to 4 level contacts, normally closed or normally open contact
M1-T70F to M3-T70F	1 to 3 level contacts, normally closed or normally open and temperature contact 70 °C, normally closed contact (option 60/80 °C)
M1-TS to M3-TS	1 to 3 level contacts, normally closed or normally open contact and Pt 100 temperature sensor
M1-TA to M3-TA	1 to 3 level contacts, normally closed or normally open contact and resistance thermometer output 4 to 20 mA
RTA	Resistance measuring chain (level) and resistance thermometer; analog output 4 to 20 mA
D1	Display and control unit with resistance measuring chain, resistance thermometer and four programmable PNP switching outputs
D2	Display and control unit with resistance measuring chain, resistance thermometer and two programmable PNP switching outputs and two analog outputs 4 to 20 mA (analog output programmable in 0-10 V, 2-10 V, 0-5 V) Two PNP outputs can be assigned as frequency output.

1.2 Field of application

WARNING!

Float switch types are no safety components.

Use in explosive areas or in case of danger due to malfunction may impair safety and health.

- Don't use the float switch if in case of failure or in case of malfunction, the safety and health of persons might be impaired.
- Don't use the float switch in explosive areas.

2 Important notes

Please check before installing the device whether the specified technical data corresponds to the application parameters. Also check whether all parts belonging to the scope of delivery are completely available.

Use of the devices is only admissible if:

- The product is used under the conditions described in the operating instructions, the use according to name plate and for applications for which it is intended. In case of unauthorized changes in the device, liability by Bosch Rexroth AG is excluded.
- The limits specified in the data sheet and the instructions are complied with.
- Monitoring equipment / protective equipment has been connected correctly.
- The service and repair works not described in these instructions are carried out by Bosch Rexroth AG.
- Original spare parts are used.

These operating instructions are part of the operating equipment. The manufacturer reserves the right to change the performance, specification or the design data without advance notice. Keep the instructions for later use.

In these instructions, the following warning signs and signal words are used:

Warning sign	Warning
	Warning of the inhalation of noxious gases
	Warning of corrosive fluids
	Warning of explosive areas

Signal word	Application
NOTE!	Signal word for important information on the product, to which particular attention is to be drawn.
CAUTION!	Signal word for marking a hazard with little risk, which can lead to damage to property or minor to medium bodily injuries unless it is avoided.
WARNING!	Signal word for marking a hazard with medium risk, which will possibly lead to death or serious bodily injuries unless it is avoided.
DANGER!	Signal word for marking a hazard with high risk, which will directly lead to death or serious bodily injuries unless it is avoided.

The device may only be installed by specialists who are familiar with the safety requirements and the risks.

You must imperatively observe the safety regulations relevant to the place of installation as well as the generally valid rules of current technology. Prevent failures and thus prevent personal injuries and damage to property.

The person responsible for the system must ensure that:

- Safety instructions and operating instructions are available and complied with,
- Accident prevention regulations of the Accident Prevention & Insurance Association are complied with; in Germany: BGV A1: Prevention principles and BGV A3: Electrical systems and work equipment,
- The admissible data and operating conditions are complied with,
- Protective devices are used and prescribed maintenance works are carried out,
- In the disposal, the legal regulations are complied with.

Maintenance, repair

Repairs at the operating equipment may only be carried out by personnel authorized by Bosch Rexroth.

- Only carry out modification, maintenance or assembly works described in these operating instructions.
- Only use original spare parts.
- When carrying out maintenance works of any kind, the relevant safety and operating provisions have to be observed.

3 Assembly and connection

3.1 Tank installation

Assembly and connection may only be performed by correspondingly trained specialists. The applicable safety regulations of the place of installation are to be complied with!

DANGER!

Danger of poisoning!

Poisonous, corrosive gases or fluids may cause serious injuries.

- ▶ Protect yourself from poisonous, corrosive gases / fluids during all works.
- ▶ Always wear inhalation protection, face protection and gloves.

DANGER!

Risk of explosion!

Risk of serious injuries due to explosions.

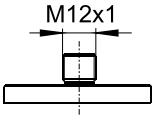
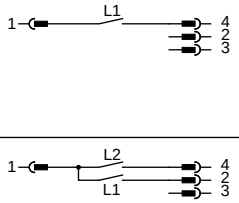
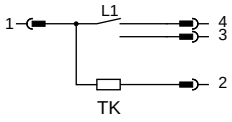
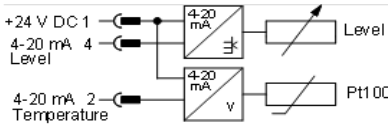
- ▶ Don't use the float switch in explosive areas.

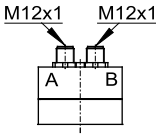
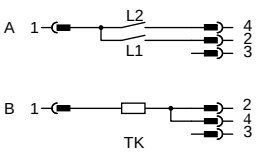
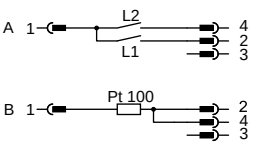
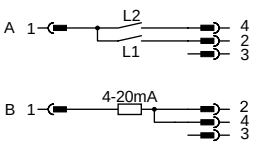
For direct tank attachment, the switching tube is screwed into the intended bore (according to DIN 24557, part 2) with the GI cork seal at the tank. The mounting is realized using the enclosed screws and seals at the DIN flange. In this connection, it must be ensured that the float is freely moveable and that the distance to the tank wall and installations is sufficient.

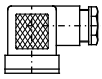
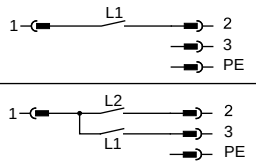
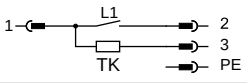
After a possible disassembly of the float, it has to be made sure that the solenoid in the float is above the fluid level. The easiest way to check this is by means of an iron part by means of which you determine the position of the solenoid in the float.

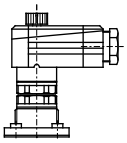
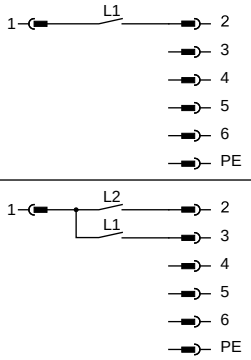
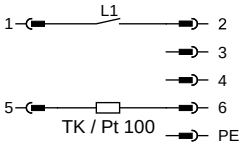
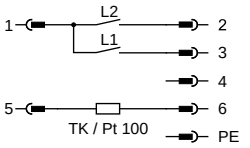
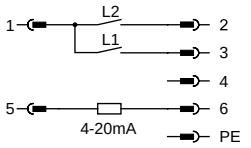
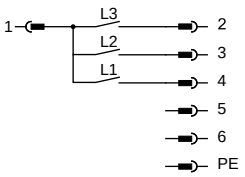
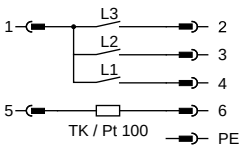
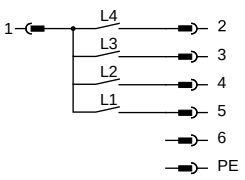
The voltage supply is effected using the connectors.

3.2 Connection variants and pinout

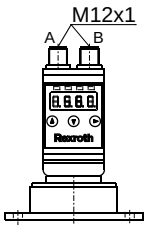
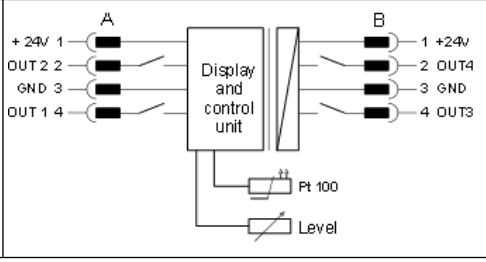
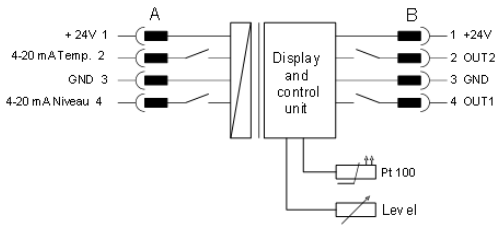
Plug-in connector type K24	Version M 1 and/or 2 level contacts	Version M 1 level contact + temperature contact	Version RTA Level output 4-20 mA + temperature output 4-20 mA
			

Plug-in connector type 2K24	2 level contacts + temperature contact	2 level contacts + temperature sensor PT 100	2 level contacts + resistance thermometer
			

Plug-in connector type K14	Version M 1 and/or 2 level contacts	Version M 1 level contact + temperature contact
		

Plug-in connector type K6	Version M up to 4 level contacts	Version M up to 3 level contacts + temperature contact / Pt 100	Version M up to 3 level contacts + resistance thermometer
			
			
			
			

Assembly and connection

Display and control unit with 2 x K24	Version D1 4 programmable PNP switching outputs	Version D2 2 programmable PNP switching outputs + 2 programmable analog outputs
		

3.3 Voltage supply variants

Function	Voltage					
	VDC 10-36				VAC 10-230	
	K24	2K24	K14	K6	K14	K6
M1	X	-	X	X	X	X
M2	X	-	X	X	X	X
M3	-	-	-	X	-	-
M4	-	-	-	X	-	-
M1-T70F	-	X	X	X	X	X
M2-T70F	-	X	-	X	-	X
M3-T70F	-	-	-	X	-	-
M1-TS	-	X	-	X	-	-
M2-TS	-	X	-	X	-	-
M3-TS	-	-	-	X	-	-
M1-TA	-	X	-	X	-	-
M2-TA	-	X	-	X	-	-
M3-TA	-	-	-	X	-	-
RTA	X	-			-	-
D1	-	X			-	-
D2	-	X			-	-

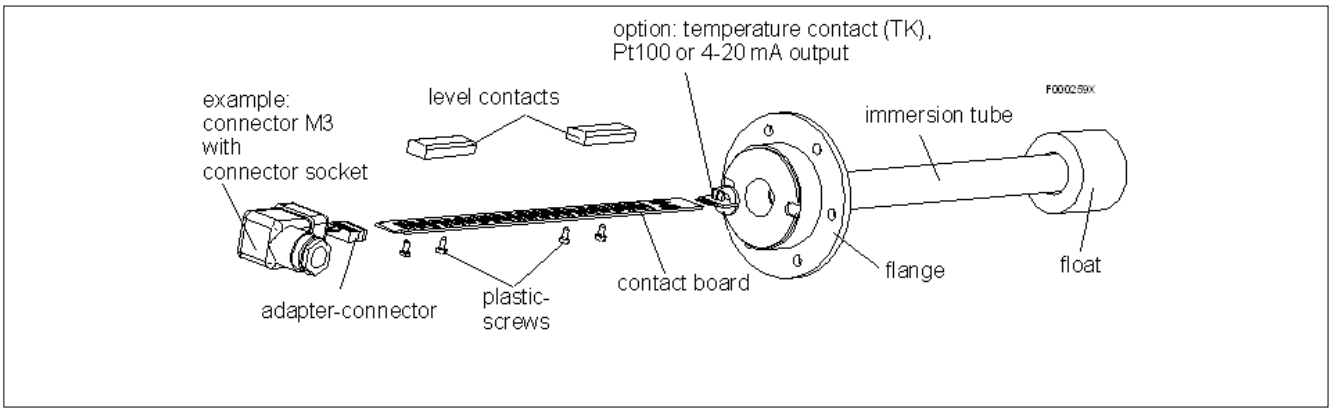
3.4 Adjustment of the switching point positioning for Mx models

The contacts operated by the float are fastened to a galvanically gold-plated contact strip (with cm scale) by means of plastic screws. The contact housings are color-coded any may only be mounted on the contact strip in the given order. They are positioned according to the order data ex works and can be adjusted upwards or downwards retroactively (observe minimum distances!).

In models with continuous level output (RTA), no changes can be made. They are fixedly set ex works (analog output: 4 mA = tank empty; 20 mA = tank full).

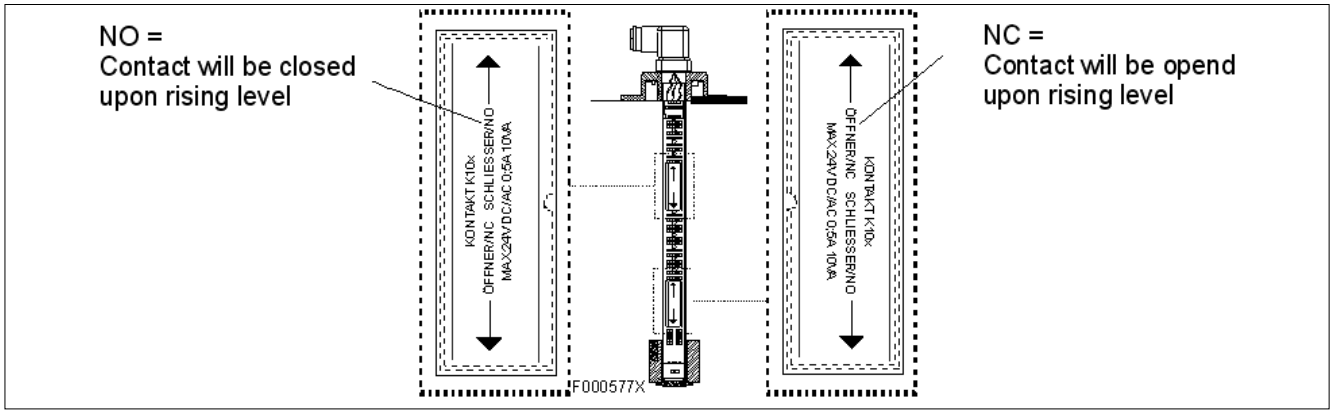
For positioning the switching points, proceed as follows:

- **Interrupt the voltage supply!**
- Loosen the plug-in connections.
- Screw off the plug-in connector base and carefully pull it out upwards together with the adapter plug and the contact strip.
- Loosen the plastic screws at the contacts and re-position the contacts using the cm scale (it is located on the back side of the contact strip). They can be adjusted in 1 cm steps.
- In order to fasten the contacts, tighten the plastic screws manually.
- Ensure during the assembly that the adapter plug is re-applied to the contact strip in the correct way. This can be seen from the red mark at the adapter plug and the contact strip.



3.5 Adjustment of the switching points' switching function for Mx models

The contacts are designed as normally open (NO) or normally closed (NC) contact, depending on the order. As the contacts are bistable, any subsequent change in the contact function is possible by rotating the contacts by 180°. On the contact housing, there are two arrows. The arrow pointing upwards in the installed condition indicates the valid contact function (see following example).



Any information with sinking oil level.

3.6 Notes on the service life extension of reed contacts

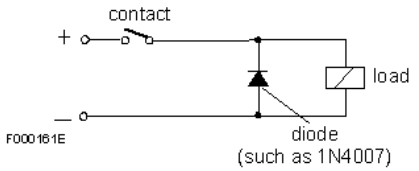
Due to their construction, reed contacts are very durable and reliable components. Nevertheless, the following should be observed:

Contact protection

Excessive inductive loads creating high inverse voltages when a reed switch is opened can be reduced by means of the following circuit.

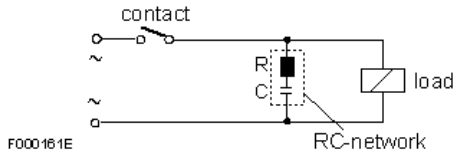
A) Direct voltage (DC):
protective diode parallel to the load

A)



B) Alternating voltage (AC):
RC element parallel to the load and according to the following table.

B)



VA	10		25		50		75		100	
Voltage at the open contact	**R/Ohm**	**C/µF**	**R/Ohm**	**C/µF**	**R/Ohm**	**C/µF**	**R/Ohm**	**C/µF**	**R/Ohm**	**C/µF**
24 AC	22	0.022	1	0.1	1	0.47	1	1.0	1	1.0
48 AC	120	0.0047	22	0.022	1	0.1	1	0.47	1	0.47
115 AC	470	0.001	120	0.0047	22	0.022	22	0.047	22	0.1
230 AC	470	0.001	470	0.001	120	0.0047	120	0.022	120	0.022

4 Operation

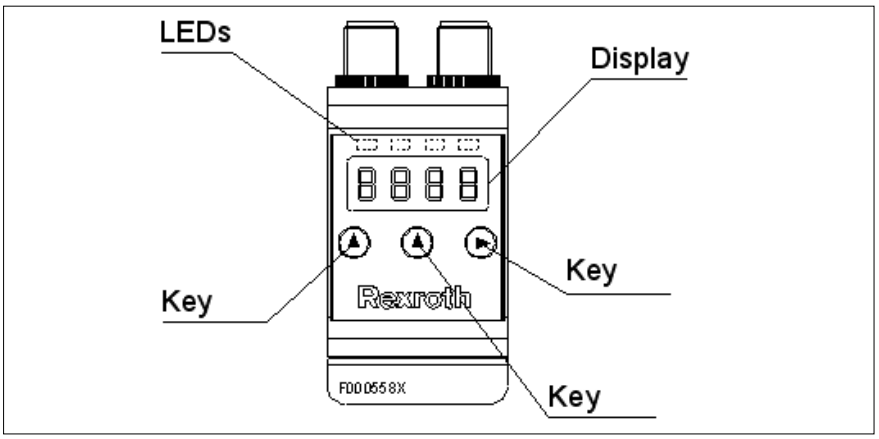
The models without indication and control unit are immediately ready for operation after connection of the supply voltage. In the following, the operation of the models with display and control unit is described.

4.1 Switch-on

If during ongoing operation, an error message appears in the display, please observe chapter 5.3 "Troubleshooting".

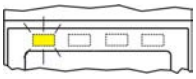
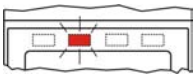
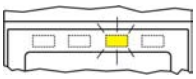
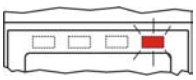
After the device has been connected to the supply voltage, the software version will be shown shortly in the beginning. Directly afterwards, the display changes to the measured value display.

In the following, the function of the display and control unit is described.



4.2 LED status displays

Light-emitting diodes above the measured value display signal the status of the switching outputs. The LEDs are fixedly assigned to the switching outputs. The following table shows the factory settings for the assignment of the switching outputs to filling level and temperature.

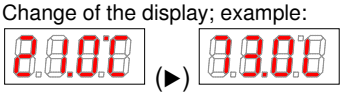
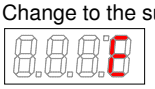
		2 switching outputs	4 switching outputs
	LED 1 – yellow Assigned: Switching output 1	Filling level	Filling level
	LED 2 - red Assigned: Switching output 2	Temperature	Filling level
	LED 3 - yellow Assigned: Switching output 3	---	Temperature
	LED 4 - red Assigned: Switching output 4	---	Temperature

The LEDs' switching behavior (illuminated in case of closed or open switching contact) can be changed; in this connection see chapter 4.7.7.

4.3 General key functions

Operation is effected using the keys below the display.

A detailed explanation of the menu control is contained in the following chapters.

Key	Mode	Function
▶	Measured value display:	Change of the display; example: 
	In the menu:	Change to a subordinate menu
	At the end of the menu:	Change to the superior menu:  (Exit) signals the end of the menu
	After entry / selection:	Confirming and storing an entered numerical value or a function selection
▲	Measured value display:	Display of the configuration, see chapter 4.5
	In the menu:	Going to the next menu item, numerical value or function selection. If the key is kept pressed, this is done continuously.
▼	Measured value display:	Change to the main menu
	In the menu:	Going to the previous menu item, numerical value or function selection. If the key is kept pressed, this is done continuously.
▼+▶*	In the menu:	Exiting the main / sub- / optional menu and going back to the measured value display
▲+▶*	In the menu:	Changing to the next higher menu level
No action for 60 s*	In the menu:	Exiting the main / sub- / optional menu

* If the optional or setup menu is exited, the changed values will not be stored.

For selecting a menu item and setting the values, proceed as follows:

- Open the main menu by means of the ▶ key.
- Select the submenu with the ▼ and ▲ keys and open the submenu using the ▶ key.
- Select the next submenu with the ▼ and ▲ keys, if applicable, and open it using the ▶ key.
- Select the desired menu item using the ▼ and ▲ keys and open the value list using the ▶ key.
- Set the value using the ▼ and ▲ keys and confirm it using the ▶ key.

  The changed settings are stored and the device returns to the submenu.

- Exit the submenu by selecting the EXIT menu item and confirming it using the ▶ key.

  The device returns to the superior menu or the measured value display.

4.4 Active key lock

When the key lock is activated, the following display will appear instead of the main menu when calling the menu using the ▼ key: 
The active number is marked by a point.

- Enter the code using the ▼ and ▲ keys and confirm it using the ▶ key.

  The active number is moved one digit to the right.
  After entry of the 3rd number, the main menu opens.

If a wrong numerical code is entered, the device jumps back to the measured value display. If you have forgotten the password, you can access the menu at any time by means of the master code 287.

You can cancel the key lock by resetting the code with the entry 000 in the Loc menu item in the **"Basic ext. functions"** bEF submenu.

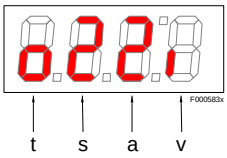
4.5 Menu overview

The menu structure is based on the VDMA standard sheet 24574 et sq. The menu has a hierarchic structure. The topmost menu level contains the main menu entries, e.g. oUt, tEMP, bEF, diA, E. Each main menu comprises more submenu items.

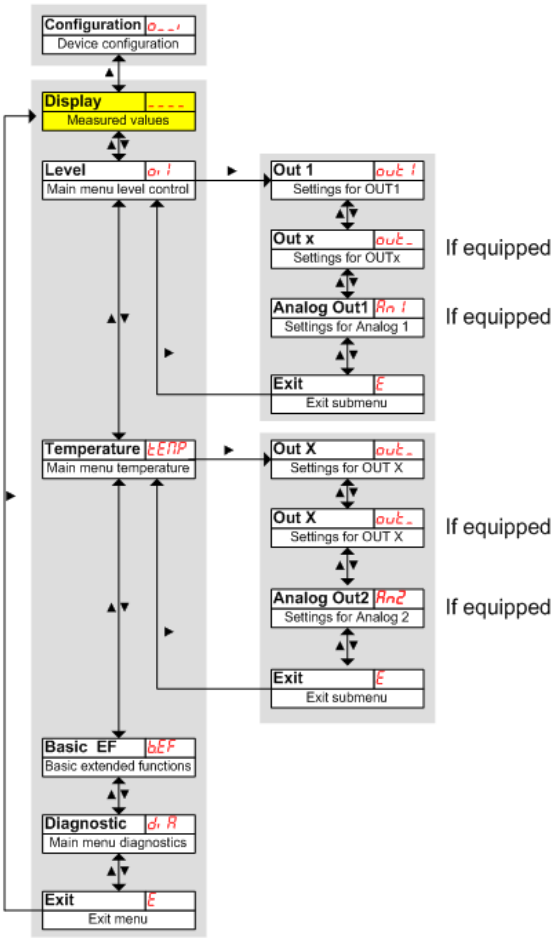
The menu items may vary depending on the device configuration. Not all menu items described in the following may be available in your device.

- You can call the configuration by pressing the ▲ key in the display mode.

  A 4-digit code will be displayed, e.g.



Whereas the 4 digits tsav have the following meaning:	
t: Type	t = Temperature measurement
	o = Level and temperature measurement
s: Number of switching outputs	2 or 4
a: Number of analog outputs	0 or 2
v: Assembly type of the devices	i = Standard assembly (tank installation)



The individual menu items will not appear if the option is not available. Example: With a = 0, the menu items for setting the analog output are not available. You can then skip the description of these points.

The structure of the main menu **"Level"** (**LEVL**) and **"Temperature"** (**TEMP**) is identical. Here, the settings for the switching outputs and/or the analog outputs (if available) are made.

The basic settings oft he device can be changed. Generally valid settings are made in the **"Basic ext. functions"** (**bEF**) menu. These settings should be made first as they influence the displays and setting possibilities in the individual menus. Such settings include e.g. the units used and the assignment of the switching outputs to filling level and temperature measurement. The assignment of the analog outputs cannot be changed.

In addition, diagnosis possibilities are available in the **"Diagnostic"** menu.

For the detailed presentation of the entire menu structure please refer to the end of these instructions.

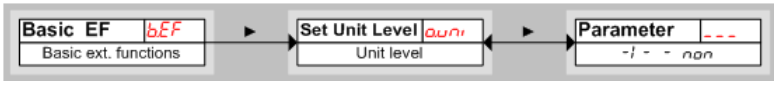
4.6 Changing the basic settings

In the **"Basic ext. functions"** (**bEF**) menu, the generally valid basic settings are made. These settings influence the presentation in the measured value display as well as the setting options in the **"Level"** and **"Temperature"** menus. Assignment of the switching outputs to the filling level and/or temperature measurement (if available) can be changed here.

- In order to access the main menu, press the ▼ key.
- Select the **bEF** menu item using the ▼ and ▲ keys and open the menu using the ▶ key.

4.6.1 Determining the filling level unit

Here, the displayed unit symbol for the filling level is determined.



Optional settings: [- I -, cn, in, Lit, CAL, non]	The following options are available: Percentage: -I- cm: cn Inch: in Liter: Lit Gallons: CAL None: non

If "without unit" is selected, the display will scale the measured values to a four-digit output.

The measured values are not converted automatically. After changing the unit (if necessary), the measurement range should be scaled (see **"Level"** oHi and oLo menu)

4.6.2 Determining the temperature unit

Here, the displayed unit symbol for the temperature is determined.

Optional settings: [°C, °F]	The following options are available: Degree Celsius: °C Degree Fahrenheit: °F

If the setting is changed, all related settings like e.g. setting of the switching points are changed accordingly.

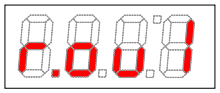
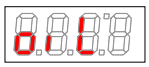
4.6.3 Re-assignment of the switching outputs

Change of the switching output assignment is here described for switching output 1. The procedure can be transferred to all other switching outputs.

The switching outputs 1 to n can be freely assigned to the filling level or temperature measurement. The assignment will influence the appearance of the filling level out 1 and temperature TEMP menu. In the factory setting, switching output OUT 1 is assigned to the filling level.

Example: OUT 1 is to be assigned to the temperature. For this purpose, rou 1 must be set to TEMP. This results in the shifting of the out 1 setup menu from the **"Level"** menu into the **"Temperature"** menu. The procedure for changing the settings does not change.

In the re-assignment of the switching outputs, all related settings have to be checked! The values set in advance are not adjusted automatically! The assignment of the LEDs to the status display does not change.

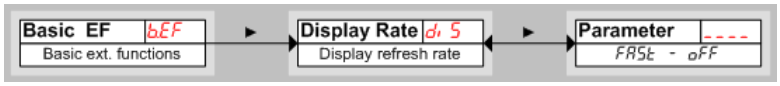
	The following options are available:  Filling level measurement  Temperature measurement

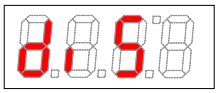
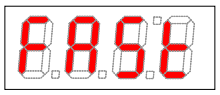
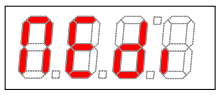
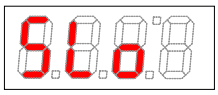
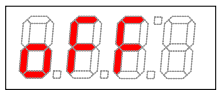
Assignment of the other switching outputs to the filling level or temperature measurement is realized in the same way as for switching output 1.

- Perform the same steps as described for the switching output OUT 1.

4.6.4 Setting the display's update rate

Depending on the application, the display's update rate can be set. The display can also be switched off completely.



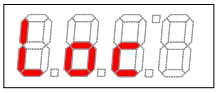
	The following options are available:			
	 Fast (FASt)	 Medium (nEdi)	 Slow (slow, SLo)	 Display off (oFF)

Error messages will be displayed despite switched-off display.

4.6.5 Activating / deactivating the key lock

In order to prevent unauthorized changes in the device settings, a key lock can be setup.

The key lock is activated if at least one number > 0 is entered. During the entry, the active number is marked with a point.

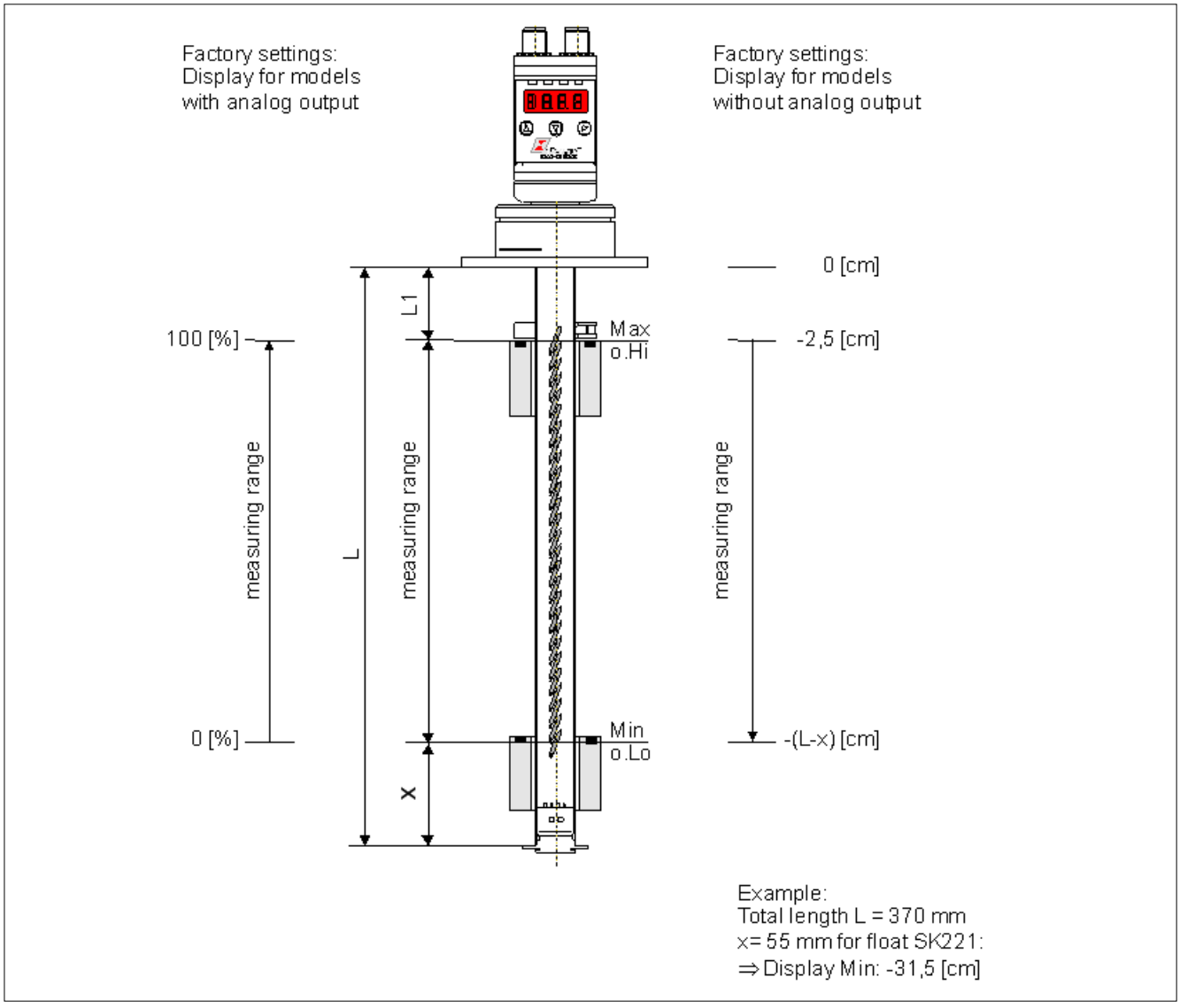
 Setting range: 000 to 999	▶ Open the value list by means of the ▶ key:  ▶ Set the figure using the ▼ and ▲ keys (0 to 9) and confirm it using the ▶ key. The active number is moved one digit to the right. ▶ Finally confirm the code by means of the ▶ key. The device returns to the submenu.

Canceling the key lock with the entry: 000

4.6.6 Filling level scaling

The display range is scaled between the highest and the lowest point of the float. The display accuracy and the resolution for the determination of the switching outputs for the filling level are also influenced by this scaling.

The factory setting of the switching points and the display is shown in the following figure:



Models with analog output:

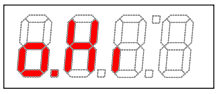
The display increases when the filling level increases so that at the lowest point possible, 0 % and with the highest point possible 100 % are displayed. These values can be changed as described below.

Models without analog output:

As the installation situation is not known in the factory, the distance of the float to the flange level in cm is shown as pre-setting. As with a falling filling level, this results in a greater value, this is relativized by putting a minus sign in front of the display value. In a level switch with a length of 370 mm, the value rises e.g. from –31.5 (cm) to –2.5 (cm) when the level rises. These values can be changed as described below.

4.6.7 Filling level: Maximum display value

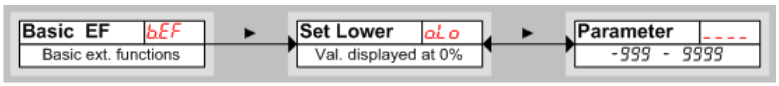
Here, the largest display value (upper limit of the measurement range) for the maximum filling level is determined.

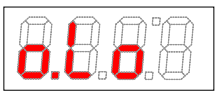
 Setting range: –999…9999	Assignment of the largest display value (upper limit of the measurement range) to the maximum filling level.

In order to avoid malfunctions, the settings of the level outputs should be checked and/or adjusted after any change in the value.

4.6.8 Filling level: Minimum display value

Here, the smallest display value (lower limit of the measurement range) for the minimum filling level is determined.

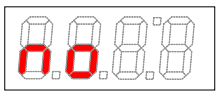
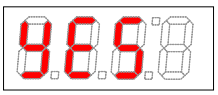


 Setting range: –999…9999	Assignment of the smallest display value (lower limit of the measurement range) to the minimum filling level.

In order to avoid malfunctions, the settings of the level outputs should be checked and/or adjusted after any change in the value.

4.6.9 Restoring the factory settings (reset)

By means of the **"Reset"** (rES) function, the factory settings can be restored. When doing so, all changes will be lost. As the limits are also reset, the settings for the filling level and the temperature must mandatorily be checked.

	The following options are available:	
	 Condition as supplied: No, the current settings are maintained	 Condition as supplied: Yes, the settings are reset to the default factory settings.

The factory settings are as follows:

Definitions:

SPx / rPx	Switching point / switch-back point x
dSx / drx	Switch-on delay / switch-back delay for switching output x
AxHi / AxLo	Maximum and minimum measured value for the output
Aoux	Signal form of the analog output
oux	Switching characteristics of the switching output x
ounI / tunI	Unit for filling level / temperature
oHi / oLo	Maximum / minimum filling level
rou	Assignment of the switching output x to the filling level or temperature monitoring
di S	Display update rate
Loc	Key lock
Sdou	Logged switching output
doNN	Delay for recording the minimum / maximum filling level
dtNN	Delay for recording the minimum / maximum temperature

Version with 4 switching outputs:

Switching outputs		Basic settings		Diagnosis	
SP1 / rP1 *	–(L–7.0 cm) / –(L–6.0 cm) *	ouni	cn	Sdou	out1
dS1 / dr1 / ou1	0 / 0 / Hno	tuni	C	doNN	00
SP2 / rP2 *	–(L–9.0 cm) / –(L–8.0 cm) *	oHi	–2.5 cm**	dtNN	00
dS2 / dr2 / ou2	0 / 0 / Hno	oLo	–(L–x)cm*		
SP3 / rP3 *	70 / 65 C	rou1	oiL		
dS3 / dr3 / ou3	0 / 0 / Hno	rou2	oiL		
SP4 / rP4 *	80 / 75 C	rou3	tEMP		
dS4 / dr4 / ou4	0 / 0 / Hno	rou4	tEMP		
		di S	FASt		
		Loc	000		

* Relating to the total length L of the level switch
x = 55 mm for stainless steel float SK 221
x = 35 mm for PU float SK 604

** Minimum distance to the flange

Version with 2 switching outputs and 2 analog outputs:

Switching outputs		Basic settings		Diagnosis	
SP1 / rP1 *	5 % / 2 % *	ouni	-I- (%)	Sdou	out1
dS1 / dr1 / ou1	0 / 0 / Hno	tuni	C	doNN	00
SP2 / rP2	60 / 55 C	oHi	100 % **	dtNN	00
dS2 / dr2 / ou2	0 / 0 / Hno	oLo	0 %		
		rou1	oiL		
Analog outputs		rou2	tEMP		
A1Hi / A1Lo / Aou1	0 / 100 / 1	di S	FASt		
A2Hi / A2Lo / Aou2	0 / 100 / 1	Loc	000		

* Relating to the total length L of the level switch -x
x = 55 mm for stainless steel float SK 221
x = 35 mm for PU float SK 604

** Minimum distance to the flange = 25 mm

4.7 Switching outputs

All switching outputs are set in the same way. The number of the switching output is therefore shown with x. Call up the switching output to be set via the menu of the corresponding measurement (o1 1 or tEMP).

The factory assignment of the switching outputs can be seen from the following table.

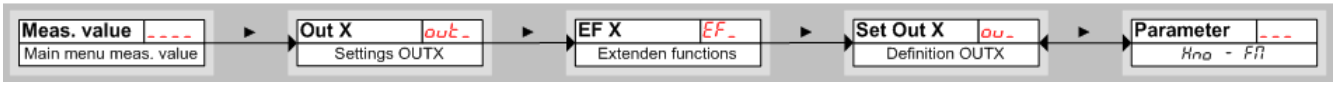
Switching output x	Assignment with 2 switching outputs	Assignment with 4 switching outputs
1	Filling level	Filling level
2	Temperature	Filling level
3		Temperature
4		Temperature

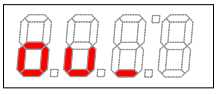
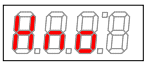
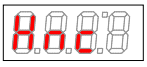
The assignment of the switching outputs as well as more basic settings referring to all switching outputs can be changed in the **"Basic ext. functions"** menu, see chapter 4.6.3.

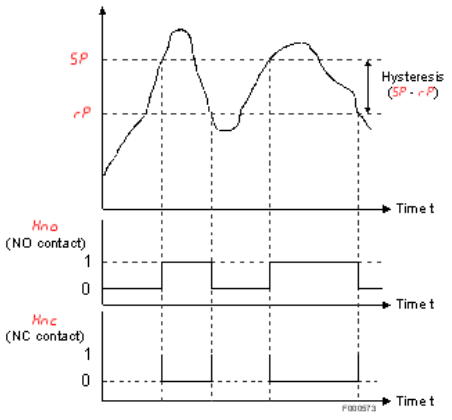
In the **"Extended functions"** submenu, more settings for each individual switching output can be made, which influence e.g. the switching behavior of the output. Here, the output can also be tested.

4.7.1 Switching output x: Definition of the switching characteristic

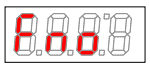
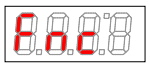
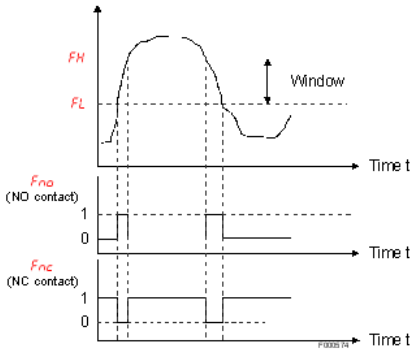
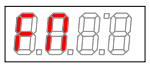
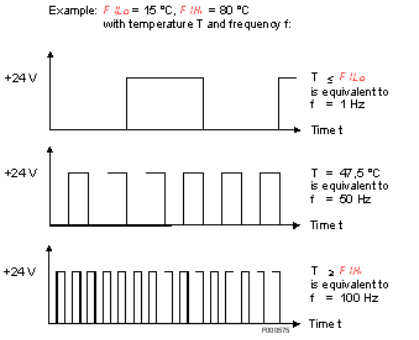
The switching characteristic for the output is determined in the following menu:



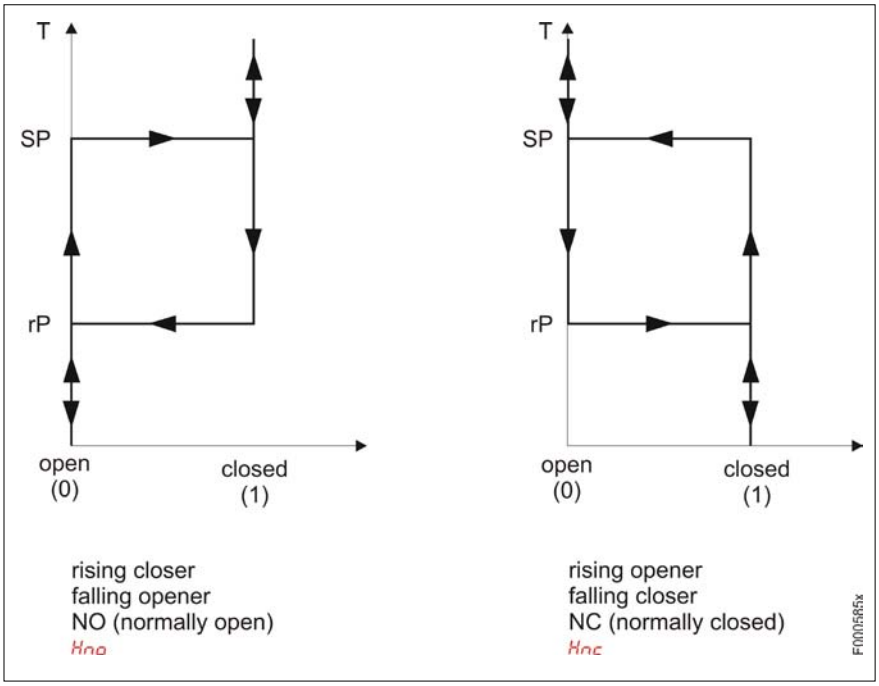
 **Hysteresis function**	The following options are available:
 Hysteresis function as normally open contact  Hysteresis function as normally closed contact	Normally open or closed contact function in which the output signal will be set if the set switching points are exceeded. If the set switch-back point is undershot, the output signal will be deleted. Here, normally open contact means that the PNP switching output is closed above the SPx switching point and opens again if the rPx switch-back point is undershot. Here, normally closed contact means that the PNP switching output is open above the SPx switching point and closes again if the rPx switch-back point is undershot. Also refer to the explanation in the following drawing.



Operation

Window function  Window function as normally open contact  Window function as normally closed contact	Normally open or closed contact function by means of which a signal window is determined. If the measuring window is reached, the output signal is set; if the window is left, it will be deleted again. Here, normally open contact means that the PNP switching output is closed if the value is within the window. Otherwise, the switching output is open. Here, normally closed contact means that the PNP switching output is open if the value is within the window. Otherwise, the switching output is closed.	
Frequency output  Frequency output	If the output is defined as frequency output, a rectangular signal with a frequency between 1 Hz and 100 Hz proportionate to the set temperature value is output.	

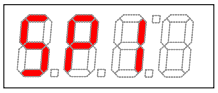
In order to increase the edge steepness of the rectangular signal, we recommend loading the switching output with a 10 kΩ resistance.



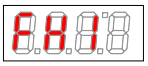
The switching function may have different designations.

4.7.2 Switching output x: Upper switching limit (switch-on point)

The upper switching limit for the OUT 1 switching output is set in the following submenu:

 Setting range [oLo]…[oHi]	Switching point for OUT x

The switching point must be selected within the range limits (see **"Basic ext. functions"** menu).

If the OUT 1 switching output has been assigned the **"Window"** function,  will be displayed.

The set value corresponds to the upper window limit.

If the OUT 1 switching output has been assigned the **"Frequency output"** function,  will be displayed.

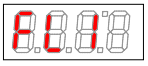
The set value corresponds to the frequency 100 Hz.

4.7.3 Switching output x: Lower switching limit (switch-back point)

The lower switching limit for the OUT 1 switching output is set in the following submenu:

 Setting range [oLo]…[oHi]	Switch-back point for OUT 1

The switch-back point must be selected within the range limits.

If the OUT 1 switching output has been assigned the **"Window"** function,  will be displayed.

The set value corresponds to the upper window limit.

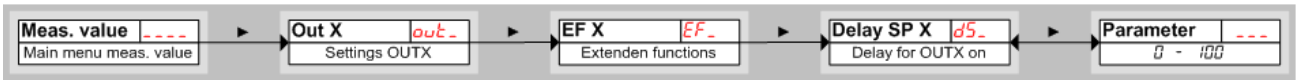
If the OUT 1 switching output has been assigned the **"Frequency output"** function,  will be displayed.

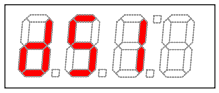
The set value corresponds to the frequency 1 Hz

4.7.4 Switching output x: Switch-on delay

In the **"Extended functions"** *EF 1* menu, more settings for switching output 1 can be made. The submenu is located on the second submenu level.

The switching and switch-back delay time prevent the alarm from responding too frequently in case of unstable conditions. The switching delay is set in the following menu:



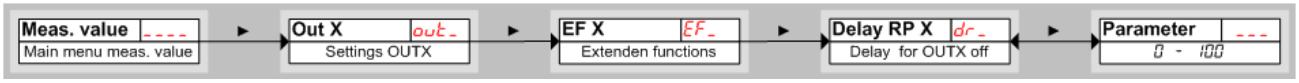
 Setting range: 0...100 seconds	Time period in seconds during which the signal must be continuously available for the switching output to respond.

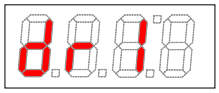
If the OUT x switching output has been assigned the Window function, the set value corresponds to the switch-on delay detecting the valid achievement of the measuring window.

If the OUT x switching output has been assigned the Frequency output function, this value will have no effect.

4.7.5 Switching output x: Switch-back delay

The switch-back delay is set in the following menu:



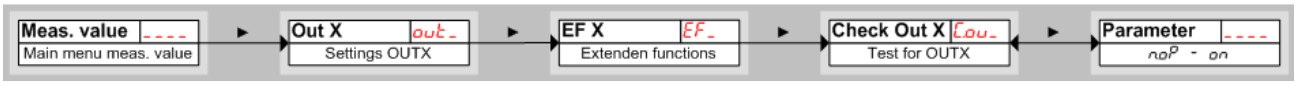
 Setting range: 0...100 seconds	Delay of the switch-back signal for OUT 1 Time period in seconds during which the signal must be continuously available for the switching output to respond.

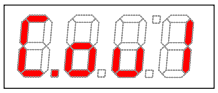
If the OUT 1 switching output has been assigned the Window function, the set value corresponds to the switch-on delay detecting the valid leaving of the measuring window.

If the OUT 1 switching output has been assigned the Frequency output function, this value will have no effect.

4.7.6 Switching output x: Testing of the switching output

The switch-back delay is set in the following menu:





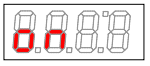
Optional settings:
[noP, oFF, on]

Test possibility for the switching output

Options when setting out to Hno / Hnc / Fno / Fnc:

Normal operation of the switching output

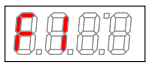
Permanently deactivating the switching output



Permanently activating the switching output

Options when setting out to FM:

Normal operation of the frequency output



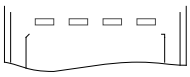
Output Frequency 1 Hz

Output Frequency 100 Hz

After termination of the test, you should imperatively set the function to noP normal operation.

4.7.7 Changing the display function of the status LED

The switching status of the output is signaled by the LEDs in the display. The assignment of the LED to the switching output can be seen from the following table:

Numbering LED	Switching output x	Assignment with 2 switching outputs	Assignment with 4 switching outputs
LED 1 2 3 4 	1	LED 1 – yellow	LED 1 – yellow
	2	LED 2 - red	LED 2 - red
	3		LED 3 – yellow
	4		LED 4 - red

In the factory setting, the LED indicates the physical condition of the PNP switching output (switching output closed – LED illuminated).

You might want the logical function of the display to work in a different way than the physical signal on the switching output. You can therefore also reverse this display in this menu item (switching output open – LED illuminated).

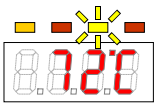
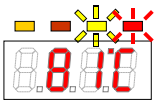
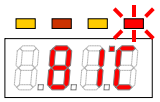
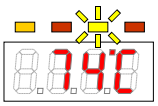
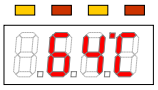
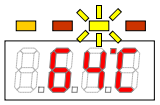
Example using the temperature:
You have 2 switching outputs for the temperature, which are set as follows:

- Upper switching contact: Max. contact, rising NO contact. The LED is illuminated if the maximum temperature value is exceeded and the temperature is outside the desired range. So the indicated status is "error" if the LED is illuminated.
- Lower switching contact: Min. contact, rising NO contact. So with the factory setting, the LED is illuminated if the minimum temperature value is exceeded. So in this case, the LED would be illuminated if the status is ok.

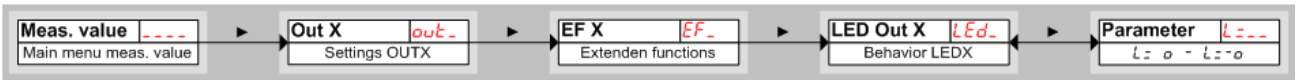
Operation

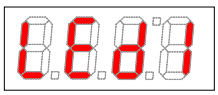
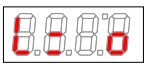
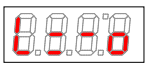
The table shows an example with the factory setting and with inverted status function for LED3. The switching points are defined as follows:

SP3 = 70 °C, rP3 = 65 °C
SP4 = 80 °C, rP4 = 75 °C

	Factory setting	Status function LED inverted	Condition	Status
A	 LED3 ON	 LED3 OFF	Temperature increases to > 70 °C PNP switching output 3 closed	OK
B	 LED4 and LED3 ON	 only LED4 ON	Temperature increases to > 80 °C PNP switching output 4 closed	Error
C	 LED3 ON	 LED3 OFF	Temperature decreases to < 75 °C PNP switching output 4 open	OK
D	 LED3 OFF	 LED3 ON	Temperature decreases to < 65 °C PNP switching output 3 open	Error

Here, you can reverse the LED status function for a contact: the LED is illuminated if the contact is open, i.e. below the minimum temperature, and the "Error" status is indicated again if the LED is illuminated. The recording of events particularly depends on the lighting up of the LED (see chapter "Diagnosis possibilities", 4.9).



 Optional settings: [Lr o , Lr-o]	The following options are available
	 LED = output; The LED is illuminated if the PNP switching output is closed.
	 LED = –output; The LED is illuminated if the PNP switching output is open.

The recording of events particularly depends on the lighting up of the LED (see chapter "Diagnosis possibilities", 4.9).

4.8 Analog outputs

4.8.1 Analog output x: Assignment of the upper limit

Here, it is assigned at which temperature the maximum analog signal is to be output. The setting is made in the menu.

Setting range
0 °C to 100 °C
(32 °F to 212 °F)

- Open the value list by means of the ▶ key.
- Set the value using the ▼ and ▲ keys and confirm it using the ▶ key (e.g. 10 °C).

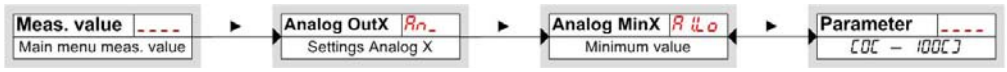
  The device returns to the submenu.

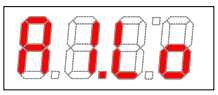
The set output range must not be selected to be less than 10 % of the measurement range. AI Hi – AI Lo >= 10 %

If the selected range is too small, the analog value output may show steps.

4.8.2 Analog output x: Assignment of the lower limit

Here, it is assigned at which temperature the minimum analog signal is to be output. The setting is made in the menu.





Setting range
0 °C to 100 °C
(32 °F to 212 °F)

- Open the value list by means of the ▶ key.
- Set the value using the ▼ and ▲ keys and confirm it using the ▶ key (e.g. 80 °C).

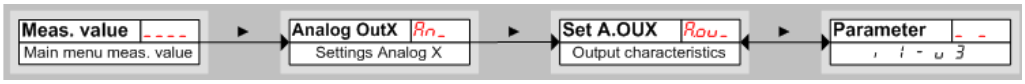
  The device returns to the submenu.

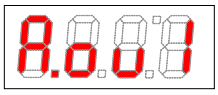
The set output range must not be selected to be less than 10 % of the measurement range. AI Hi – AI Lo >= 10 %

If the selected range is too small, the analog value output may show steps.

4.8.3 Analog output x: Determining the signal form

The analog output can be defined as voltage or current output with different value ranges. The setting is made in the menu.



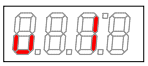


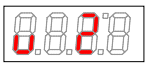
- Open the value list by means of the ▶ key.
- Set the value using the ▼ and ▲ keys and confirm it using the ▶ key (e.g. 10L or 10 %).

  The device returns to the submenu.

The following options are available:


4 mA to 20 mA

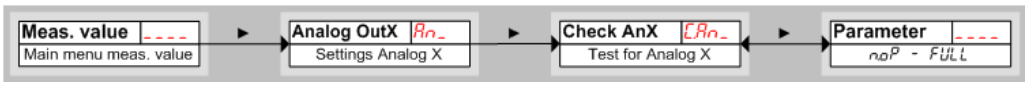

2 V to 10 V

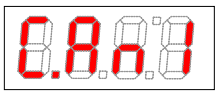

0 V to 10 V


0 V to 5 V

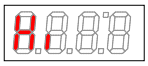
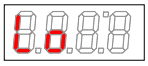
4.8.4 Analog output x: Testing the analog output

The analog output can be tested, as well. The largest, the medium and the smallest analog value can be output one after the other. The setting is made in the menu





The following options are available:

 Normal operation	 Output highest analog value
 Output medium analog value	 Output lowest analog value

After termination of the test, you should imperatively set the function to nop normal operation.

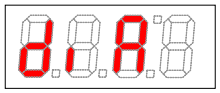
4.9 Diagnosis possibilities

The device is able to log events for a switching output. An event is defined as the lighting up of the LED. I.e. the recording of the switching processes depends on the setting of the LED switching function (see 4.7.7).

The settings and the analysis can be made here.

Only one switching output can be logged. The switching output to be logged is set in the switching output log alarm SwOu menu item.

- In order to access the main menu, press the ▼ key.
- Select the di A menu item using the ▼ and ▲ keys.



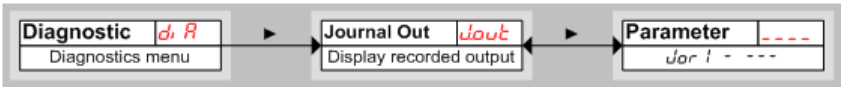
From here, you can access different diagnosis values and logs regarding the filling level and temperature monitoring.

- Open the menu by means of the ▶ key.

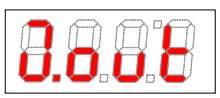
Now, you can change and/or call the diagnosis settings.

4.9.1 Calling the log book

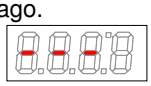
Here, the last 6 events of the logged switching output can be called or deleted.



The log entries are displayed in the following way:	Example:
• Latest event dor 1 occurred before x hours (h) / days (d), • events 2 to 5 occurred before x hours / days, • the oldest event dor6 occurred before x hours / days, • Delete function (---). * Not yet assigned, only 4 events have occurred	dor 1 ⇔ 13h, key ▼ dor2 ⇔ 2.4h, key ▼, ▲ dor3 ⇔ 6.1h, key ▼, ▲ dor4 ⇔ 8.2h, key ▼, ▲ dor5 ⇔ non *, key ▼, ▲ dor6 ⇔ non *, key ▼, ▲ ---, key ▲; ▶ = delete



The index of entry x and the time are indicated alternately, e.g. dor 1 ⇔ 14h for the latest event 1.4 hours ago.

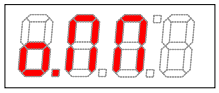
Confirming the display  by means of the ▶ key deletes the event list and returns to the submenu.

If no events have been recorded, the display changes between dor and non. The stored data will be overwritten after 6 months.

4.9.2 Maximum and minimum filling level

Here, the stored maximum and minimum filling level are displayed or deleted.

The values are displayed in the following way	Example:
• Maximum filling level value,	150, key ▼
• Reached x hours / days ago,	8.4h, key ▼, ▲
• Minimum filling level value,	60, key ▼, ▲
• Reached x hours / days ago,	2.1h, key ▼, ▲
• Delete function.	---, key ▲; ▶ = delete



Menu order:
Max. value,
time
Min. value,
time
delete

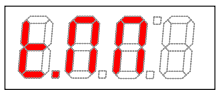
Confirmation of the display  using the ▶ key deletes the event list and returns to the submenu.

The stored data will be overwritten after 6 months.

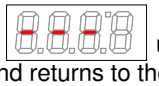
4.9.3 Maximum and minimum temperature

Here, the stored maximum and minimum temperature are displayed or deleted.

The values are displayed in the following way	Example:
• Maximum temperature value,	72 C, key ▼
• Reached x hours / days ago,	8.4h, key ▼, ▲
• Minimum temperature value,	22 C, key ▼, ▲
• Reached x hours / days ago,	2.1h, key ▼, ▲
• Delete function.	---, key ▲; ▶ = delete



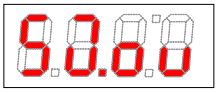
Menu order:
Max. value,
time
Min. value,
time
delete (reset)

Confirmation of the display  using the ▶ key deletes the event list and returns to the submenu.

The stored data will be overwritten after 6 months.

4.9.4 Determining the switching output to be logged

Here, the switching output to be logged is selected. Only one switching output can be logged.



Selection:
out 1 to out

- Open the value list by means of the ▶ key.
- Select the value using the ▼ and ▲ keys and confirm it using the ▶ key.

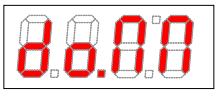
The device returns to the submenu.

The values are stored from the volatile memory into the non-volatile one approx. every three hours.

The stored data will be overwritten after 6 months.

4.9.5 Delay until storage of the min/max filling level

In order to record reliable values in case of an unstable fluid level, a delay time until storage of the minimum and maximum filling level can be set. Here, the time period in seconds is indicated during which the signal must be continuously available before the filling level will be logged.



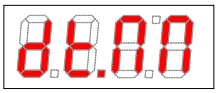
Setting range:
0...100 seconds

- Open the value list by means of the ▶ key.
- Set the value using the ▼ and ▲ keys and confirm it using the ▶ key (e.g. 5 (seconds)).

The device returns to the submenu.

4.9.6 Delay until storage of the min/max temperature

In order to record reliable values in case of temperature fluctuations, a delay time until storage of the minimum and maximum temperature can be set. Here, the time period in seconds is indicated during which the signal must be continuously available before the temperature will be logged.



Setting range:
0...100 seconds

- Open the value list by means of the ▶ key.
- Set the value using the ▼ and ▲ keys and confirm it using the ▶ key (e.g. 5 (seconds)).

The device returns to the submenu.

5 Maintenance

5.1 Inspection and maintenance

The device is working in a maintenance-free way.

5.2 Service and repair

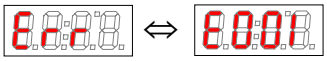
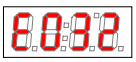
If an error occurs during operation, the following table provides troubleshooting information.

If after removal of possible failures and switch-on of the mains voltage, the device does not function correctly, it must be checked by the manufacturer. For this purpose, please put the device in suitable packing and return it to one of the Bosch Rexroth service representations.

Please refer to www.boschrexroth.com/adressen for addresses of service representations.

5.3 Troubleshooting

In case of an error, all outputs are de-energized. The four LEDs flash. Errors remain stored in the device until switch-off.

Problem / failure	Possible cause	Remedy
No display	No supply voltage	Check cables and replace, if necessary
Error messages in the display: Change between Err and Exxx: e.g.		
 Error 01	Ambient temperature too low	Comply with the limits
 Error 02	Ambient temperature too high	Comply with the limits
 Error 04	Pt 100 defective (short circuit)	Replace the feed line Pt100 Send in the device for repair
 Error 08	Pt 100 defective (cable break)	Replace the feed line Pt100 Send in the device for repair
 Error 16	Reed chain defective (short circuit)	Replace the feed line Send in the device for repair
 Error 32	Reed chain defective (feed line open)	Replace the feed line Send in the device for repair

6 Disposal

In the disposal, the legal regulations of the country of use are to be observed, particularly the regulations regarding the disposal of electronic components.

7 Technical data

general			
Installation position:			Vertical ±10°
Medium temperature range			–20 to +70 °C [–4 to +158 °F]
Ambient temperature range			–20 to +85 °C [–4 to +185 °F]
Material	Sliding tube Ø	20 mm [0.79 inch]	CU alloy
	Float		1.4571
	Flange		PA12 + 25GF (25 % of glass fiber)
	Protective tube Ø	60.3 mm [2.37 inch]	Stainless steel 1.4301

hydraulic			
Maximum operating pressure	bar [psi]	1 [14.5]	
Hydraulic fluid			
Density	g/cm³	> 0.8	
Resistance			
Mineral oils		HLP according to DIN 51524	Resistant
Flame-resistant	Emulsions	HFA-E according to DIN 24320	Resistant
	Water solutions	HFC	Resistant
	Phosphoric acid esters	HFD-R according to VDMA 24317	Resistant
	Organic esters	HFD-U	Resistant
Fast biodegradable	Triglycerides (rape seed oil)	HETG	Resistant
	Synthetic esters	HEES	Resistant
	Polyglycols	HEPG	Resistant

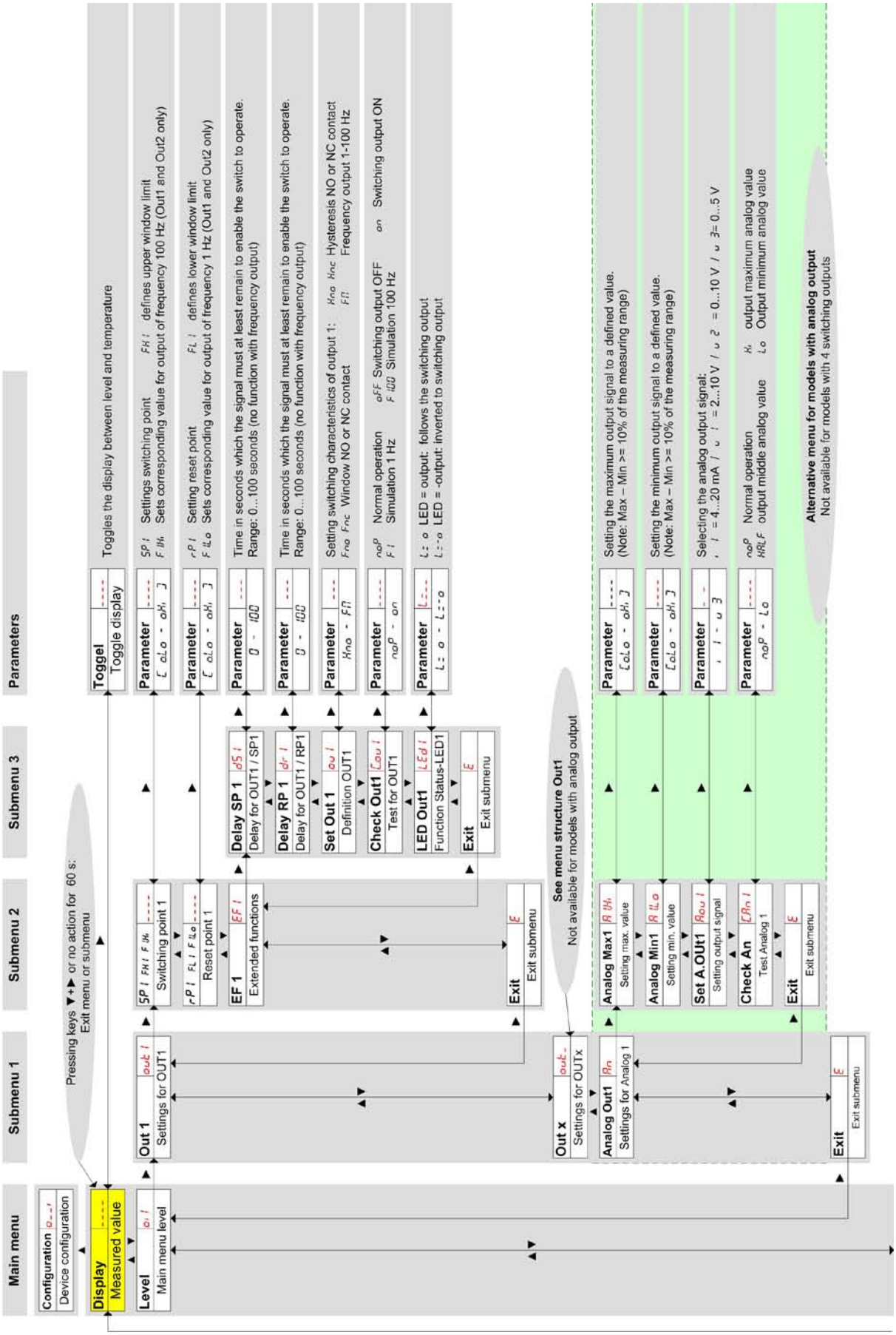
Technical data

electric			
Protection class according to DIN EN 60529			IP 65
Plug-in connection		K24	4-pole M12x1 (material metal)
		K14	4-pole (3+PE) DIN EN 175301-803
		K6	7-pole (6+PE) DIN EN 175301-804
Reed contacts of the float switches with connection K24 for mating connector M12x1, 4-pole			
Voltage range		VDC	10 to 36
Max. switching current		A	0.5
Max. contact load VA			10
Temperature contacts of the float switches with connection K24 for mating connector M12x1, 4-pole			
Voltage range		VDC	10 to 50
Max. switching current		A	0.5
Max. contact load VA			10
Max. switching cycles			100 000
Response tolerance		K	±3 with max. 1 K/min
Hysteresis		K	up to 10 with max. 1 K/min
Max. temperature change velocity		K/min	1
Reed contacts of the float switches with connection K14/ K6			
Voltage range		VDC/VAC	10 to 230
Max. switching current		A	0.5
Max. contact load VA			10
Temperature contacts of the float switches with connection K14/ K6			
Voltage range		VDC/VAC	10 to 230
Max. switching current		A	0.5
Max. contact load VA			10
Max. switching cycles			100 000
Response tolerance		K	±3 with max. 1 K/min
Hysteresis		K	up to 10 with max. 1 K/min
Max. temperature change velocity		K/min	1
Pt 100			
Sensor element			Pt 100 class B DIN EN 60751
Temperature measuring range		°C [°F]	0 to 100 [32 to 212]
Accuracy		K	±0.8
Resistance measuring chain and resistance thermometer with connection K24 for mating connector M12x1, 4-pole			
Operating voltage		VDC	10 to 36
Signal output		mA	4 to 20 (alternatively 0 to 10, 2 to 10 or 0 to 5 V can be set)
Resolution resistance measuring chain		mm	5
Max. load		Ω	(U-9.0 V) / 0.02 A
Measuring range temperature		°C [°F]	0 to 100 [32 to 212]
Display and control unit			
Supply voltage		VDC	10 to 32
Display range		°C [°F]	–20 to +120 [–4 to +248]
Alarm adjustment range	Temperature	°C [°F]	0 to 100 [32 to 212]
	Level	% / liter [US gal]	0 to 100 / 0 to 999 [263.91]
Switching points			4 programmable switching outputs (2 level + 2 temperature)
Housing design			PA, IP 65 (antistatic)

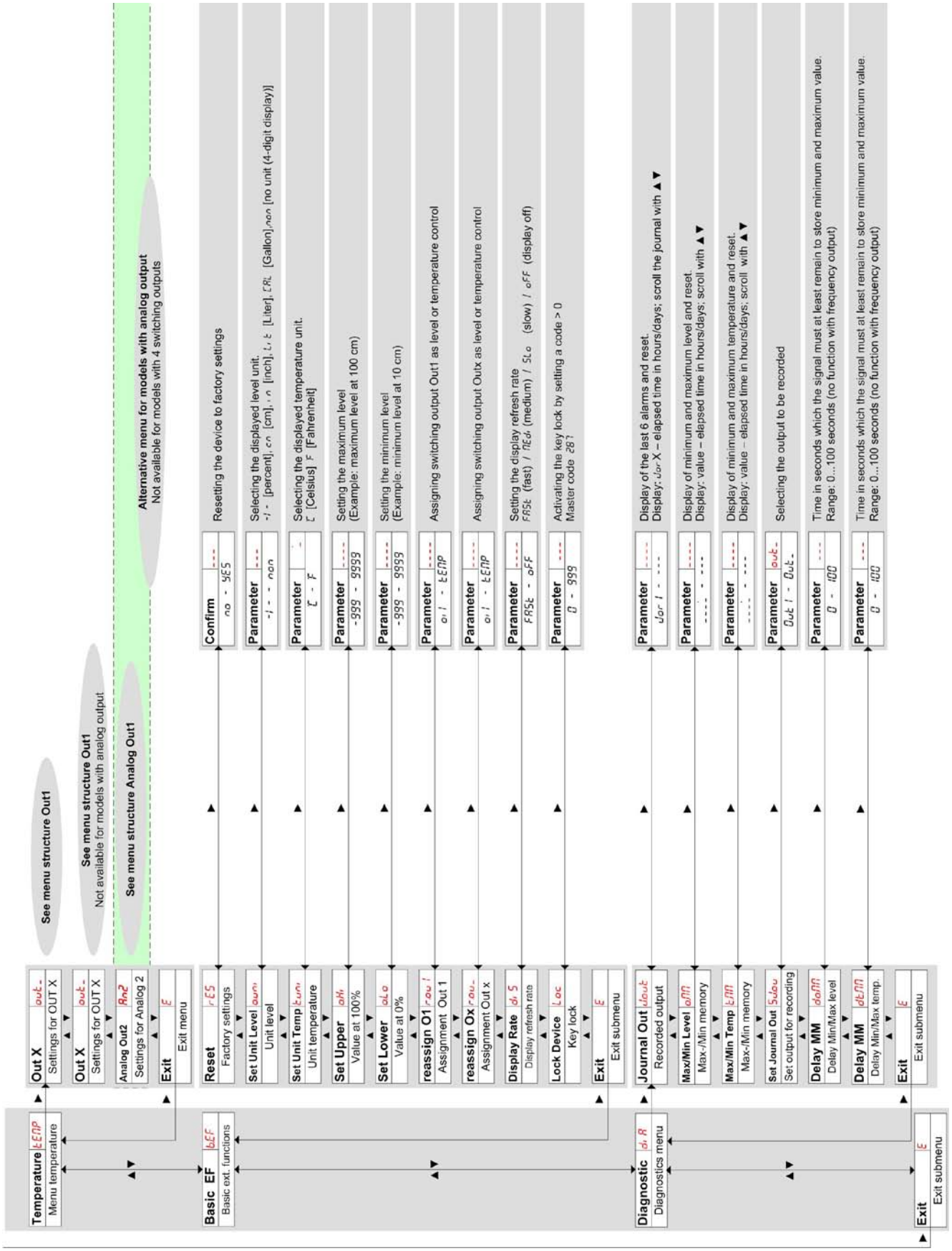
Display		4 digit seven-segment LED display
Current consumption upon switch-on		approx. 100 mA for 100 ms
Current consumption in operation		approx. 50 mA with UB 24 V
Switching output		PNP, max. 0.5 A switching power
Max. ambient temperature	°C [°F]	–20 to +70 [–4 to +158]
Accuracy		1 % of the measurement range end value
Operation		3 keys

8 Appendix: Overview menu sequence

Appendix: Overview menu sequence



Appendix: Overview menu sequence



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Rexroth
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