

LK 162 SmartStove®



OPERATING AND INSTALLATION INSTRUCTIONS

DIFFERENTIAL TEMPERATURE CONTROLLER FOR ROOM/SPACE
HEATING SYSTEMS AND DOMESTIC HOT WATER SYSTEMS
HANDLING SOLID FUEL HEAT SOURCES, NAMELY WOOD LOG AND
PELLET STOVES



LK Armatur

These Operating and Installation Instructions are an integral part of the product.

- › Read Operating and Installation Instructions carefully before using the product.
- › Keep them in a safe place during the product's service life.

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Important information

Safety information

The Assembly and Operating Instructions indicate possible hazards:

 **DANGER** indicates an almost certain danger of serious personal injury or death.

 **WARNING** indicates a possible danger of serious personal injury.

 **CAUTION** indicates a possible danger of slight personal injury.

NOTICE indicates a possible danger of damage to the equipment.

When handling the differential temperature controller LK SmartStove® and the entire plant, please make sure that the safety provisions in the Operating and Installation Instructions are complied with!

Conditions of use

These instructions describe installation, commissioning, operation, repair, and disassembly of the differential temperature controller LK SmartStove® for solid fuel heat sources, namely wood log and pellet stoves.

For operation of the entire plant, the technical documentation of all the components used such as stove, boiler, tank, pumps, mixers, and valves, etc. must be complied with.

 DANGER	
	<p>Assembly, connection, commissioning, repair, or disassembly</p> <p>Lethal danger due to electrocution!</p> <p>Whenever work is performed on the open terminal cover, all poles of the power supply must be disconnected reliably and protected against being switched on again!</p>

The controller is handled by the operator of the entire thermal plant, i. e. as a rule by technical non-experts.

NOTICE	The controller by no means replaces the safety components required under plant engineering aspects!
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Make sure not to use the controller until you have thoroughly read and understood these Assembly and Operating Instructions and the safety provisions. Comply with all safety provisions and involve a specialist in case of doubt.

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NOTICE

The installer installing the controller must inform the plant operator about operation, functioning and the method of action of the LK SmartStove®!

Keep these Assembly and Operating Instructions and all reference documents so that they are available if required.

When relocating or when selling the device, hand the documents over to your successor.

NOTICE

The device in operation may only be made accessible to adults disposing of appropriate knowledge and experience!

NOTICE

Make sure that only a dry or slightly moistened cloth is used for cleaning and servicing of the housing, the control elements and the display.

The surfaces must never get into contact with cleaning products or solvents - mat, brittle or slightly dissolved plastic parts must be replaced immediately!

A device with damaged housing must not be operated!

Intended use

The differential temperature controller LK SmartStove® may be used exclusively as controller for wood log and pellet stoves.

It must be operated within the scope of all the specifications described.

Installation and set-up of the controller may only be performed by specialists.

The installer must have read and understood the operating manual. The installer explains all the relevant functions to the operator.

For operation, it is essential that the housing is closed and free of damage.

Description

The differential temperature controller LK SmartStove® is an independent electronic controller for surface-mounting which is used for the control of wood log and pellet stoves.

The controller is equipped with a robust three-part plastic housing which can only be opened by means of tools (screw driver PH2).

Operation is effected by means of only two control elements; indications appear against a backlit colour display.

Scope of supplies

- 1 Differential temperature controller LK SmartStove®
- 4 pcs temperature sensors (Pt 1000, 4 m cable)
- 1 CD with Operating Instructions

Mounting and connection

Before connection of the electrical system, the controller must be mounted firmly to a perpendicular, robust surface (wall), see "Mounting" on page 40.

For its own supply and the supply of the outputs, the controller must be connected to an electrical energy supply system in accordance with the technical data, see "Electrical connection" on page 44.

 DANGER	
	<p>Loose installation or connection</p> <p>Lethal danger due to electrocution!</p> <p>Whenever work is performed on the open terminal cover, all poles of the power supply must be disconnected reliably and protected against being switched on again!</p>

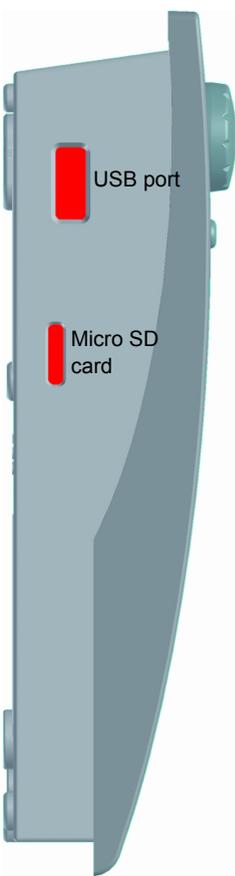
Assembly, connection, commissioning, repair and disassembly of the controller are only admissible in a specialist workshop.

NOTICE	To ensure correct operation, temperature sensors type Pt 1000 must be used - the sensor design does not affect function.
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Each temperature sensor has two connectors which are equivalent, i. e. interchangeable. Thus, polarity reversal is not an issue.

The sensor lines can be extended up to a length of 100 m, to this effect, a cable cross section of 2 x 1.5 mm² is recommended.

Data interfaces



The controller has the following data interfaces:

The cut-outs at the left of the housing base accommodate a USB port as well as a slot for a storage medium (Micro SD card).

These interfaces are used, for example, for reading of error messages or log data or loading of software updates.

The USB port provides access to the Micro SD card.

Only SD cards approved by the manufacturer must be used.

The controller automatically detects the Micro SD card.

Prior to removing the Micro SD card ›Rem.SD card safely‹ must be selected in ›1.2 Settings‹, otherwise data loss may occur.

Since the controller can only read formatted SD cards, the Micro SD card must be formatted with a PC.

<p>NOTICE</p>	<p>Micro SD cards recommended by the manufacturer:</p> <ul style="list-style-type: none"> Transcend® 2GB Product-No. TS2GUSDC Transcend® 4GB HC Transcend® 1GB Verbatim 2GB PNY 2GB hp 2GB SanDisk 2GB
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Data logging

When an optional Micro SD card is inserted in the device, data logging is always active on the controller.

Data is written to the LOGFILES directory.

The recording is performed in CSV format, so that the files can be easily imported into calculation or presentation programs. A new file will be created for each day. The interval for data recording is 10 seconds.

The following values will be recorded and each row contains the following information:

- Time of the day (hours, minutes, seconds)
- Current temperature values of TS1 – TS6
- Output states (speed) of RO1, RO2, REL, TS7, TS8
- Lock-states (safety functions)
- Error codes

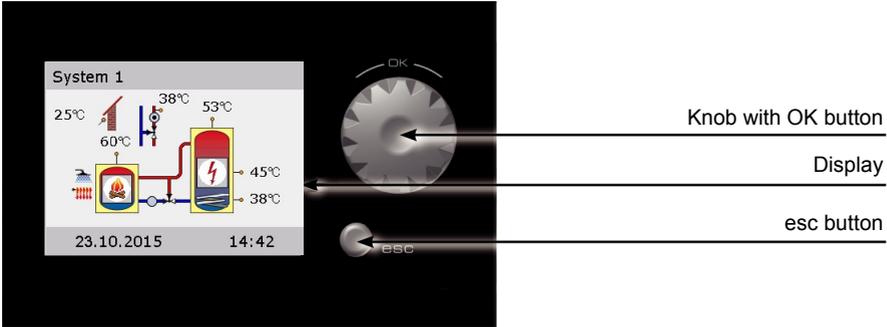
In the header of each file the date, the controller ID, as well as the column label of the recording data is applied.



Operation of the controller

Control elements

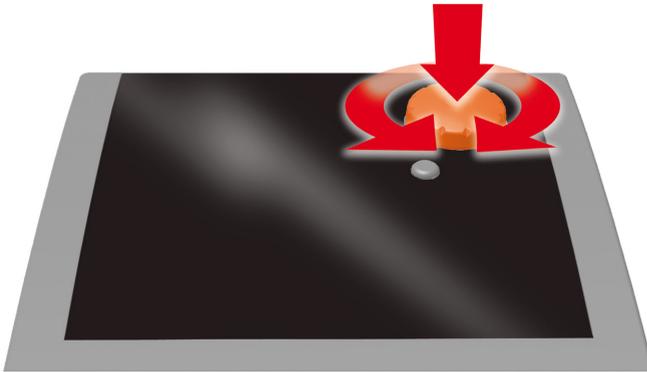
The entire set-up and operation of the differential temperature controller LK SmartStove® is effected via only two control elements on the device front.



All settings and interrogations are effected via the **knob** and the **esc button**.

- To find a required menu item, *turn the knob* to scroll through the menu - the selectable option appears on a coloured background on the display.
- To confirm the selected menu item, *press the knob* ("OK").

An appropriate submenu is called up, or selection is activated.



Knob

- *Press the esc button* to make the menu return by one level from any subitem.

If no input is made within the preset time (30-255 s), the controller returns automatically to the initial level.



esc button

Display

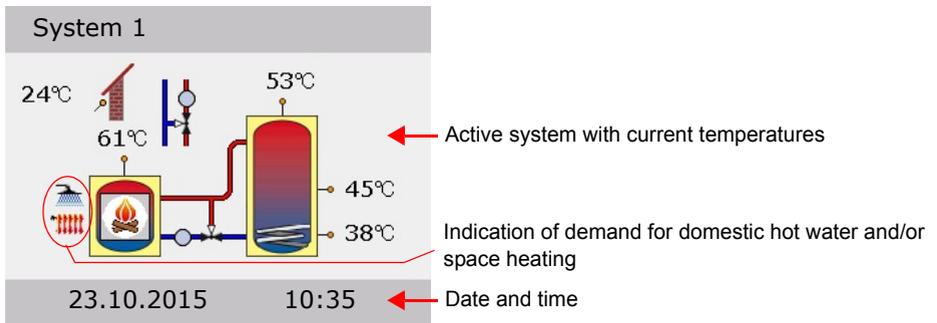
For indication of the operating mode and for communication in case of set-up, malfunction, modification and evaluation, the differential temperature controller LK SmartStove® is equipped with a coloured full graphics display which is permanently backlit.

The display is active as long as there is supply voltage on the controller.

After a preset time (30 - 255 s), backlighting is dimmed to 10%.

Information screen

During normal operation, the information screen is displayed. It shows the active system, the system state, the current temperatures, and it animates active hydraulic components.



(Example)

NOTICE	<p>The real-time clock has a power reserve of 8 hours minimum.</p> <p>If the controller is disconnected from power supply for a longer time, date and time must be set, see "Settings" on page 34.</p>
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Operation mode

When you *turn the knob* while the information screen is shown, the ›Operation mode‹ screen will be displayed.

The following operation modes are available:

- **Comfort mode:** Provides more stored energy to be used over time.
- **Economy mode:** Conserves energy and stores only a minimum.

The setting Eco or Comfort to select depends on your requirements, season of year and the heating installation. When changing from Eco to Comfort, the controller will use temperature sensors in a different positions. This determines when the controller will stop a request for heat.



- **Common mode:** Eco/Comfort mode is the same for space heating and domestic hot water.



- **Separate mode:** Eco/Comfort mode can be individually selected for space heating and domestic hot water.

You can change the operation mode by *pressing the knob* once.

When Separate mode is configured, turning the knob will move the selection between space heating or domestic hot water.

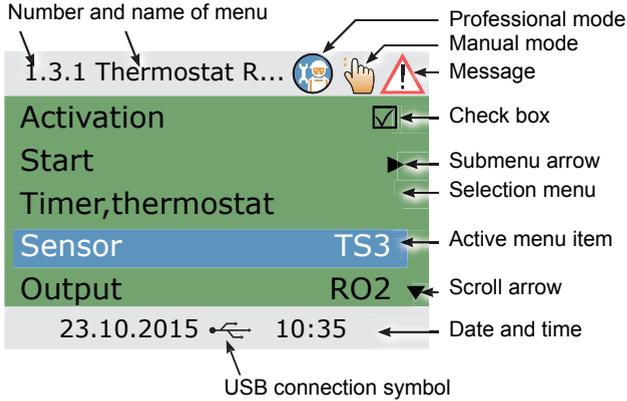
The Common mode can be activated via ›Common Eco/Comf‹ during commissioning, see "Checklist" on page 51.

To return to the information screen, *press the esc button*.

Communication screen

When you *press the knob* while the information screen is shown, the communication screen will be displayed. It shows the menu of selectable functions and parameters.

“Menu structure” on page 31



(Example)

To return to the information screen, *press the esc button*.



Hydraulic systems



<p>NOTICE</p>	<p>Define structure and design of the plant already when planning the entire wood log or pellet stove thermal system and align the design with the one of the hydraulic systems of the controller!</p> <p>If you want to complete an existing system or replace the existing controller, please make sure that LK SmartStove® is compatible with the existing configuration!</p> <p>The sensors are connected to TS1 to TS6, pumps and valves are connected to RO1/RO2/REL/TS7/TS8 - The interfaces are assigned to the functions in question on commissioning.</p>
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Hydraulic symbols

Supply line

Return line

Pump

Zone valve or mixing valve (controlled by other plant components)

Zone valve controlled by LK SmartStove®

Wood log stove

Pellet stove

Boiler, e. g. using fossil fuels/solid fuels/heat pump etc.

Temperature sensor

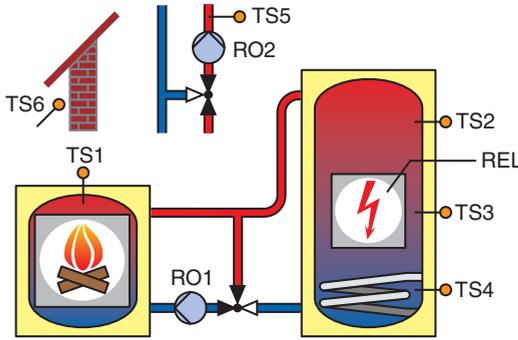
Outdoor temperature sensor

Hot-water/buffer tank without internal components

Hot-water/buffer tank with:

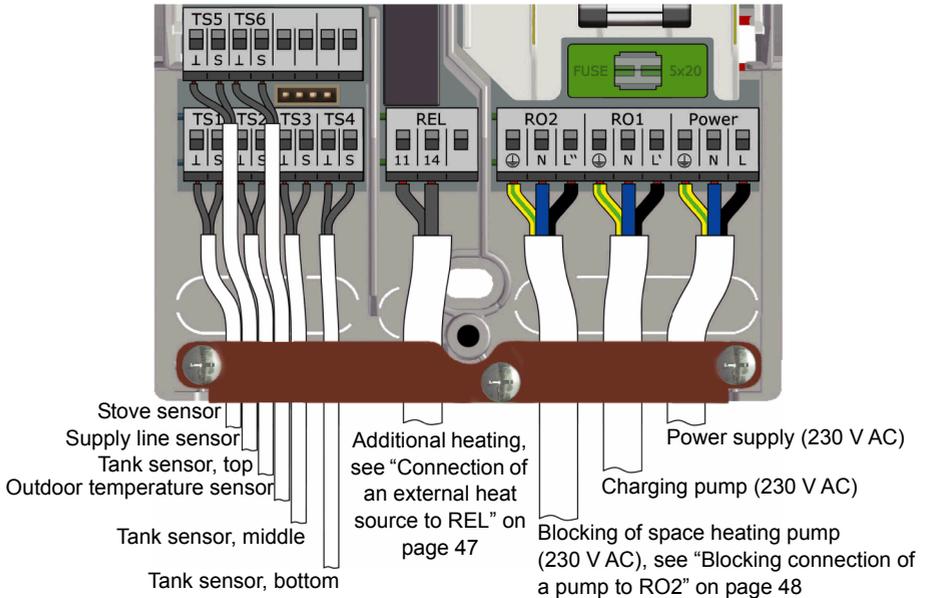
- Additional domestic hot water tank
- Additional heating, e.g. electric
- Heat exchanger
- Solar coil

Hydraulic system 1: Wood log stove

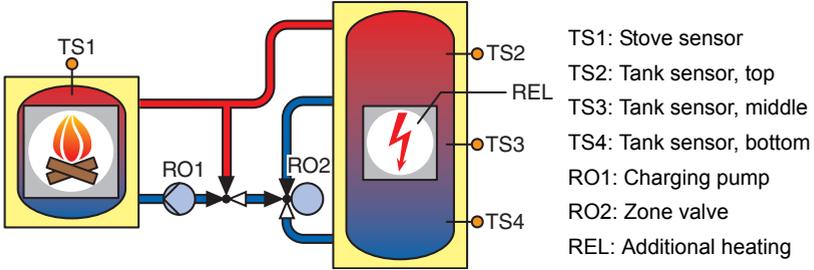


- TS1: Stove sensor
- TS2: Tank sensor, top
- TS3: Tank sensor, middle
- TS4: Tank sensor, bottom
- REL: Additional heating
- TS5: Supply line sensor (optional)
- TS6: Outdoor temperature sensor (optional)
- RO1: Charging pump
- RO2: Blocking of space heating pump

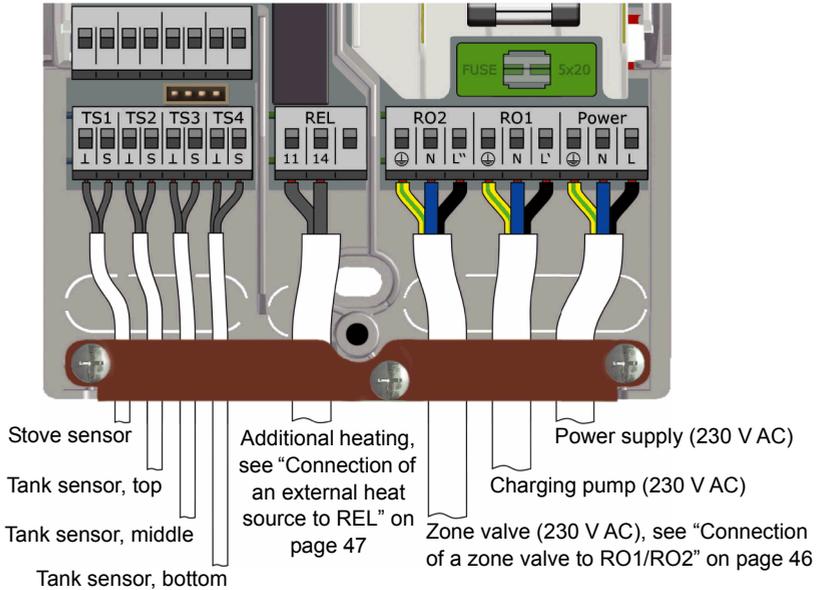
Connection of hydraulic system 1



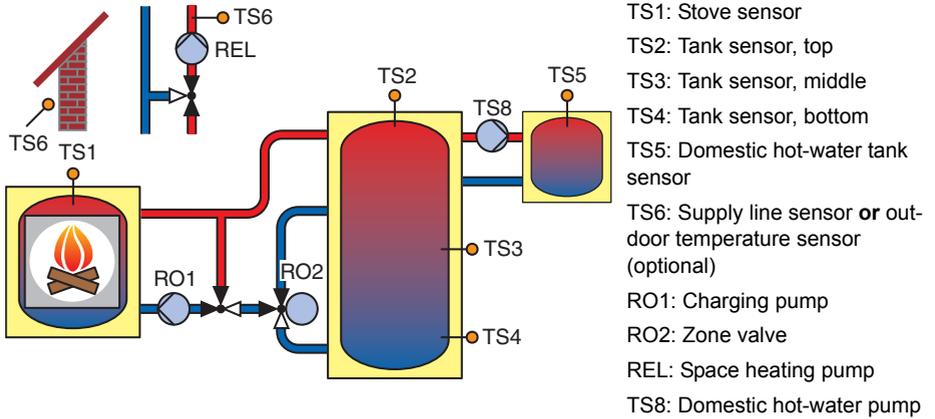
Hydraulic system 2: Wood log stove, tank with zone valve



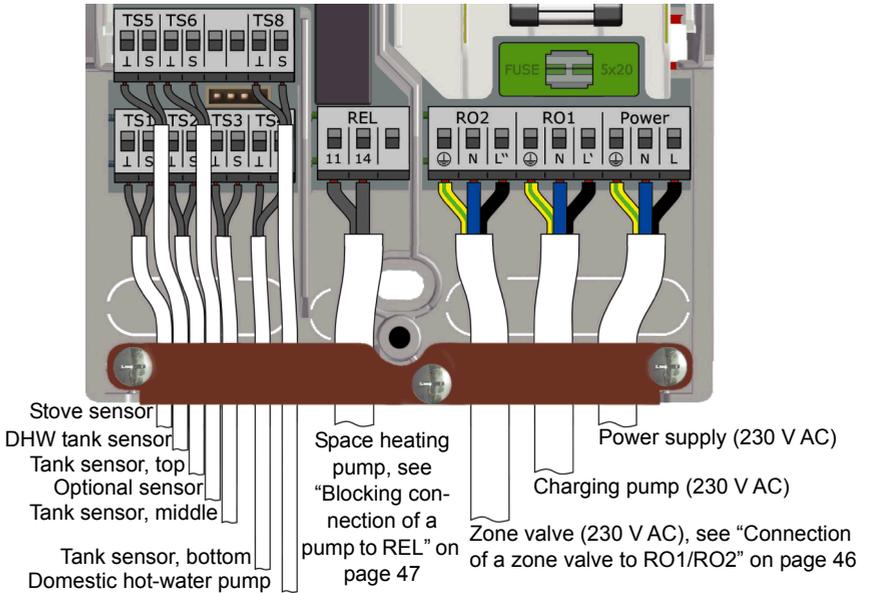
Connection of hydraulic system 2



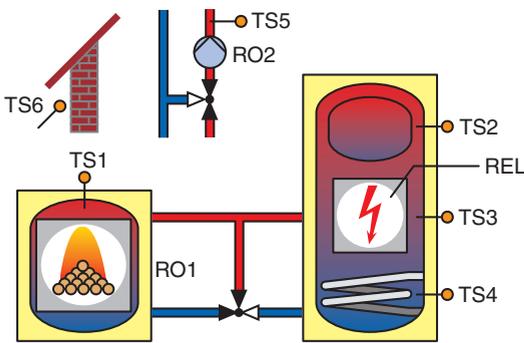
Hydraulic system 3: Wood log stove, tank with charging zones, external domestic hot-water tank



Connection of hydraulic system 3

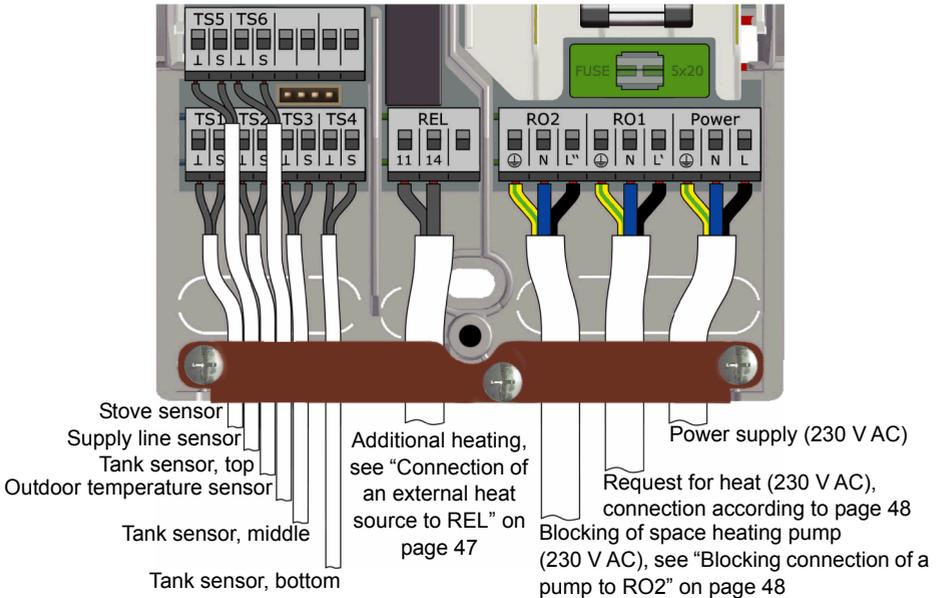


Hydraulic system 4: Pellet stove with combination tank

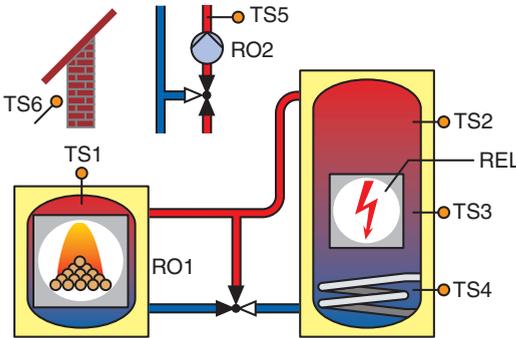


- TS1: Stove sensor
- TS2: Tank sensor, top
- TS3: Tank sensor, middle
- TS4: Tank sensor, bottom
- TS5: Supply line sensor (optional)
- TS6: Outdoor temperature sensor (optional)
- RO1: Request for heat from pellet stove
- RO2: Blocking of space heating pump
- REL: Additional heating

Connection of hydraulic system 4

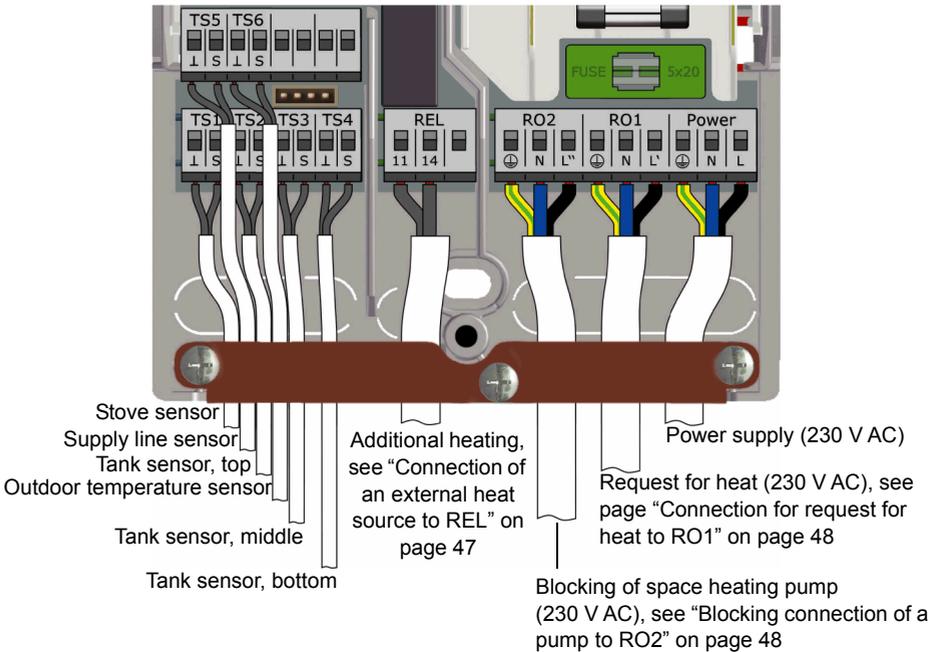


Hydraulic system 5: Pellet stove

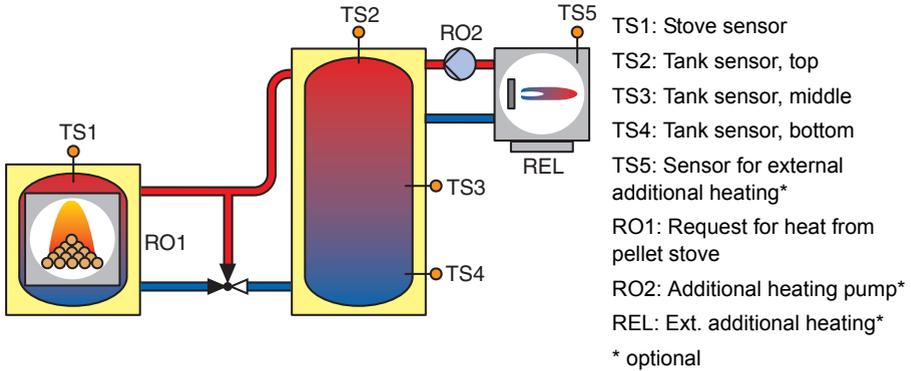


- TS1: Stove sensor
- TS2: Tank sensor, top
- TS3: Tank sensor, middle
- TS4: Tank sensor, bottom
- TS5: Supply line sensor (optional)
- TS6: Outdoor temperature sensor (optional)
- RO1: Request for heat from pellet stove
- RO2: Blocking of space heating pump
- REL: Additional heating

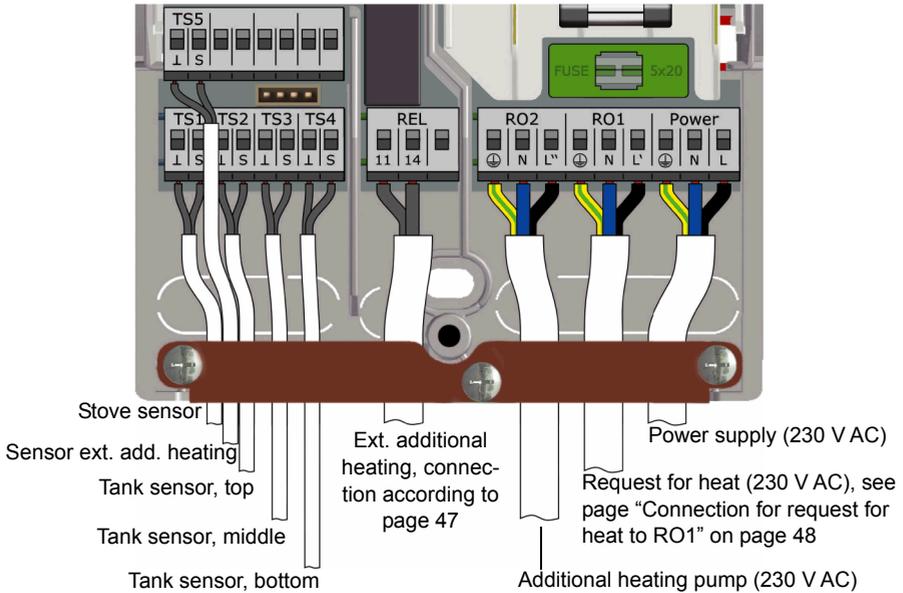
Connection of hydraulic system 5



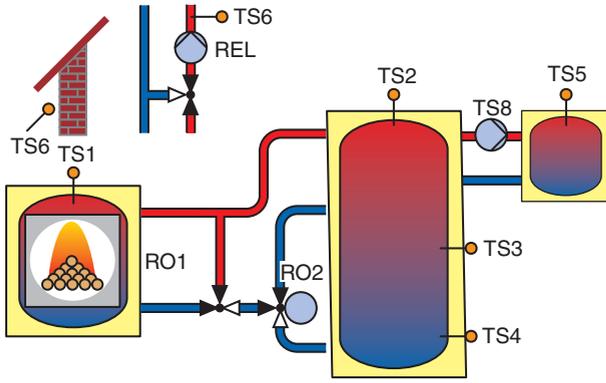
Hydraulic system 6: Pellet stove with external additional heating



Connection of hydraulic system 6

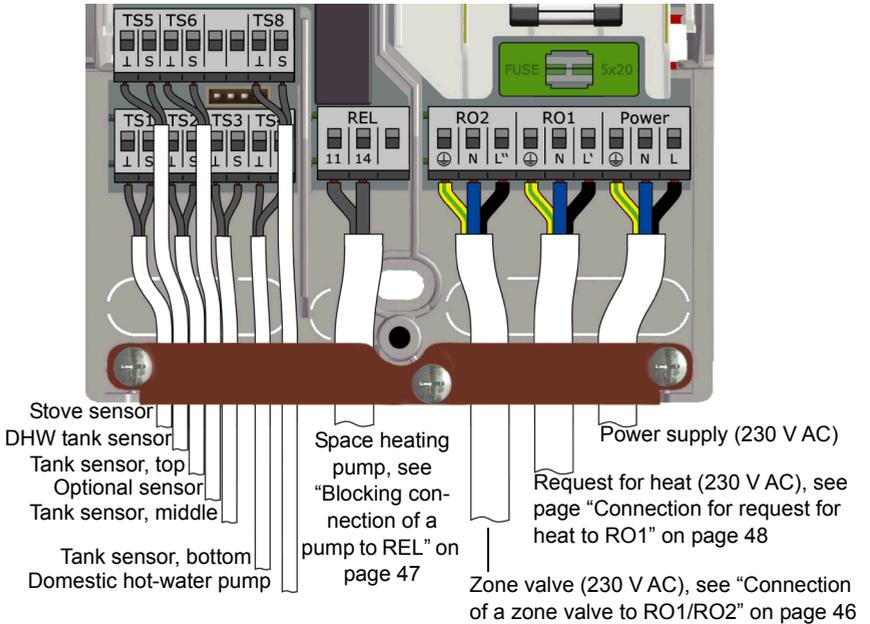


Hydraulic system 7: Pellet stove, tank with charging zones, external domestic hot-water tank



- TS1: Stove sensor
- TS2: Tank sensor, top
- TS3: Tank sensor, middle
- TS4: Tank sensor, bottom
- TS5: Domestic hot-water tank sensor
- TS6: Supply line sensor or outdoor temperature sensor (optional)
- RO1: Request for heat from pellet stove
- RO2: Zone valve
- REL: Space heating pump
- TS8: Domestic hot-water pump

Connection of hydraulic system 7



Functions for stove control

Fire detection

The “fire detection” recognizes, if fire in the wood log or pellet stove is burning.

When fire is detected, a flame symbol will be displayed ( or ).

Fire detection is performed by monitoring the stove temperature (TS1).

Fire detection with pellet stove

If a system with a pellet stove is configured, the option “fire detection with pellets” is available to allow fire detection in combination with pellets.

- If “fire detection with pellets” is enabled, fire will be detected on and off in the same manner as with wood log stove.
- If “fire detection with pellets” is disabled, the flame symbol will be highlighted when the request for heat from the stove (RO1) is active.

Dynamic pump delay (DPD)

When the stove is fired, a start condition for the charging pump must be fulfilled.

The dynamic pump delay ›DPD‹ is calculated as the product of temperature and time from the point when the stove temperature (TS1) passes a set stove temperature ›Charge start‹. When the set value of ›DPD‹ is reached, the pump starts.

The dynamic pump delay can be set in professional mode, see “Basic functions” on page 55.

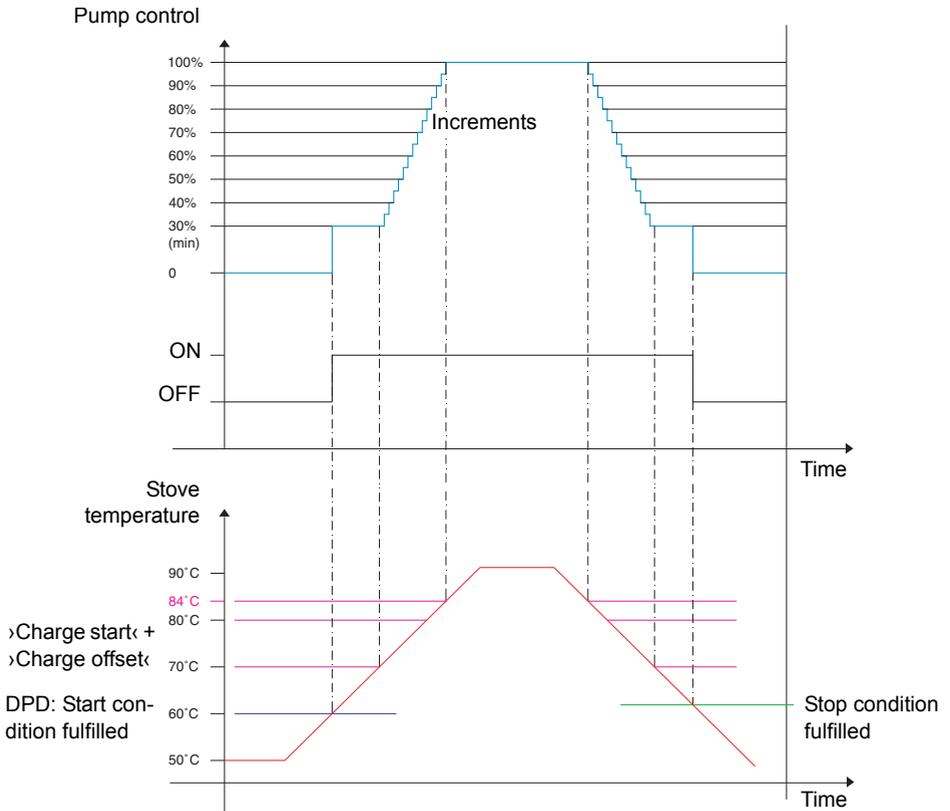
Dynamic pump control

The charging pump should be speed-controlled to maintain a fixed stove temperature.

During commissioning, see “Checklist” on page 51, between dynamic pump control, pump speed control, or combination of both must be selected. Speed control is available only for high efficiency pumps (PWM or analog 0-10 V).

- In case of using a fixed-speed-pump, the start of the pump is triggered by reaching a fixed stove temperature ›Charge start‹ *and* the fulfilled dynamic pump delay ›DPD‹. The dynamic pump control is activated when the stove temperature (TS1) rises above the set stove temperature ›Charge start‹.
- In case of using a speed-controllable pump, the start of the pump (at minimum speed) is triggered by reaching a fixed stove temperature ›Charge start‹ and the fulfilled dynamic pump delay ›DPD‹. The control of the pump is triggered by fulfilling a separate set-point (›Charge start‹ + ›Charge off-set‹) and the product of an increment factor with the minimum pump speed.

The following diagram illustrates the dynamic pump delay and dynamic pump control.



The pump starts when a fixed stove temperature ›Charge start‹ and the dynamic pump delay ›DPD‹ are reached (›Charge start‹ * dt).

The pump increases its speed above (›Charge start‹ + ›Charge offset‹). With each temperature increase by 1 K it will speed-up by an adjustable increment (default 5%).

The parameters for dynamic pump control can be set in professional mode, see “Basic functions” on page 55.

Overtemperature protection

The temperatures of the stove and the tanks are monitored. When overtemperature occurs, at wood-log stove the charging pump is forced to run. At pellet stove the stove is forced to stop.

The temperature limits can be changed in professional mode, see “Basic functions” on page 55.

NOTICE	In order to avoid overheating, the wood log or pellet stove must be equipped with its own overtemperature protection.
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Antifreeze protection

i If the temperature at any sensor falls below the set value (AF, factory setting: 3°C, range: 2°C - 10°C), the pumps will be activated at 100%. In addition, an alarm message will be generated (buzzer alarm selectable).

The parameters for antifreeze protection can be set in professional mode, see “Protective functions” on page 63.

Anti-legionella function

To avoid possible affection of legionella at domestic hot water, a cyclic, thermic treatment shall take place.

The anti-legionella function is only available, if domestic hot water heating is designated by the selected hydraulic system.

The anti-legionella functions checks if the minimum temperatures for reduction of legionella has been achieved in the tank due to heating activity within a set interval.

If no sufficient heating has taken place, the water will be heated up to disinfection temperature, specifically for reduction of legionella.

The installer must set the parameters based on the applicable general directives and local requirements. The time of the disinfection cycle can be determined freely.

The parameters for anti-legionella protection can be set in professional mode, see “Basic functions” on page 55.

Additional heating

A dynamic recharge delay (DRD) postpones the activation of the additional heating. Before the additional heating is activated, the dynamic recharge delay has to expire.

The dynamic recharge delay is calculated by the minutes*degrees product. The recharging will start at the calculated temperature point.

The DRD value can be set between 0 and 500 min*K (minutes * degrees Kelvin).

- With DRD = 0, the delay is disabled, additional heating will start immediately.
- Example DRD = 50 min*K: If the tank temperature falls by 10 K (e.g. from 50°C to 40°C), additional heating will start after 5 minutes (5 min * 10 K = 50 min * K). If the tank temperature falls by 5 K, additional heating will start after 10 minutes (10 min * 5 K = 50 min * K).
- Example DRD = 100 min*K: If the tank temperature falls by 10 K, additional heating will start after 10 minutes (10 min * 10 K = 100 min * K), etc.

With a bar graph inside of the heat-generator symbol, you will be informed about the progress of the dynamic recharge delay.

During the falling of the tank temperature the following will happen:

- When the tank temperature falls below the set-point for additional heating, the calculation will be started and the bar graph will start with a fully green coloured circle inside of the tank symbol.
- When the tank temperature reaches the calculated temperature of the dynamic recharge delay, the symbol inside of the tank will switch to fire or electrical flash and the recharging is started.

The parameters for additional heating can be set in professional mode, see “Basic functions” on page 55.

Request for heat

The controller system is designed to control heat for space heating and domestic hot water separately.

For each demand a separate setpoint can be adjusted, one for request heat by stove, one to request heat by an additional heater.

For example:

- Domestic hot water (DHW) setpoint stove = 65°C
- Domestic hot water (DHW) setpoint additional heater = 55°C
- Space heating (SH) setpoint stove = 50°C
- Space heating (SH) setpoint additional heater = 40°C

An occurring demand by temperature conditions is visualized by little symbol on the information screen:



Request for heating domestic hot water

Request for space heating

Request for heat with wood log stove

With a wood log stove, a demand will activate an orange blinking background on the stove symbol as an invitation to make fire. With a little delay, a buzzer will assist the request. The buzzer can be enabled/disabled optionally.

If fire is made in the stove, it will be detected and the charging pump will be activated and controlled automatically. With reaching the setpoint (stove), the related demand symbol will vanish.

With undercutting the setpoint for additional heater, what should be set always clear below the setpoint for stove, the additional heater will be activated immediately related to selected mode (comfort) respectively with dynamic delay (eco).

Request for heat with pellet stove

In combination with an pellet stove, an occurring demand from domestic hot water or space heating by the stove setpoint will activate the pellet stove. If it is enabled for providing heat, fire will be detected and displayed, similar to wood log stove.

Request for additional heater is working in the same way as in wood log schemes.

Thermostat functions



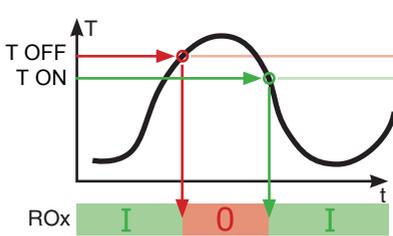
The free outputs of the controller can be used as thermostats and/or timers for various applications.

The thermostat functions must be defined in professional mode under ›1.3.1 Thermostat‹, see “Basic functions” on page 55.

The thermostat functions can also be activated or deactivated in operation mode under ›1.3.1 Thermostat‹, see “Basic functions” on page 36.

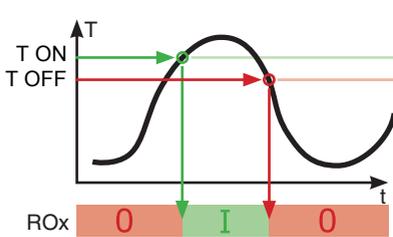
Various thermostat and/or timer functions can be defined:

Temperature thermostat “Heating”



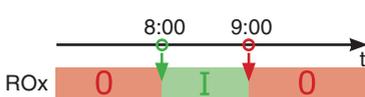
$T\ OFF > T\ ON$ The output is deactivated once the ›T OFF‹ temperature is reached, and activated once the ›T ON‹ temperature is reached.

Temperature thermostat “Cooling”



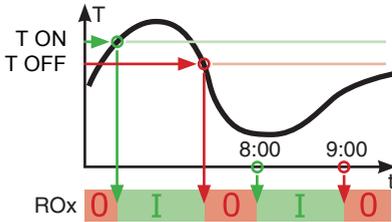
$T\ ON > T\ OFF$ The output is activated once the ›T ON‹ temperature is reached, and deactivated once the ›T off‹ temperature is reached.

Timer function



The output is activated within a selected time frame.

Timer thermostat

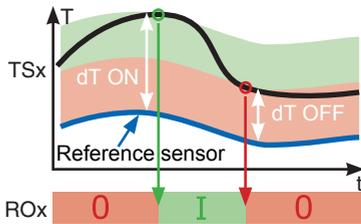


Combination of timer and thermostat.

Once at least one of these criteria is met, the output is activated.



Temperature comparator



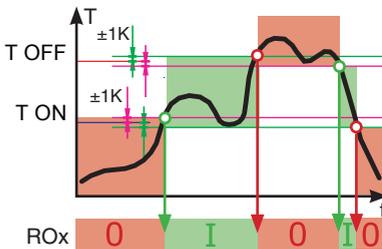
Any temperature difference to a reference sensor will trigger a control signal:

The output is activated once ΔT_{ON} is reached, and deactivated once ΔT_{OFF} is reached.

Temperature thermostat "Window"

The window function is similar to a thermostat function, but with an additional threshold to start and stop the output. The "window" is defined by two temperature values (lower and upper limits), each within a defined range. A fixed hysteresis of $\pm 1K$ for start and stop is added onto the defined limits.

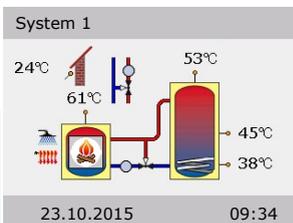
Only a free (unused) output can be used for the window function. The relay can also be driven inverted.



The output is activated, if the temperature is between upper and lower limits (\pm hysteresis).

- The output is switched ON when the lower limit + hysteresis or the upper limit - hysteresis is reached.
- The output is switched OFF when the upper limit - hysteresis or the lower limit + hysteresis is reached.

Automatic operation



In automatic mode, the screen displays the date, the time and the active hydraulic system.

The current temperature is displayed for each temperature sensor.

Pump operation and valve position are illustrated on the animated display.

There is no need for intervention by the installer or operator.

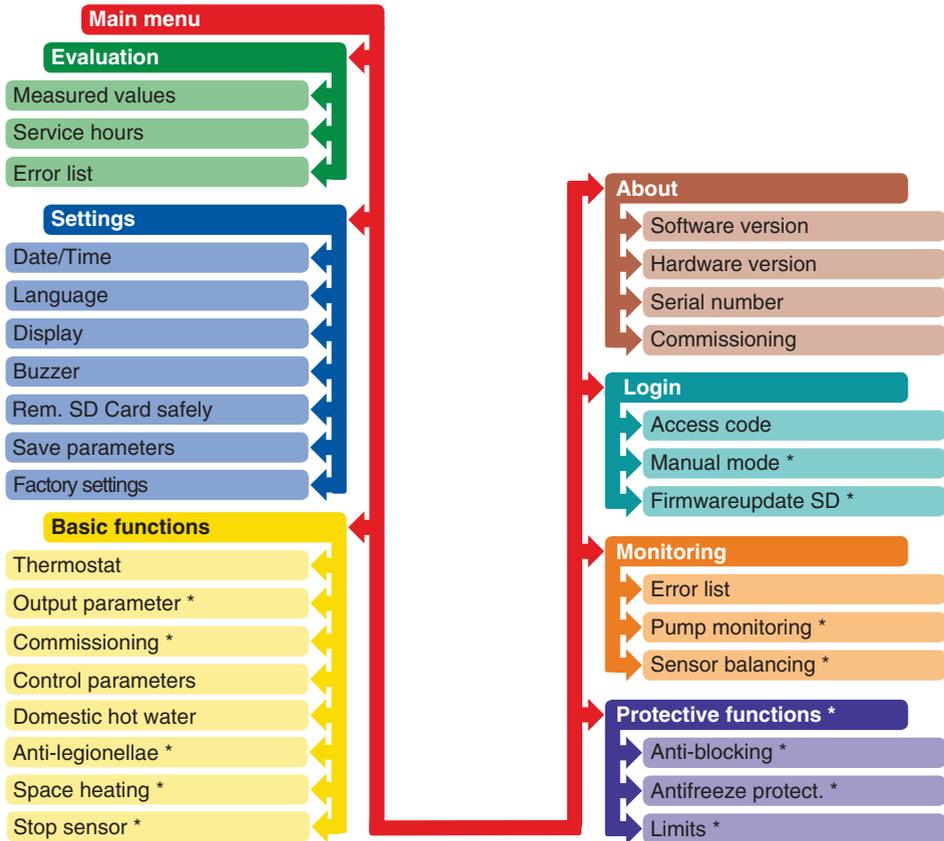
NOTICE

Check the display screen of the LK SmartStove® on a regular basis to be able to eliminate any malfunctions promptly!

Settings during operation

Menu structure

The following illustration shows the structure of the control menu.

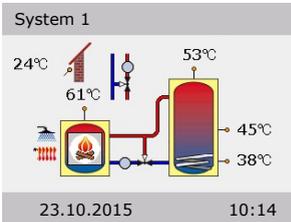


Items marked by an asterisks * are only available in professional mode, see page 54.

NOTICE	The controller does not display any sub menus which are not required by either the selected hydraulic schema or by the activated options.
---------------	---

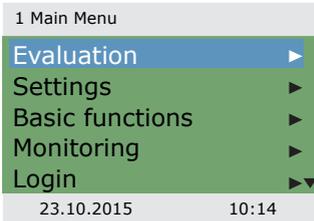
SETTINGS DURING OPERATION

Main menu



On the controller, you can make various settings and obtain information about states and processes.

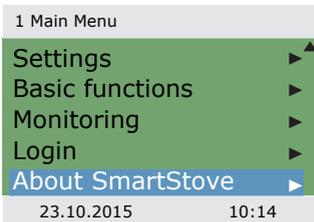
To this effect, press the knob in automatic mode.



›1 Main menu‹ appears.

A list of subitems appears.

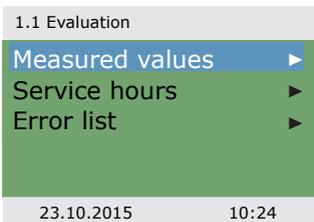
By turning the knob ...



...the lower part of the menu is displayed.

Select a subitem by pressing the knob.

Evaluation



The ›1. Evaluation‹ menu provides information about the differential temperature controller LK SmartStove® and the entire plant.

Select ›Measured values‹.

1.1.1 Measured val...	
Heat source	60.6°C
Tank top.	52.8°C
Tank mid.	45.2°C
Tank bot.	37.8°C
External DHW	45.2°C ▼
23.10.2015	10:24

Here, the temperatures and dates concerning the controller are displayed.

If additional sensors have been defined on commissioning, these sensors also appear here.

By scrolling ...

1.1.1 Measured val...	
Outdoor	13.8°C ▲
Charge pump	100%
Charge zone v	Off
DHW pump	100%
SH blocking	Off
23.10.2015	10:24

...the lower part of the menu is displayed.

Here, the operational status of the pumps and valves is displayed.

›SH blocking‹ indicates the blocking status for space heating.

Return to ›1.1 Evaluation‹.

Select ›Service hours‹.

1.1.2 Service hours	
Charge pump	4h
Charge zone v	1h
SH blocking	2h
DHW pump	3h
Additional heat	1h
23.10.2015	10:24

The operating times of the activated plant components are displayed in hours.

By scrolling down and actuating the menu item ›Reset‹, all counters will be reset to zero.

Return to ›1.1 Evaluation‹.

Select ›Error list‹.

1.1.5 Error list	
M05: 08:31 03.09	
M04: 07:44 03.09	

23.10.2015	10:24

The ›Error list‹ shows all the error messages of the differential temperature controller LK SmartStove® in a temporal order.

To view information for an error message, select it.



1.1.5 Error list

M05:
Sensor short-circuit
on TS3!

Press ESC to return

23.10.2015 10:24

The error message appears in plain text.
If necessary, take the appropriate measures.

Return to ›1 Main menu‹.
Select ›Settings‹.

Settings

1.2 Settings

Date/Time ▶

Language ▶

Display ▶

Buzzer

Rem.SD card safely ▼

23.10.2015 10:34

In the ›1.2 Settings‹ menu, you can change settings of the differential temperature controller LK SmartStove®.

By scrolling ...

1.2 Settings

Buzzer ▶▲

Rem.SD card safely ▶

Save parameters

Factory settings ▶

23.10.2015 10:34

...the lower part of the menu is displayed.

Select ›Date/Time‹.

1.2.1 Time/Date

Date 23.10.2015

Time 10:23

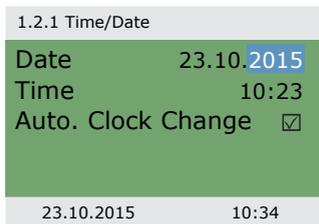
Auto. Clock Change

23.10.2015 10:34

Here, date and time can be set in case of deviation or an extended period of de-energizing.

If the differential temperature controller LK SmartStove® is installed at a location where daylight-saving time exists, the time shift can be activated by ›Auto Clock Change‹.

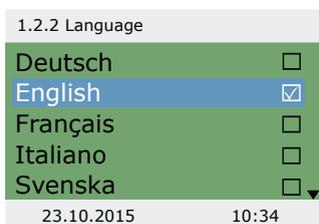
Select the subitem ›Date‹ or ›Time‹ by pressing the knob.



One group of figures each is activated and can be varied via the knob; whenever the knob is pressed, the activation jumps to the next group.

Return to ›1.2 Settings‹.

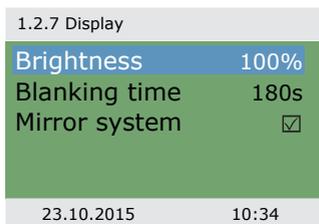
Select ›Language‹.



Here, you can change over to another available language.

Return to ›1.2 Settings‹.

Select ›Display‹.



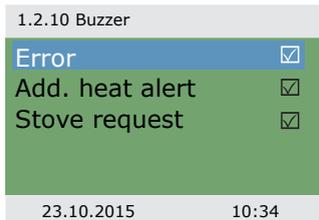
›Brightness‹ serves to adjust the backlighting of the display in steps of 10% from 5% to 100%.

›Blanking time‹ is used to determine the time after which, in case of inactivity, backlighting is reduced from the set value to 10%. Adjustable in the range from 30 to 255 seconds.

Activate ›Mirror system‹ if you want to mirror the hydraulic scheme display.

Return to ›1.2 Settings‹.

Select ›Buzzer‹.

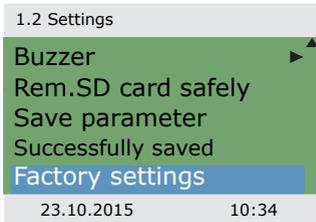


Here, you can disable or enable for which events the controller issues acoustic signals.

›Error‹: Acoustic signal for alarms

›Add. heat alert‹: Acoustic signal on request for additional heat, see page 27

›Stove request‹: Acoustic signal on request for heat from stove



Return to ›1.2 Settings‹.

Before the SD card can be removed, ›Remove SD card safely‹ must have been selected.

With the ›Save parameter‹ function, the current configuration is saved on the Micro SD card.

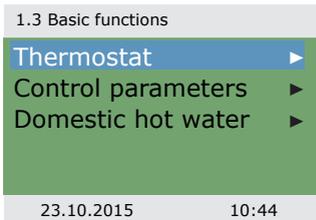
The last menu item is ›Factory settings‹.

By selecting and pressing the knob, followed by ›esc‹, the pre-set values are deleted and replaced by the factory settings.

Return to ›1 Main menu‹.

Select ›Basic functions‹.

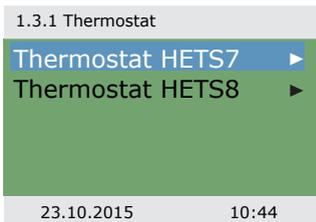
Basic functions



In the ›1.3 Basic functions‹ menu, you can configure thermostat controls, setpoints for domestic hot water and space heating, and enable additional heating (if available).

The menu depends on the selected hydraulic system.

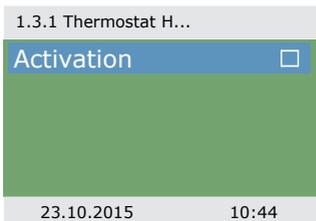
Select ›Thermostat‹.



The controller's free outputs can be used as thermostats for various applications.

In professional mode, presettings must be made to this effect - your installer will explain the appropriate function to you, if necessary.

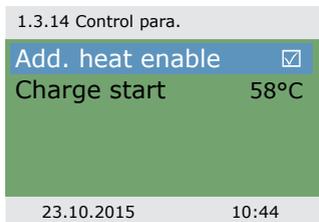
By selecting a subitem ...



...the appropriate activation screen is displayed.

Return to ›1.3 Basic functions‹.

Select ›Control parameters‹.



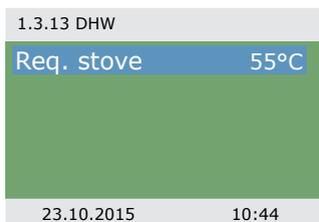
By ›Add. heat enable‹, recharging of the tank by the additional heating can be disabled or enabled (if available).

By ›Charge start‹, you can set the minimum stove temperature for starting the loading pump.



Return to ›1.3 Basic functions‹.

Select ›Domestic hot water‹.



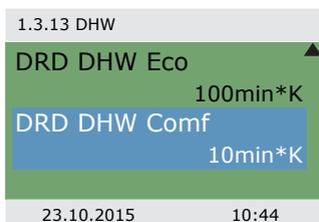
By ›Req. stove‹, you can set the minimum stove temperature for domestic hot water heating.



Only for use with additional heating:

When the buffer tank temperature falls below the ›Req. add. heat‹, the dynamic recharge delay (DRD) (time x temperature) is started. When the DRD is reached, additional heating will be enableed.

Scroll down.



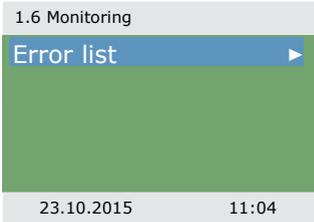
›DRD DHW Eco‹ is the dynamic recharge delay for domestic hot water in economy mode.

›DRD DHW Comf‹ is the dynamic recharge delay for domestic hot water in comfort mode.

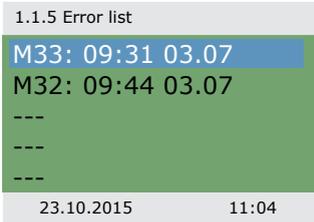
Return to ›1 Main menu‹.

Select ›Monitoring‹.

Monitoring

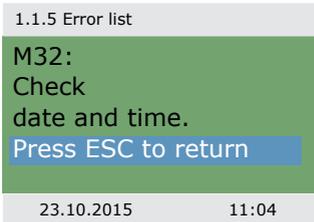


In the ›1.6 Monitoring‹ menu, you can view error messages.



The ›Error list‹ shows all the error messages of the differential temperature controller LK SmartStove® in a temporal order.

To view information for an error message, select it.



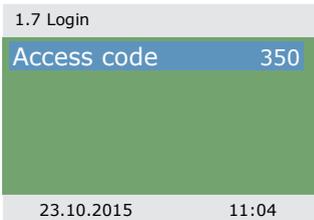
The error message appears in plain text.

If necessary, take the appropriate measures.

Return to ›1 Main menu‹.

Select ›Login‹.

Login



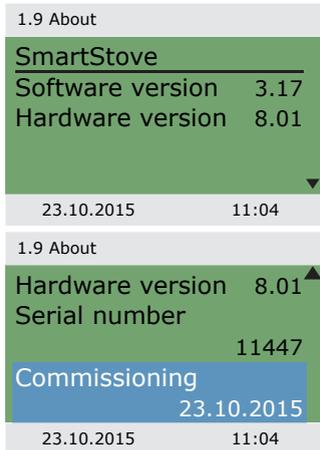
In order to enter the professional mode, you must enter the access code.

See “Settings in the professional mode” on page 54

Return to ›1 Main menu‹.

Select ›About‹.

About

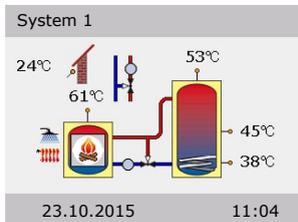


In the ›1.9 About‹ menu, you can find out the software version, the hardware version, the serial number, and the date of commissioning of your differential temperature controller LK SmartStove®.

This information is required for repairs and for version management.



System

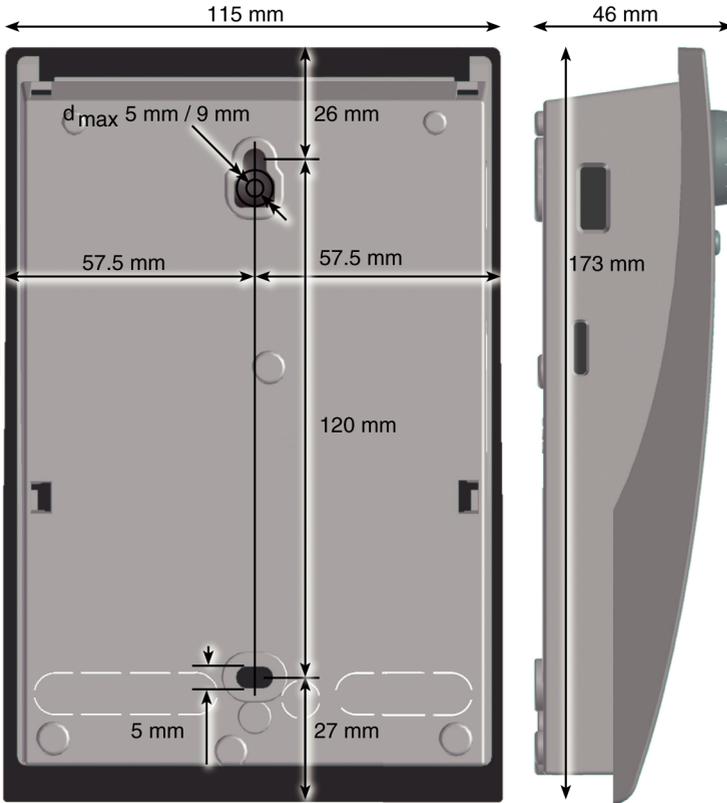


If no entry is made within the preset time (30 - 255 s) on the LK SmartStove®, the display returns to ›System‹.

Use ›esc‹ to return to the home screen from every menu.

Mounting

Dimensions



Opening the terminal cover

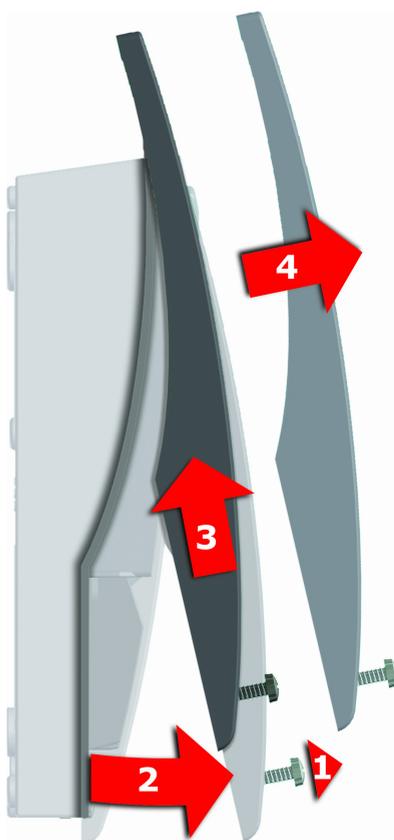
 **DANGER**



Electrical hazard

Lethal danger due to electrocution!

Whenever work is performed on the open terminal cover, all poles of the power supply must be disconnected reliably and protected against being switched on again!



- 1 Release the lock screw.
- 2 Swing terminal cover forward ...
- 3 ... push it upwards ...
- 4 ... and remove it.

Store the terminal cover carefully and protect it against damage!

To close the terminal cover, reverse the opening procedure.

Wall-mounting



WARNING

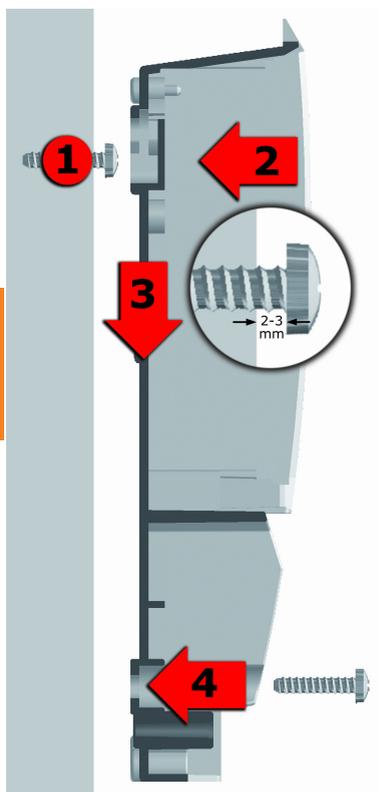
The device corresponds to protection type IP 20.

Electrical hazard

Make sure the appropriate prerequisites exist on the place of installation.

NOTICE

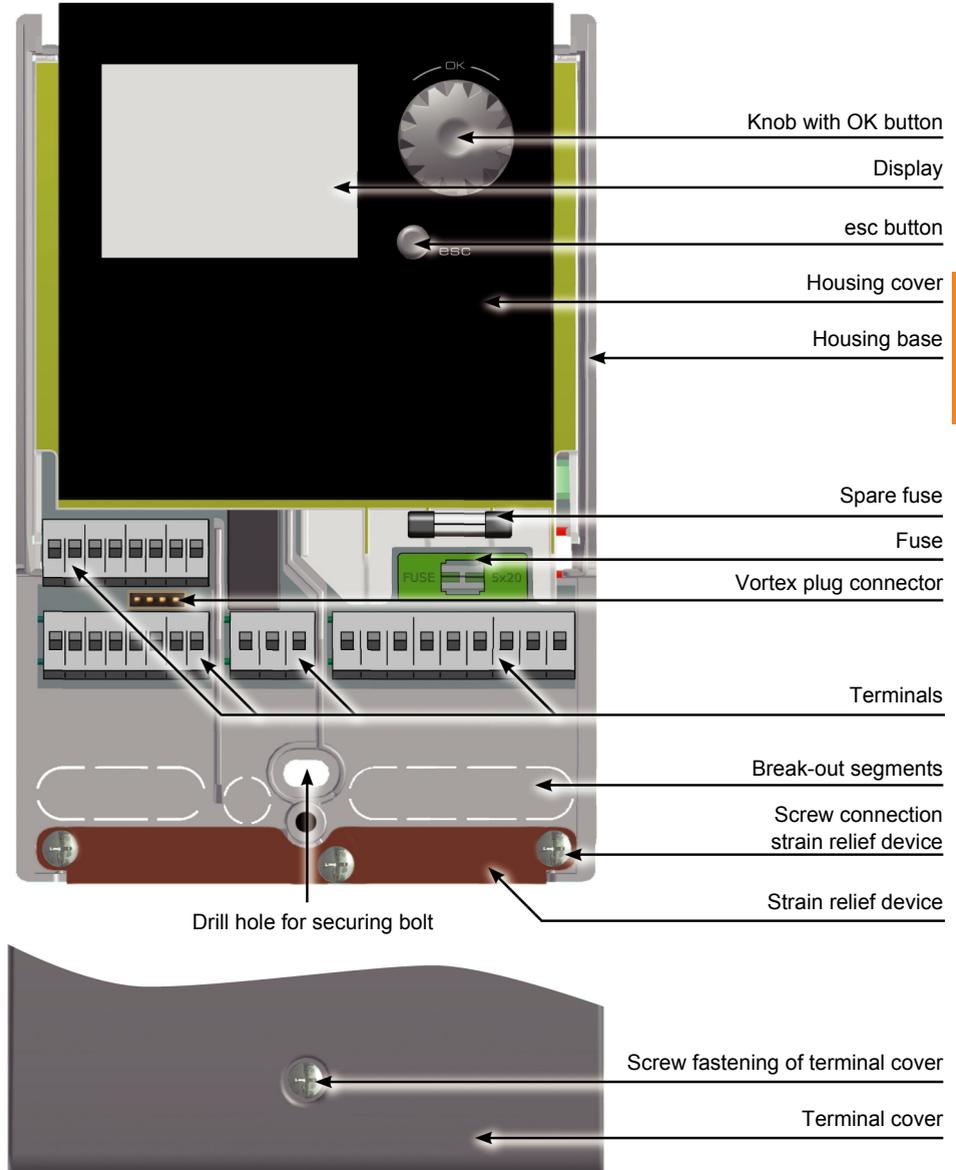
Do not use the housing base as drill template.
A device with damaged housing must not be operated!



- 1 Fasten the top securing screw so that a space of 2 to 3 mm is created between the wall and the screw head.
- 2 Move the device so that the upper fastening port is located above the screw head ...
- 3 ... and push it downwards.
- 4 Fasten the lower securing screw.

If necessary, use dowels for wall-mounting!

Designation of the components



“Opening the terminal cover” on page 40

Electrical connection

 DANGER	
	<p>Electrical hazard</p> <p>Lethal danger due to electrocution!</p> <p>Whenever work is performed on the open terminal cover, all poles of the power supply must be disconnected reliably and protected against being switched on again!</p>

Terminals

The differential temperature controller LK SmartStove® is connected by four three groups of spring-type terminals which are visible once the terminal cover is opened.

To introduce the cables, release the three screws on the strain relief device; if necessary, remove the strain relief device.

In case of flush mounting of the cables, the break-out segments in the housing base can be removed carefully and the cables routed through these ports.

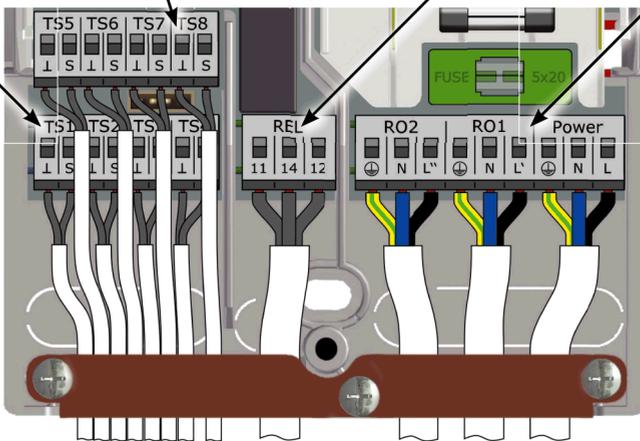
The central terminal block is the interface to a potential-free change-over contact - here, it may be necessary to route electrical resistors into the spring-type terminals and to connect part of the cables via luster terminals.

Terminal block
TS1-TS4

Terminal block
TS5-TS8

Terminal block
REL

Terminal block
RO2/RO1/Power



The spring-type terminals for the power supply, RO1, RO2 and REL, and for TS1 to TS8 can accommodate solid wires up to a cross section of 1.5 mm^2 . Appropriate stranded wires must be preassembled with cable end sleeves.

For the strain relief device function, TS1 to TS7 and REL require cable diameters of at least 5 mm, for Power, RO1, RO2 at least 7 mm.

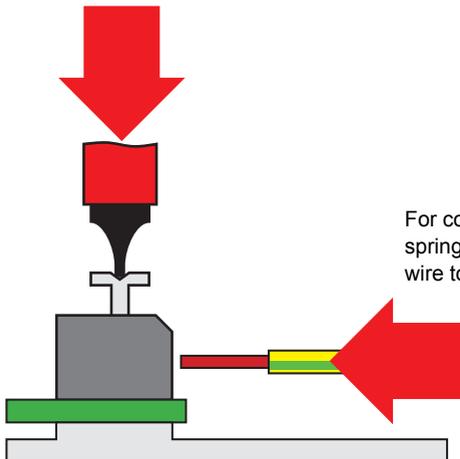
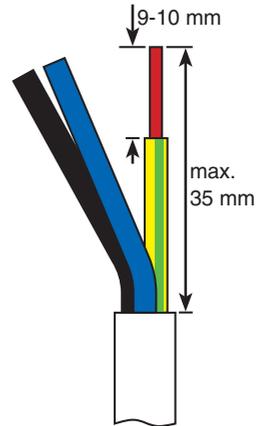
The strain relief fixture can be slightly reworked to fit larger cable diameters without producing sharp edges. For a larger number of sensor lines, cable straps can be used to support the strain relief.

Cable preparing

The strain relief device can only ensure solid clamping if the cables are not stripped to a length of over 35 mm.

Insulation of the individual wires must be removed over a length of 9 - 10 mm to ensure safe electric contact in the spring-type terminal.

Stranded wires must be provided with cable end sleeves!



For connection, press the actuation push button of the spring-type terminal using a screwdriver and insert the wire to its stop in the appropriate port.

Release the actuation push button and pull the cable slightly to ensure that it is safely clamped.

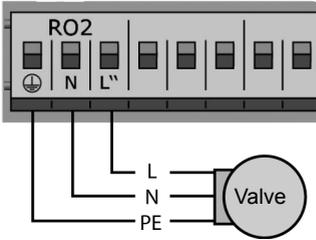
NOTICE

Before closing the terminal cover, make sure the strain relief device is tightened safely.

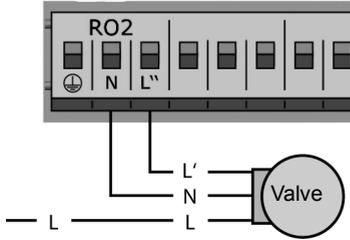
Check once more that all cables are in good condition and connected correctly.

Connection of a zone valve to RO1/RO2

Connection diagram for a zone valve without power supply to RO2:

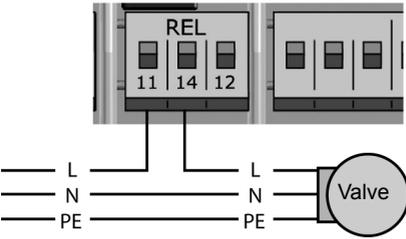


Connection diagram for a zone valve with power supply to RO2:

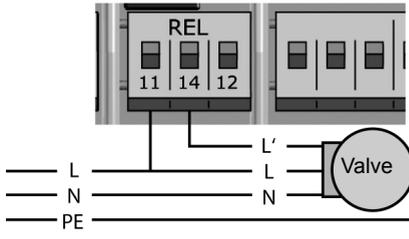


Connection of a zone valve to REL

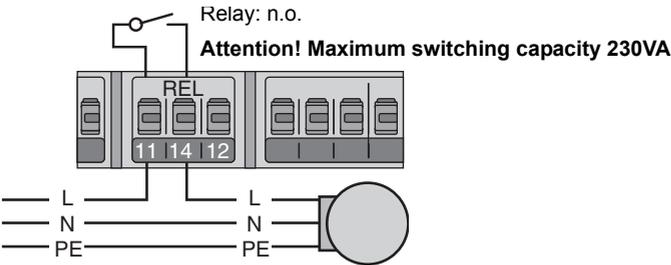
Connection diagram for a zone valve without power supply to REL:



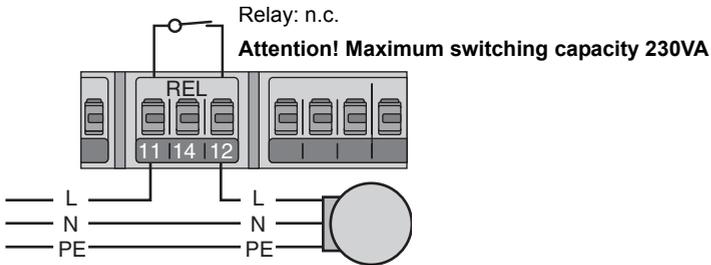
Connection diagram for a zone valve with power supply to REL:



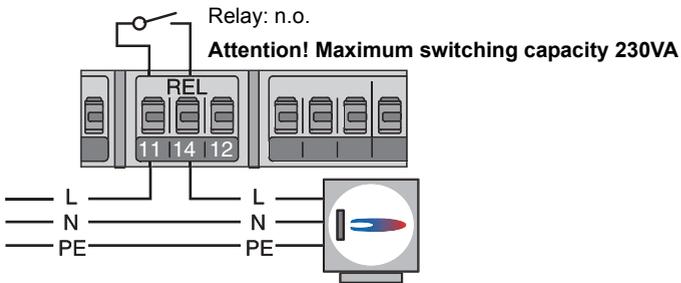
Connection of a pump to REL



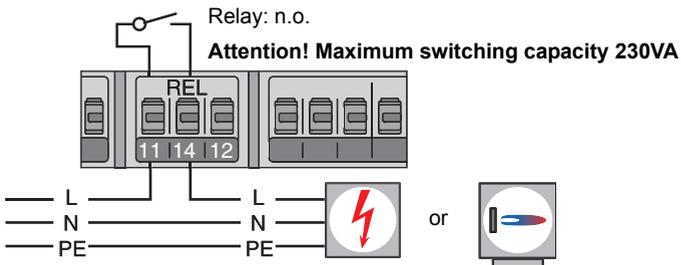
Blocking connection of a pump to REL



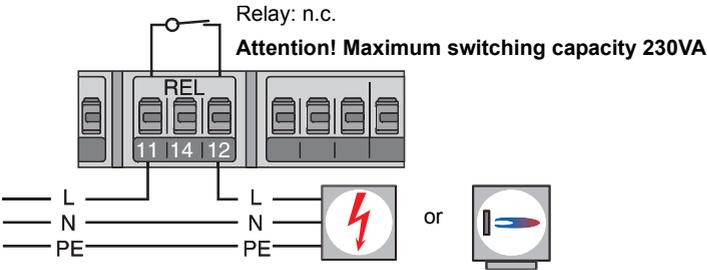
Connection of a boiler to REL



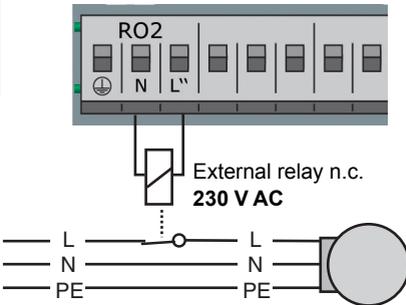
Connection of an external heat source to REL



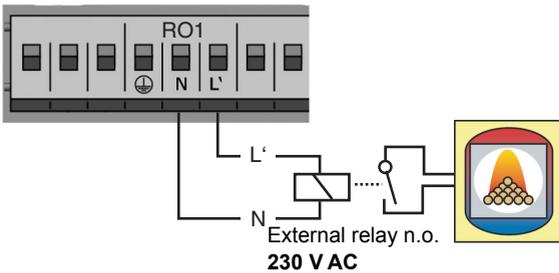
Blocking connection of an external heat source to REL



Blocking connection of a pump to RO2



Connection for request for heat to RO1



High-efficiency pump

A high-efficiency pump can be connected via RO1 or RO2.

The appropriate control signal is issued at TS7/TS8.

The control signal may be an analog voltage 0 - 10V or a PWM signal.



TS7/TS8: PWM-control signal for the high-efficiency pump

RO1 or RO2: 230V supply of the high-efficiency pump

Left-hand terminal: GND

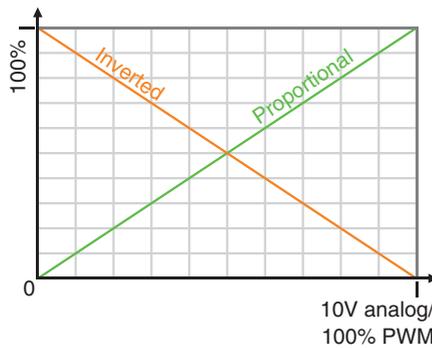
Right-hand terminal: Signal

For further details, please refer to the pump specification.

For definition and settings, the professional mode under >1.3.7 Output parameter< has been provided.

NOTICE

High-efficiency pumps are supplied with proportional or inverted control signals. (Only inverted for PWM control.)



The pump type is selected during commissioning, see page 51.

Commissioning

NOTICE	For commissioning, the controller must be assembled correctly, all inputs and outputs must be connected and ready for operation, the strain relief device must be screw-fastened and the terminal cover closed!
---------------	---

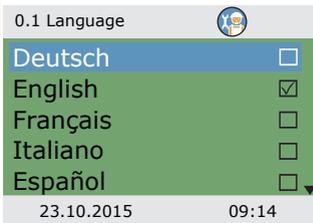
This is an explanation in terms of an example of commissioning of the differential temperature controller LK SmartStove®; details vary along with the hydraulic configuration and the software version.

The differential temperature controller LK SmartStove® accompanies you during the entire configuration and interrogates everything it must know for optimum operation.

The power supply of the controller must be switched on - the display screen appears.



Basic settings

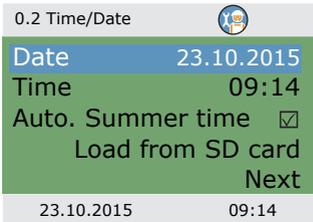


›0.1 Language‹ appears after a short booting sequence.

Various languages are available in this version of the LK SmartStove®.

Activate the required language by turning the knob and acknowledge it by pressing the knob.

Scroll down and select ›Next‹.



›0.2 Time/Date‹ appears.

Press the knob, the first value will be highlighted.

Turn the knob until the correct value is displayed and acknowledge by pressing the knob.

Enter all values in this way.

At any place of installation where European daylight saving time is applicable, the automatic time difference can be activated here.

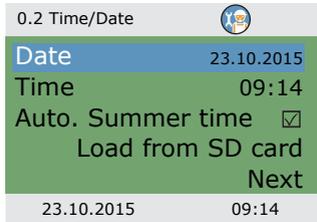
To change the setting, select ›Auto Summer time‹ and press the knob.

There are the following possibilities to continue:

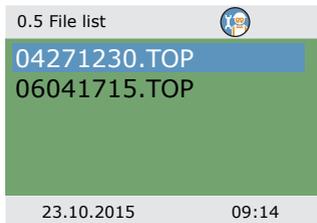
- “Choose system” on page 51
- “Load an existing configuration” on page 51

Load an existing configuration

If there is a Micro SD card with an already saved configuration, insert it in the device before starting commissioning.



Select ›Load from SD card‹ and acknowledge.



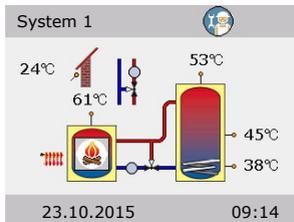
A list of pre-configured plant settings is displayed.

Select the desired file and acknowledge.

The configuration is loaded and the settings are applied in the following commissioning.

The files are on the SD card in the ›PARAMS‹ folder. It is possible to change the file names on the PC: Max. 8 characters, only letters and figures. Do not change the file extension!

Choose system

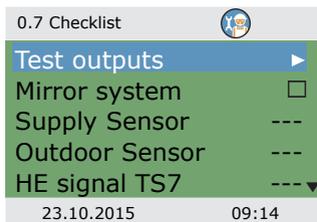


After selecting ›Next‹, the graphic illustration of a hydraulic system is shown.

Scroll through all available hydraulic schemes as by turning the knob, select the illustrated hydraulic schema by pressing the knob.

Then, any parameters relevant for the selected hydraulic schema are queried.

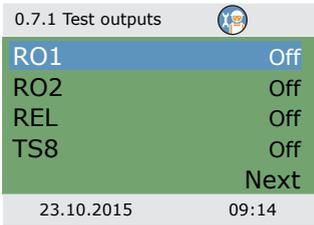
Checklist



›0.7 Checklist‹ appears.

The menu depends on the selected hydraulic system.

Check the function of the connected pumps and valves by selecting ›Test outputs‹.



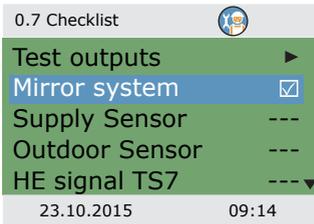
›0.7.1 Test outputs‹ appears.

The menu depends on the selected hydraulic system.

Select an output, acknowledge, select ›On‹ on the knob and activate it. The connected pump and/or the connected valve must now be activated.

Complete the test operation by pressing ›Next‹.

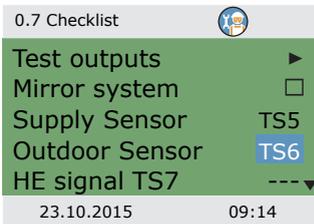
NOTICE	<p>If the hydraulic installation does not comply with the standard, or if special products were used which cause incorrect valve positions during test operation, the ›Inverted‹ option must be activated by accessing the corresponding output menu 1.3.7 in professional mode after commissioning.</p> <p>The controller will then exchange energized and de-energized conditions.</p>
---------------	--



You can mirror the hydraulic scheme display, i.e. the buffer tank will be displayed on the other side of the boiler.

Activate ›Mirror system‹ if your plant is that way.

Note: ›Mirror system‹ does not influence the functions of the controller.

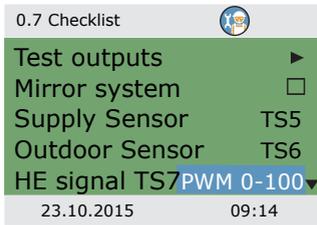


The further menu items depend on the selected hydraulic system.

If a temperature sensor for space heating is installed, select it by the ›Supply Sensor‹ item.

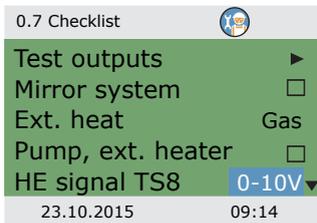
If an outdoor temperature sensor is installed, select it by the ›Outdoor Sensor‹ item.

Note: The availability of temperature sensors depends on the selected system. By selecting a temperature sensor, the regarding functions are enabled simultaneously.



In ›HE signal TS7‹/›HE signal TS8‹, you select the type of high efficiency pump which is connected to TS7/TS8:
›PWM 0-100‹, ›PWM 100-0‹ (i.e. inverted), ›0-10V‹, or none

Or



If the hydraulic system 6 with an additional boiler is selected, choose the heat source in the ›Ext. heat‹ item:
›Electric‹, ›Gas‹, ›Heat pump‹, ›Oil‹, ›Pellet‹, or ›None‹

If the pump for the additional boiler is controlled by LK SmartStove®, activate ›Pump, ext. heater‹.

In ›HE signal TS8‹, you select the type of high efficiency pump which is connected to TS8:
›PWM 0-100‹, ›PWM 100-0‹ (i.e. inverted), ›0-10V‹, or none

Scroll down.



By ›Common Eco/Comf‹, the ›Operation mode‹, see page 14, will be activated for space heating and domestic hot water simultaneously.

By ›Fire Detection‹, you can disable or enable fire detection for the stove, see page 24.

By ›Use Tank Bottom‹, you can disable or enable the bottom tank temperature sensor (TS4).

Acknowledge by selecting ›Next‹.



›0.9 End‹ appears.

By selecting ›Next‹, the controller changes over to automatic mode.

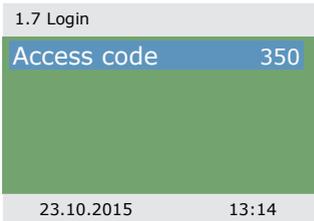
Commissioning is complete.

From now on, the wood log or pellet stove plant is controlled automatically.

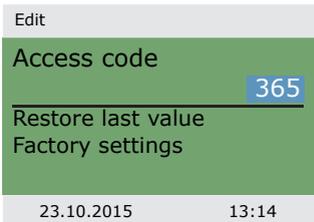
Settings in the professional mode

NOTICE	<p>In professional mode, settings are made which require detailed knowledge of the heating as well as wood log or pellet stove plants.</p> <p>Moreover, solid specialist knowledge regarding control engineering, hydraulics and wood heating is required!</p> <p>If a single parameter is changed, this may affect the safety, function, and efficiency of the entire plant!</p> <p>Leave the settings in professional mode to a specialist workshop, the installer!</p> <p>Modifications by non-experts tend to result in damage to the plant, rather than to an improvement of its efficiency!</p>
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Login



To enter the professional mode, select ›1.7 Login‹ from the main menu, activate it and ...



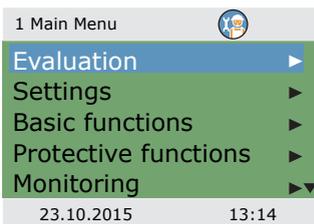
... enter the access code.

The access code to professional mode is ›365‹.

The fact that the installer must be available for his/her customers on 365 days per year may serve as a mnemonic trick.

If the professional mode is not exited actively, the controller automatically displays the plant layout after the preset display shut-off time and the access code is reset to 350.

Main menu



After having returned to ›1 Main menu‹, the screen shows a similar list of subitems as in operation mode.

›Protective functions‹ is additionally available.

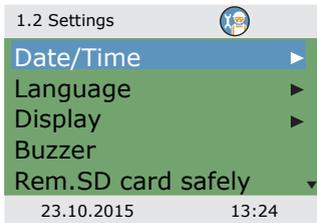
Evaluation



The menu ›1.1 Evaluation‹ is identical to that in the operating mode.

“Evaluation” on page 32

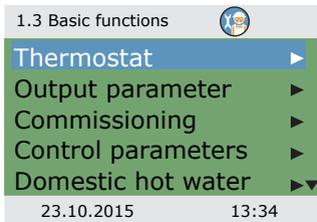
Settings



The menu ›1.2 Settings‹ is also identical to that in the operating mode.

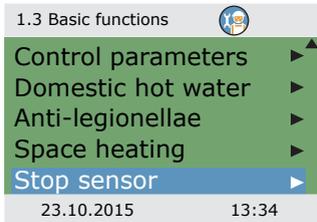
“Settings” on page 34

Basic functions



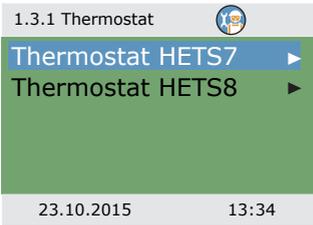
Under ›1.3 Basic functions‹, the following items are additionally available next to the operation mode menus:

- ›Output parameter‹
- ›Commissioning‹
- ›Anti-legionellae‹
- ›Space heating‹
- ›Stop sensor‹



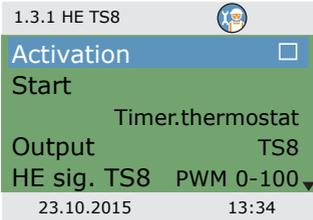
The ›Thermostat‹, ›Control parameters‹, and ›Domestic hot water‹ menus contain additional parameters.

Call up the menu item ›Thermostat‹.



Any controller outputs which are not assigned can be configured as a thermostat.

Select the appropriate thermostat/output.



Perform activation.

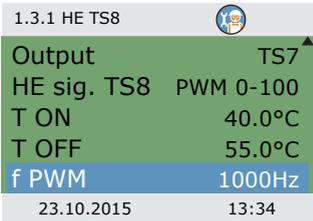
Define in ›Start‹ the thermostat or timer function, see page 28.

Depending on the selection of ›Start‹, the following parameters are shown.

The output has already been defined by the selection - the related sensor remains to be defined.

In ›HE sig. TS8‹, you select the type of high efficiency pump which is connected to TS8:

›PWM 0-100‹ or ›PWM 100-0‹ (i.e. inverted)



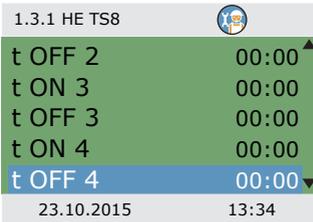
Scroll down.

Define switch-ON/OFF temperatures:

For the heating function, T ON must be < T OFF.

For the cooling function, T ON must be > T OFF.

In ›f PWM‹, you define the PWM frequency.



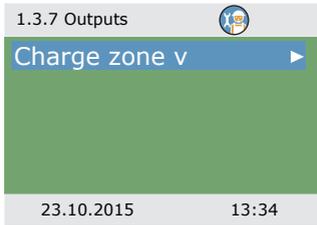
In case a timer function has been selected, up to four time slots can be assigned to each thermostat function.

Scroll down.

First define the times for activation ›t ON‹ and then for deactivation ›t OFF‹.

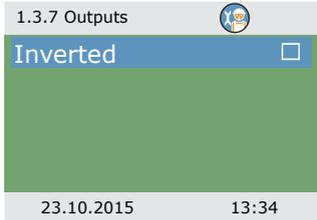
Return to ›1.3 Basic functions‹.

Select ›Output parameter‹.



The menu is only available for systems with charge zone valve (systems 2, 3, 7).

Select ›Charge zone v‹.

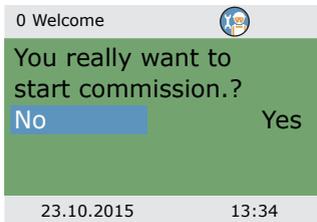


The ›Inverted‹ function inverts the switching function of the valve, e.g. if valve installation does not comply with the standard.

The controller will then exchange energized and de-energized conditions.

Return to ›1.3 Basic functions‹.

Select ›Commissioning‹.



Here, new commissioning can be started - e. g. if the hydraulic system has been changed.

Select ›Yes‹ to start commissioning.

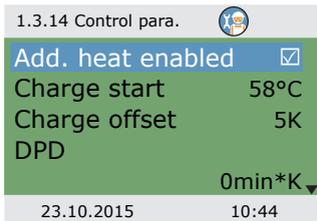
“Commissioning” on page 50

Return to ›1.3 Basic functions‹.

Select ›Control parameters‹.

The menu depends on the selected hydraulic system.

System 1:



›Add. heat enabled‹: Recharging of the tank by the additional heating can be disabled or enabled (if available)

›Charge start‹: Minimum stove temperature for starting the loading pump

›Charge offset‹: Temperature offset for starting the speed control of the loading pump

›DPD‹: Dynamic pump delay, see page 24

1.3.14 Control para. 

High. imm. heater

Min control PWM 30%

Step PWM 5%

23.10.2015 10:44

- ›High. imm. heater<: Force start and stop sensor to TS2 for additional heating. This option shall be activated if the immersion heater is positioned high in the buffer tank.
- ›Min control PWM<: Lower PWM speed level for controlling the stove charging pump
- ›Step PWM<: PWM pump speed increment

Systems 2, 3:

1.3.14 Control para. 

Add. heat enabled

Charge start 58°C

Charge offset 5K

Act. ZV below 43°C

Offset ZV act. 2K

23.10.2015 10:44

- ›Add. heat enabled<: Recharging of the tank by the additional heating can be disabled or enabled (if available)
- ›Charge start<: Minimum stove temperature for starting the loading pump
- ›Charge offset<: Temperature offset for starting the speed control of the loading pump
- ›Act. ZV below<: Lower temperature threshold for activation of zone valve
- ›Offset ZV act.<: Temperature offset (hysteresis) for zone valve activation

1.3.14 Control para. 

DPD 0min*K

High. imm. heater

fix PWM 100%

Min control PWM 30%

23.10.2015 10:44

- ›DPD<: Dynamic pump delay, see page 24

1.3.14 Control para. 

High. imm. heater

fix PWM 100%

Min control PWM 30%

Step PWM 5%

23.10.2015 10:44

- ›High. imm. heater<: Force start and stop sensor to TS2 for additional heating. This option shall be activated if the immersion heater is positioned high in the buffer tank.
- ›fix PWM<: Fixed PWM speed of high efficiency pump for loading domestic hot water
- ›Min control PWM<: Lower PWM speed level for controlling the stove charging pump
- ›Step PWM<: PWM pump speed increment

Systems 4, 5:

1.3.14 Control para. 	
Add. heat enabled	<input checked="" type="checkbox"/>
Charge start	58°C
High. imm. heater	<input type="checkbox"/>
23.10.2015	10:44

›Add. heat enabled‹: Recharging of the tank by the additional heating can be disabled or enabled (if available)

›Charge start‹: Minimum stove temperature for starting the loading pump

›High. imm. heater‹: Force start and stop sensor to TS2 for additional heating. This option shall be activated if the immersion heater is positioned high in the buffer tank.

System 6:

1.3.14 Control para. 	
Add. heat enabled	<input checked="" type="checkbox"/>
Charge start	58°C
Ext. AH pump On	5K
Ext. AH pump Off	2K
fix PWM	100%
23.10.2015	10:44

›Add. heat enabled‹: Recharging of the tank by the additional heating can be disabled or enabled (if available)

›Charge start‹: Minimum stove temperature for starting the loading pump

›Ext. AH pump On‹: Switch-on temperature offset (hysteresis) for additional heating pump

›Ext. AH pump Off‹: Switch-off temperature offset (hysteresis) for additional heating pump

›fix PWM‹: Fixed PWM speed of high efficiency pump for external heat source

System 7:

1.3.14 Control para. 	
Charge start	58°C
Act. ZV below	43°C
Offset ZV act.	2K
fix PWM	100%
23.10.2015	10:44

›Charge start‹: Minimum stove temperature for starting the loading pump

›Act. ZV below‹: Lower temperature threshold for activation of zone valve

›Offset ZV act.‹: Temperature offset (hysteresis) for zone valve activation

›fix PWM‹: Fixed PWM speed of high efficiency pump for loading domestic hot water

Return to ›1.3 Basic functions‹.

Select ›Domestic hot water‹.

1.3.13 DHW 	
Req. stove	55°C
Offset stove	10K
Max. temp DHW	60°C
Charge diff DHW	3K
Charge hys DHW	6K
23.10.2015	10:44

›Req. stove‹: Setpoint for request for heat from stove. If the tank temperature falls below this temperature the request will be activated, see page 27.

›Offset. stove‹: Offset for deactivating request for heat from stove

›Max. temp DHW‹: Maximum temperature for external domestic hot water tank

›Charge diff DHW‹ and ›Charge hys DHW‹ control the pump for domestic hot water with the following conditions:

$TS2 > TS5 + \text{Charge diff DHW}$ and

$TS5 < \text{Max. temp DHW} - \text{Charge hys DHW}$

With additional heating:

›Req. add. heat‹: Setpoint for request for heat from additional heating. If the tank temperature falls below this temperature the request will be activated, see page 27.

›Offset. add. heat‹: Offset for deactivating request for heat from additional heating

1.3.13 DHW 	
Req. add. heat	50°C
Offset add. heat	5K
Req. stove	55°C
Offset stove	10K
Max. temp DHW	60°C
23.10.2015	10:44

1.3.13 DHW 	
Offset stove	10K 
DRD DHW Eco	100min*K
DRD DHW Comf	20min*K 
23.10.2015	13:34

Scroll down.

›DRD DHW Eco‹: Dynamic recharge delay for domestic hot water heating - economy mode

›DRD DHW Comf‹: Dynamic recharge delay for domestic hot water heating heating - comfort mode

Return to ›1.3 Basic functions‹.

Select ›Anti-legionellae‹.

1.5.4 Anti-legionellae 	
Target temp	60.0°C
Hysteresis	3.0°C
Start time	3h
Duration	10min
Max. time	48h 
23.10.2015	13:54

The anti-legionella parameters must be set based on the applicable national regulations.

›Target temp‹: Target temperature for disinfection

›Hysteresis‹: Temperature hysteresis for switch-on

›Start time‹: Starting time for heating

›Duration‹: Duration of the required heating cycle

›Max. time‹: Maximum heating period (timeout)

1.5.4 Anti-legionellae 	
Use add. heat	<input checked="" type="checkbox"/>
Delay add. heat	72h
Day	Monday
Interval	7 days
Allow any heat	<input checked="" type="checkbox"/>
23.10.2015	13:54

Scroll down.

- ›Use add. heat‹: Use additional heating for disinfection
- ›Delay add. heat‹: Time delay for heating cycle with additional heating
- ›Day‹: Day of week for disinfection
- ›Interval‹: Repetition interval for disinfection
- ›Allow any heat‹: Use any heat source for disinfection

Return to ›1.3 Basic functions‹.

Select ›Space heating‹.

1.3.9 Space heating 	
Block SH below	43°C
Offset SH block.	2K
Req. stove	55°C
Offset stove	10K
23.10.2015	13:34

- ›Block SH below‹: Tank temperature for blocking space heating
- ›Offset SH block‹: Temperature offset (hysteresis) for blocking space heating
- ›Req. stove‹: Required tank temperature for space heating with stove
- ›Offset. stove‹: Tank temperature offset (hysteresis) for space heating with stove

1.3.9 Space heating 	
Block SH below	43°C
Offset SH block.	2K
Req. add. heat	50°C
Offset add. heat	5K
Req. stove	55°C
23.10.2015	13:34

With additional heating:

- ›Req. add. heat‹: Setpoint for request for heat from additional heating. If the tank temperature falls below this temperature the request will be activated, see page 27.
- ›Offset. add. heat‹: Offset for deactivating request for heat from additional heating

1.3.9 Space heating 	
Offset stove	10K
DRD SH Eco	100min*K
DRD SH Comf	20min*K
23.10.2015	13:34

- ›DRD SH Eco‹: Dynamic recharge delay for space heating - economy mode
- ›DRD SH Comf‹: Dynamic recharge delay for space heating - comfort mode

Return to ›1.3 Basic functions‹.

Select ›Stop sensor‹.

Here, you can define the temperature sensors which are used for stopping the demands. In general, two sensors are used for controlling the functions: The switch-on sensor (positioned on top) and the switch-off sensor, which can be selected here depending on the ›Operating mode‹.

The menu items with additional heating ›... AH ...‹ are hidden when ›High imm. heater‹ is enabled.

The menu depends on the selected hydraulic system.

1.3.16 Stop sensor		
Stove DHW Eco	TS3	
Stove DHW Comf	TS3	
Stove SH Eco	TS3	
Stove SH Comf	TS3	
23.10.2015	13:34	

›Stove DHW Eco‹: Temperature sensor for domestic hot water with stove in economy mode

›Stove DHW Comf‹: Temperature sensor for domestic hot water with stove in comfort mode

›Stove SH Eco‹: Temperature sensor for space heating with stove in economy mode

›Stove SH Eco Comf‹: Temperature sensor for space with stove heating in comfort mode

Or

1.3.16 Stop sensor		
AH DHW Eco	TS2	
AH DHW Comf	TS3	
Stove DHW Eco	TS3	
Stove DHW Comf	TS3	
AH SH Eco	TS2	
23.10.2015	13:34	

›AH DHW Eco‹: Temperature sensor for domestic hot water with additional heating in economy mode

›AH DHW Comf‹: Temperature sensor for domestic hot water with additional heating in comfort mode

›Stove DHW Eco‹: Temperature sensor for domestic hot water with stove in economy mode

›Stove DHW Comf‹: Temperature sensor for domestic hot water with stove in comfort mode

1.3.16 Stop sensor		
Stove DHW Comf	TS3	
AH SH Eco	TS2	
AH SH Comf	TS3	
Stove SH Eco	TS3	
Stove SH Comf	TS3	
23.10.2015	13:34	

›AH SH Eco‹: Temperature sensor for space heating with additional heating in economy mode

›AH SH Comf‹: Temperature sensor for space heating with additional heating in comfort mode

›Stove SH Eco‹: Temperature sensor for space heating with stove in comfort mode

›Stove SH Comf‹: Temperature sensor for space heating with stove in comfort mode

Return to ›Main menu‹.

Select ›Protective functions‹.

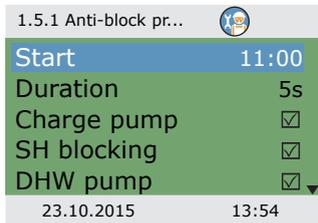
Protective functions



In professional mode, the ›1.5 Protective functions‹ menu is additionally available. It has the following items:

- ›Anti-Blocking‹
- ›Antifreeze protection‹
- ›Limits‹

Select ›Anti-Blocking‹.



The pumps and valves can be moved daily to prevent them from getting blocked.

This function is not activated as long as the pumps are activated in normal operation.

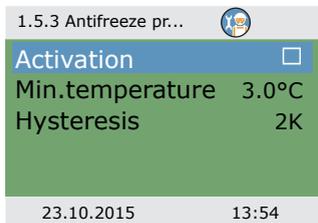
Determine the time of the day and the operating period.

Activate the required pumps and valves.

Return to ›1.5 Protective functions‹.

Select ›Antifreeze protect.‹

NOTICE	<p>The antifreeze protection function may prevent the heating system from damage which could be caused by freezing medium.</p> <p>Enter the lowest temperature ›Min.temperature‹ at which a system filled with pure water without antifreeze could operate without suffering damage.</p>
---------------	--



Activation and setting of the anti-freeze protective function.

Change the anti-freeze protection temperature and activation interval via ›Min.temperature‹ and ›Hysteresis‹.

Return to ›1.5 Protective functions‹.

Select ›Limits‹.

1.3.12 Limits 	
TS1 Limit	85°C
TS2 Limit	85°C
TS3 Limit	85°C
TS4 Limit	75°C
TS5 Limit	75°C
23.10.2015	13:34

Here, the limits for overtemperature protection can be changed.

›TS1 Limit‹: Limit for overload of fuel in stove
 ›TS2 Limit‹ to ›TS4 Limit‹: Limits for tank temperature too high
 ›TS5 Limit‹: Limits for hot-water tank temperature too high (hydraulic systems 3 and 7 only)

Return to ›Main menu‹.

Select ›Monitoring‹.



Monitoring

1.6 Monitoring 	
Error list	▶
Pump monitoring	▶
Sensor balancing	▶
23.10.2015	14:04

Under ›1.6 Monitoring‹, the following items are additionally available next to the operation mode menus:

- ›Pump monitoring‹
 - ›Sensor balancing‹

Select ›Pump monitoring‹.

1.6.6 Pump monito... 	
Activation	<input type="checkbox"/>
Temp. change 1	0.5K
Temp. change 2	0.5K
Monitoring time	15min
23.10.2015	14:04

When activated, ›Pump monitoring‹ observes the temperature change during the ›Monitoring time‹.

If the temperature does not change during this time, the controller releases an alarm.

Continue with ›Sensor balancing‹.

1.6.5 Sensor balan... 	
TS1 Offset	0.0°C
TS2 Offset	0.0°C
TS3 Offset	0.0°C
TS4 Offset	0.0°C
TS5 Offset	0.0°C
23.10.2015	14:04

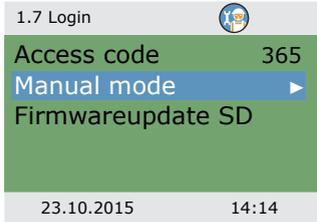
Long piping and other factors may distort measured variables.

Here, an offset value can be entered for each sensor.

Return to ›Main menu‹.

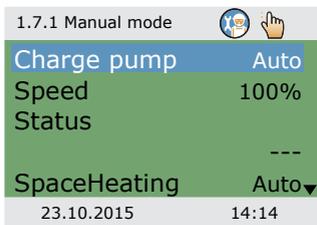
Select ›Login‹.

Login



Continue with ›Manual mode‹.

Manual mode



In manual mode, the individual outputs can be activated for testing purposes, e. g. to check that a pump is working properly.

Select output, acknowledge, select ›On‹ and acknowledge.

The connected pump and/or the connected valve must now be activated.

Manual mode can only be exited by pressing the esc button.

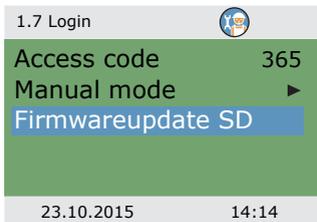
Firmware update

The controller software can be updated via the Micro SD card.

Two files are required for the update process: STOVE123.HEX and UPDJOB.S.TXT (where “123”, for example, indicates the software version V1.23)

Copy the firmware update files manually to the Micro SD card on a PC and then insert the Micro SD card in the controller.

- If the Micro SD card is inserted while the controller is powered off, firmware update will start automatically when it is powered on again.



- If the Micro SD card is inserted while the controller is powered on, login and select ›Firmwareupdate SD‹.

The display flashes every second.

The new firmware is installed.

When installation is finished, the controller reboots.

NOTICE	Nothing should interrupt the update process, especially no power loss!
---------------	--

NOTICE	<p>If the update has not begun within one minute after the selection of »Firmwareupdate SD«, the controller will restart.</p> <p>If the update process is aborted, and so the controller is not ready for operation, it must be switched off. (Disconnected from the mains.)</p> <p>When switching it on again, press the esc button until the display flashes.</p> <p>The update process can now be repeated.</p>
---------------	--

Two files are generated by the update process on the Micro SD card: RESULTS.TXT which contains the result of each update process and UPDLOGS.TXT which shows the software version after the update.

Summary of parameters in ›Basic functions‹

Items marked by an asterisks * are only available in professional mode.

Menu/parameter	Default	Range	Unit	Description	Hydraulic system							
					1	2	3	4	5	6	7	
Basic functions												
Control parameters					x	x	x	x	x	x	x	x
Add. heat enabled	Yes	No/Yes		Recharging of the tank by the additional heating	x	x	x	x	x	x	x	x
Charge start	58	30 ... 90	°C	Minimum stove temperature for starting the loading pump	x	x	x	x	x	x	x	x
Charge offset *	5	2 ... 15	K	Temperature offset for starting the speed control of the loading pump	x	x	x					
Act. ZV below *	43	20 ... 90	°C	Lower temperature threshold for activation of zone valve		x	x					x
Offset ZV act. *	2	1 ... +10	K	Temperature offset (hysteresis) for zone valve activation		x	x					x
Ext. AH pump On *	5	1 ... 5	K	Switch-on temperature offset (hysteresis) for additional heating pump								x
Ext. AH pump Off *	2	-5 ... +2	K	Switch-off temperature offset (hysteresis) for additional heating pump								x
DPD *	0	0 ... 50	min*K	Dynamic pump delay	x	x	x					
High. imm. heater *	No	No/Yes		Force start and stop sensor to TS2 for additional heating	x	x	x	x	x	x	x	x



Menu/parameter	Default	Range	Unit	Description	Hydraulic system							
					1	2	3	4	5	6	7	
Basic functions												
Common Eco/Comf *	Yes	No/Yes		Disable or enable the ›Operation mode‹ display (during commissioning only)	x	x	x	x	x	x	x	x
fix PWM *	30	5 ... 100	%	Fixed PWM speed of high efficiency pump for loading domestic hot water/external AH			x				x	x
Min control PWM *	30	5 ... 100	%	Lower PWM speed level for controlling the stove charging pump	x	x	x					
Step PWM *	5	2 ... 10	%/K	PWM pump speed increment	x	x	x					
Domestic hot water					x	x	x	x	x	x	x	x
Req. add. heat	50	20 ... 90	°C	Setpoint for request for heat from stove with additional heating. If the tank temperature falls below this temperature the request will be activated.	x	x		x	x	x		
Offset add. heat *	+5	1 ... +20	K	Offset for deactivating request for heat from stove with additional heating	x	x		x	x	x		
Req. stove	55	20 ... 90	°C	Setpoint for request for heat from stove. If the tank temperature falls below this temperature the request will be activated.	x	x	x	x	x	x	x	x
Offset stove *	+10	1 ... +50	K	Offset for deactivating request for heat from stove	x	x	x	x	x	x	x	x

Menu/parameter	Default	Range	Unit	Description	Hydraulic system							
					1	2	3	4	5	6	7	
Basic functions												
Max. temp DHW *	60	20 ... 90	°C	Maximum temperature for external domestic hot water tank			x					x
Charge diff DHW *	3	1 ... 5	K	Control of the pump for domestic hot water with conditions: TS2 > TS5 + Charge diff DHW <i>and</i> TS5 < Max. temp DHW - Charge hys DHW			x					x
Charge hys DHW *	6	2 ... 10	K				x					x
DRD DHW Eco	100	0 ... 500	min*K	Dynamic recharge delay for domestic hot water heating - economy mode	x	x		x	x	x		
DRD DHW Comf	0	0 ... 500	min*K	Dynamic recharge delay for domestic hot water heating heating - comfort mode	x	x		x	x	x		
Anti-legionellae *					x	x	x	x	x	x	x	x
Activation *	Yes	No/Yes		Activation of anti-legionella function	x	x	x	x	x	x	x	x
Target temp *	60	55 ... 85	°C	Target temperature for disinfection	x	x	x	x	x	x	x	x
Hysteresis *	3	1 ... 5	K	Temperature hysteresis for switch-on	x	x	x	x	x	x	x	x
Start time *	3	0 ... 23	hour	Starting time for heating	x	x	x	x	x	x	x	x
Duration *	10	5 ... 60	min	Duration of the required heating cycle	x	x	x	x	x	x	x	x
Max. time *	48	4 ... 96	h	Maximum heating period (timeout)	x	x	x	x	x	x	x	x
Use add. heat *	Yes	No/Yes		Use additional heating for disinfection	x	x	x	x	x	x	x	x

Menu/parameter	Default	Range	Unit	Description	Hydraulic system								
					1	2	3	4	5	6	7		
Basic functions													
Delay add. heat *	72	0 ... 96	h	Time delay for heating cycle with additional heating	x	x	x	x	x	x	x	x	
Day *	Friday	Monday ... Sunday	day	Day of week for disinfection	x	x	x	x	x	x	x	x	
Interval *	7	1 ... 14	days	Repetition interval for disinfection	x	x	x	x	x	x	x	x	
Allow any heat *	Yes	No/Yes		Use any heat source for disinfection	x	x	x	x	x	x	x	x	
Space heating					x	x	x	x	x	x	x	x	
Block SH below *	43	20 ... 90	°C	Tank temperature for blocking space heating	x		x	x	x				x
Offset SH block *	2	1 ... +10	K	Temperature offset (hysteresis) for blocking space heating	x		x	x	x				x
Req. add. heat	50	20 ... 90	°C	Setpoint for request for heat from additional heating. If the tank temperature falls below this temperature the request will be activated	x	x		x	x	x			
Offset. add. heat *	+5	1 ... +20	K	Offset for deactivating request for heat from additional heating	x	x		x	x	x			
Req. stove	55	20 ... 90	°C	Required tank temperature for space heating with stove	x	x	x	x	x	x	x	x	
Offset stove *	+10	1 ... +50	K	Tank temperature offset (hysteresis) for space heating with stove	x	x	x	x	x	x	x	x	

Menu/parameter	Default	Range	Unit	Description	Hydraulic system							
					1	2	3	4	5	6	7	
Basic functions												
DRD SH Eco	100	0 ... 500	min*K	Dynamic recharge delay for space heating - economy mode	x	x		x	x	x		
DRD SH Comf	0	0 ... 500	min*K	Dynamic recharge delay for space heating - comfort mode	x	x		x	x	x		
Stop sensor *					x	x	x	x	x	x	x	
AH DHW Eco *	TS 2	TS 2 ... TS 4		Temperature sensor for domestic hot water with additional heating in economy mode	x	x		x	x	x		
AH DHW Comf *	TS 2	TS 2 ... TS 4		Temperature sensor for domestic hot water with additional heating in comfort mode	x	x		x	x	x		
Stove DHW Eco *	TS 3	TS 3 ... TS 4		Temperature sensor for domestic hot water with stove in economy mode	x	x	x	x	x	x	x	
Stove DHW Comf *	TS 3	TS 3 ... TS 4		Temperature sensor for domestic hot water with stove in comfort mode	x	x	x	x	x	x	x	
AH SH Eco *	TS 2	TS 2 ... TS 4		Temperature sensor for space heating with additional heating in economy mode	x	x		x	x	x		
AH SH Comf *	TS 3	TS 3 ... TS 4		Temperature sensor for space heating with additional heating in comfort mode	x	x		x	x	x		
Stove SH Eco *	TS 3	TS 3 ... TS 4		Temperature sensor for space heating with stove in economy mode	x	x	x	x	x	x	x	

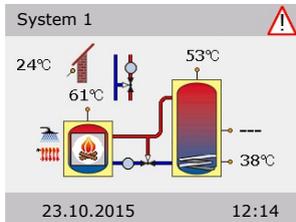


Menu/parameter	Default	Range	Unit	Description	Hydraulic system							
					1	2	3	4	5	6	7	
Basic functions												
Stove SH Eco Comf *	TS 3	TS 3 ... TS 4		Temperature sensor for space with stove heating in comfort mode	x	x	x	x	x	x	x	x
Allow TS4 *	No	No/Yes			x	x	x	x	x	x	x	x



Malfunction

The differential temperature controller LK SmartStove® indicates malfunctions and faults.



The “Attention” symbol appears at the top right corner of the display.

A flashing symbol indicates a pending message or an active safety function.

A permanent symbol indicates that there is an active malfunction and the controller is in failure operation.

To start the ›Service Wizard‹, press the knob.

NOTICE

If a malfunction message appears in the display, the operator can define the possible causes by means of the ›Service Wizard‹ so that he/she can provide the installer with precise information.

There may be various deficiencies in a thermal system, which require a wide variety of approaches. The controller communicates every step to the operator or installer via the screen, so that there is no need to describe all malfunctions in detail in this operating manual.



DANGER



Repair or disassembly

Lethal danger due to electrocution!

For troubleshooting on the plant, disconnect all poles of the power supply reliably and protect it them against being switched on again!

Sensor monitoring

The temperature sensors TS1 to TS6 are monitored for short-circuit or interruption. A sensor fault (interruption or short-circuit) is indicated in the model diagram by three minus signs: “---”.

The controller has stored temperature limits which comprise the temperature range that is usually to be expected for a heating control. If this range is left, the controller signals an error.

In case of use of PT1000 sensors, the following limits have been established:

- Short-circuit: Measured temperature $< -30^{\circ}\text{C}$ (resistance $< 882\ \Omega$)
- Interruption: Measured temperature $> 250^{\circ}\text{C}$ (resistance $> 1.931\ \Omega$)

Service Wizard

The ›Service Wizard‹ indicates the possible causes of malfunctions on the basis of the detected symptoms and thus supports immediate and comfortable detection of deficiencies.

Example for protective function



If ›Safety function‹ appears in the display, this is a message, no malfunction.

In this case, there is no fault, but limits have been exceeded. The controller indicates that a protective function has been triggered.

The message is only active until normal operation has been restored.

Example for malfunction

Here, a malfunction message with troubleshooting process is presented as an example.



›1.10 Service Wizard‹ appears.

The malfunction appears in plan text - here:

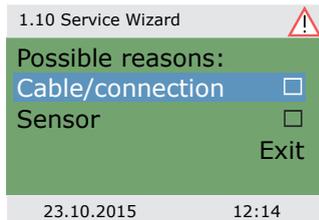
›M02: Breakage of sensor on TS1!‹.

If an analysis/repair is not required at present, press ›Menu‹ to return to the main menu.



The Service Wizard helps detect possible causes of malfunctions.

Acknowledge by selecting ›Next‹.



For this malfunction, the following causes are assumed:

›Cable/connection‹ or ›Sensor‹ -

Select the first menu item and confirm by pressing the knob.

<p>1.10 Service Wizard </p> <p>Please check the connection cable to the sensor</p> <p style="text-align: right;">Next</p> <p>23.10.2015 12:14</p>	<p>The controller here provides the troubleshooting instruction to check the connection cable.</p> <p>Perform the measure in accordance with the recommendation.</p> <p>Acknowledge by selecting ›Next‹.</p>
<p>1.10 Service Wizard </p> <p>Disconnect it and measure its resistor.</p> <p style="text-align: right;">Next</p> <p>23.10.2015 12:14</p>	<p>More detailed instructions are available if required.</p> <p>Acknowledge by selecting ›Next‹.</p>
<p>1.10 Service Wizard </p> <p>Could you detect a short-circuit / cable break?</p> <p>No <input type="radio"/> Yes <input checked="" type="radio"/></p> <p>23.10.2015 12:14</p>	<p>The troubleshooting result is interrogated.</p> <p>Continue via ›Yes‹ for the case that the malfunction has been determined.</p>
<p>1.10 Service Wizard </p> <p>Please replace the cable.</p> <p style="text-align: right;">Exit</p> <p>23.10.2015 12:14</p>	<p>Repair information appears.</p> <p>Perform the appropriate repair work.</p> <p>Exit the ›Service Wizard‹ by pressing ›Exit‹.</p>
<p>1.10 Service Wizard </p> <p>Could you detect a short-circuit / cable break?</p> <p>No <input checked="" type="radio"/> <input type="radio"/> Yes <input type="radio"/></p> <p>23.10.2015 12:14</p>	<p>If the cause of the malfunction has not yet been determined, troubleshooting can be continued.</p> <p>Continue with ›No‹.</p>



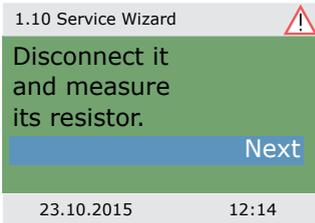


Select all the sources of malfunctions listed, and confirm.



Appropriate instructions appear for each source of faults.
Perform the measure in accordance with the recommendation.

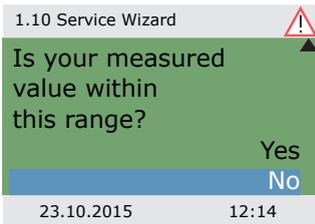
Continue with ›Explanation‹.



A part of the information and instructions may be provided in close detail, so that ...



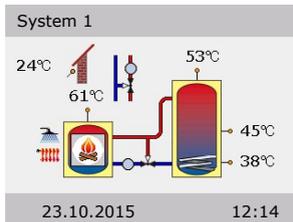
...the texts may well take several screens.



After description of the troubleshooting measure, the result determined by you is interrogated...



... and the appropriate logical conclusion is made, the repair work displayed.



After elimination of the malfunction, the plant screen without the "Attention" symbol appears again on the display, automatic mode is continued.



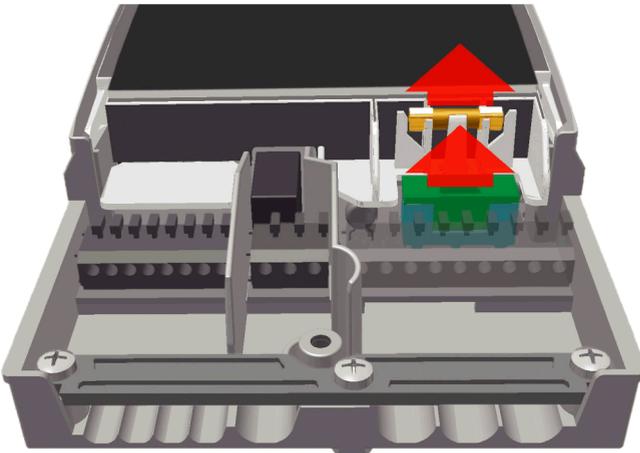
Replacement of fuse



Repair or disassembly

Lethal danger due to electrocution!

Before opening the terminal cover, disconnect all poles of the power supply reliably and protect it them against being switched on again!



To remove the device fuse, open the terminal cover.

Above the right-hand group of terminals, the fuse base and a spare fuse are located. Pull the upper part of the support and the spare part out.

The glass tube fuse is clamped in the formed piece and is removed together with the plastic holder.



 DANGER	
	Wrong fuse type used. Risk of fire due to overload or short-circuit! Only use glass tube fuses type 5 x 20 mm, T2A!

Now, push the micro-fuse laterally out of its holder.

The glass tube fuse is installed by reversing the above order.

Make sure to procure yourself immediately a new spare fuse!



Technical data

Differential temperature controller LK SmartStove®

Type of mounting	Wall-mounting
Housing	Plastics, in several parts
Mode of operation	Type 1
Type of protection	IP 20
Dimensions Width x Height x Depth [mm]	115 x 173 x 46
Weight [g] Basic version	370
Storage/operating temperature [°C]	0-40, non-condensation
Handling	via knob and push buttons
Display	TFT colour display 47 x 35 mm, backlit
Power reserve of real time clock, at least [h]	8

Connection to power supply

Design	3 spring-type terminals PE, N and L
Operating voltage [VAC]	230 ±10%
Line frequency [Hz]	50 ±1%
Auxiliary consumption typ. [W]	1.74
Power consumption max. [W]	3.5
Fuse	Micro fuse, type 5 x 20 mm, T2A/250 V
Rated pulse voltage [V]	2500

Max. cross sections to be connected

Cable end sleeve:	0.25 to 0.75 mm ²
Single-wire	0.50 to 1.50 mm ²
Fine-wired	0.75 to 1.50 mm ²

Interfaces TS1 / TS2 / TS3 / TS4 / TS5 / TS6

Design	2 spring-type terminals each
Assignment as inputs	Temperature sensor Pt 1000
Admissible temperature sensor	
Optional assignment of TS3 / TS4 to the impeller sensor	DFZ 1-100 pulses/litre
Optional assignment as output on TS4	PWM signal 100 Hz...2 kHz or analogue output 0...10 V, max. 10 mA

Interface TS7 / TS8

Design	2 spring-type terminals each
Assignment as output	PWM signal 100 Hz...2 kHz or analogue output 0...10 V, max. 10 mA

Triac outputs RO1 / RO2

Design	3 spring-type terminals each, PE, N and L
Output voltage [VAC]	230 \pm 10%
Output power max. per output [VA]	200
Output current max. per output [A]	1

Switching output REL: change-over contact

Design	3 spring-type terminals
Switching voltage max. [V]	253
Switching capacity max. [VA]	230
Switching current max. [A]	1

Interface for analogue Vortex flow sensors

Design	Plug connector
--------	----------------

Disassembly/disposal

 DANGER	
	<p>Disassembly</p> <p>Lethal danger due to electrocution!</p> <p>Before opening the terminal cover, disconnect all poles of the power supply reliably and protect it them against being switched on again!</p>

For disassembly of the differential temperature controller LK SmartStove[®], reverse assembly procedure:

- Disconnect the power supply.
- Open the terminal cover.
- Disconnect all cables.
- Release the wall screw fastening.
- Remove the controller from its mounting location.

 DANGER	
	<p>Loose cables</p> <p>Lethal danger due to electrocution!</p> <p>When removing the controller, secure all stripped cable ends so that they cannot be touched by persons!</p> <p>Remove cables completely on definite removal.</p>

NOTICE	<p>The person who or the institute which is responsible for disposal of the device must not discard the controller with the residual waste, but must ensure correct recycling in accordance with the local provisions!</p> <p>In case of doubt, ask the local disposal company or the authorized dealer from which you have purchased the device.</p>
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Warranty and liability

The differential temperature controller LK SmartStove® was developed, manufactured and tested according to stringent quality and safety specifications and corresponds to the state of the art.

The device is subject to the warranty period prescribed by law of 2 years after the date of sale.

The seller shall eliminate all defects in material and workmanship which occur on the product during the warranty period and which impair the product's functionality.

Natural wear and tear does not constitute a defect.

Warranty and liability does not include all damage which is due to one or several of the following reasons:

- Non-compliance with these Assembly and Operating Instructions.
- Inappropriate transport.
- Faulty assembly, commissioning, maintenance or operation.
- Modifications of the structure or tampering with the software of the device.
- Installation of supplementary components which are not approved by the manufacturer.
- Continued use of the controller despite an obvious defect.
- Use of non-approved spare parts and accessories.
- Applications exceeding the intended scope of utilization.
- Inappropriate utilization of the device / improper handling, e. g. ESD.
- Use of the device outside of the admissible technical boundaries.
- Voltage surges, e. g. due to lightning strokes.
- Force majeure.

Further claims based on this warranty obligation, especially compensation for damage exceeding the asset value of the differential temperature controller, are excluded.

Construction, design and project engineering of heating installations are performed by specialist installers based on the applicable standards and directives.

The functioning and safety of a plant are the exclusive responsibility of the companies commissioned with planning and execution.

Contents and illustrations of this manual have been elaborated to the best of our knowledge and with utmost diligence - we reserve the right of error and technical modifications.

Liability of the manufacturer for inappropriate, incomplete or incorrect information and all damage resulting therefrom is excluded on principle.

Service request

Error pattern/error description: _____

Error message: _____

Software version: _____

Service Wizard executed: Yes No _____

Readings: TS1: _____
 TS2: _____
 TS3: _____
 TS4: _____
 TS5: _____
 TS6: _____
 TS7: _____
 TS8: _____

Wiring: RO1: Pump HE Valve _____
 RO2: Pump HE Valve _____
 REL: Yes No _____

Service hours: RO1: _____
 RO2: _____
 REL: _____

Equipment/Accessories/Options: _____

NOTICE	For repair or replacement of the controller, make sure that completed copies of the commissioning report and of the error report are included!
---------------	--



CE DECLARATION OF CONFORMITY

We, LK Armatur AB, Garnisonsgatan 49, SE - 254 66 Helsingborg – Sweden
www.lkarmatur.se info@lkarmatur.se

DECLARES

that the Differential temperature controller LK 162 SmartStove

COMPLIES

with the directives 2006/95/EC (LVD), 2004/108/EC (EMC), 2011/65/EU RoHS2

CONFIRMS ALSO THAT THE PRODUCT FULFILLS

"Method of protection against electric shock Class II"
regulation 1907/2006 (REACH)

The conformity was assessed in accordance with the following EN standards:

EN 60730-1:2000 + amendments	Automatic electrical controls for household ... General requirements
EN 61000-3-2:1995 + amendments	EMC. Emission test
EN 61000-3-3:1995 + amendments	EMC. Limitations of voltage changes
EN55022:1998 + corr 1999 (class B)	Information technology equipment - Radio disturbance characteristics - Limits [...]

Helsingborg, 12 October 2015

Magnus Eriksson

Managing Director

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