JUMO Quantrol LC100/LC200/LC300

Universal PID Controller Series



B 702030.0

Operating Manual

JUMO

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1.1 Device documentation

Data sheet T 702030 (as a PDF document)
The data sheet contains general information about the device and forms the basis for planning and purchase decision.

Brief instructions B 702030.7 (printed in DIN A6 format)
These brief instructions contain the most important information about installation, the electrical connection as well as operation, parameterization and configuration of the device. The brief instructions are supplied with every device. For further information, please refer to the operating manual B 702030.0 available as a PDF document.

Operating manual B 702030.0 (as a PDF document)
This operating manual contains all information about installation, the electrical connection as well as operation, parameterization and configuration of the device.

Interface description B 702030.2.0 (as a PDF document)
It contains information about the RS485 interface, the Modbus protocol and the communication with other devices.

All **PDF documents** can be downloaded under **www.jumo.net**.

1.2 Safety information

This manual contains information that must be observed in the interest of your own safety and to avoid damage to assets. This information is supported by symbols which are used in this manual as follows.
Please read this manual before starting up the device. Keep the manual in a place accessible to all users at all times.
All necessary settings are described in this manual. Manipulations not described in this manual or expressly forbidden will jeopardize your warranty rights.

Warning signs



DANGER!
This symbol indicates that **Injury or death caused by electrical shock** can occur, if the respective protective measures have not been taken.



CAUTION!
This symbol in combination with the signal word indicates that **damage to assets or data loss** will occur if suitable precautions are not taken.



READ DOCUMENTATION!
This symbol – placed on the device – indicates that the associated **device documentation has to be observed**. This is necessary to recognize the kind of the potential hazards as well as to take the measures to avoid them.

Note signs



TIP!
This symbol refers to **Important information** about the product or its handling or additional use.



REFERENCE!
This symbol refers to **Further information** in other sections, chapters or manuals.

1.3 Scope of delivery

- Controller (including seal and fastening elements)
- Brief instructions B 702030.7 in DIN A6 format

2.1 Identifying the device version

	Basic type
702031	Quantrol LC100 (format 48 mm x 48 mm)
702032	Quantrol LC200 (format 48 mm x 96 mm, portrait format)
702034	Quantrol LC300 (format 96 mm x 96 mm)
	All types including 1 analog input (universal), 1 binary input (for potential-free contact; can be used as an alternative to analog input 0 to 10 V), 1 relay output (N/O)

	Basic type extension
8	Standard, with factory settings
9	Customer-specific programming (on request)

1	2	3	4	Options (3 and 4 not for LC100)
0	0	0	0	-
1	1	1	1	1 relay output (N/O)
2	2	2	2	1 logic output
3	-	-	-	1 analog output (configurable)
-	4	-	-	1 RS485 interface

	Voltage supply
23	AC 110 to 240 V +10/-15 %, 48 to 63 Hz
25	AC/DC 20 to 30 V, 48 to 63 Hz

	/		-					-		**Order code**
702034	/	8	-	3	4	1	2	-	23	**Example**

2.2 Excerpt from the technical data

Case

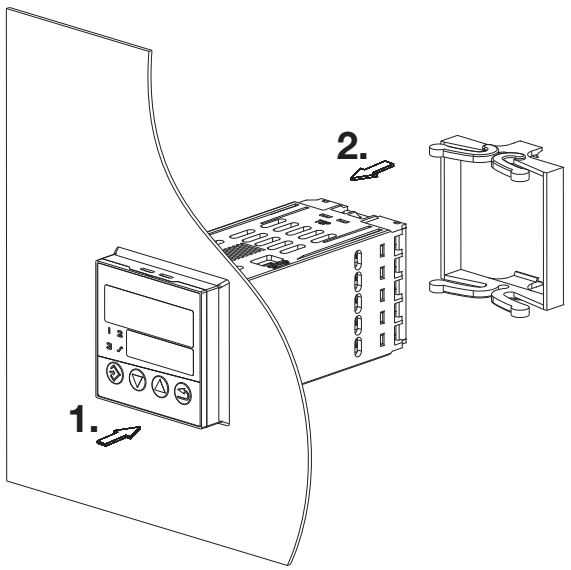
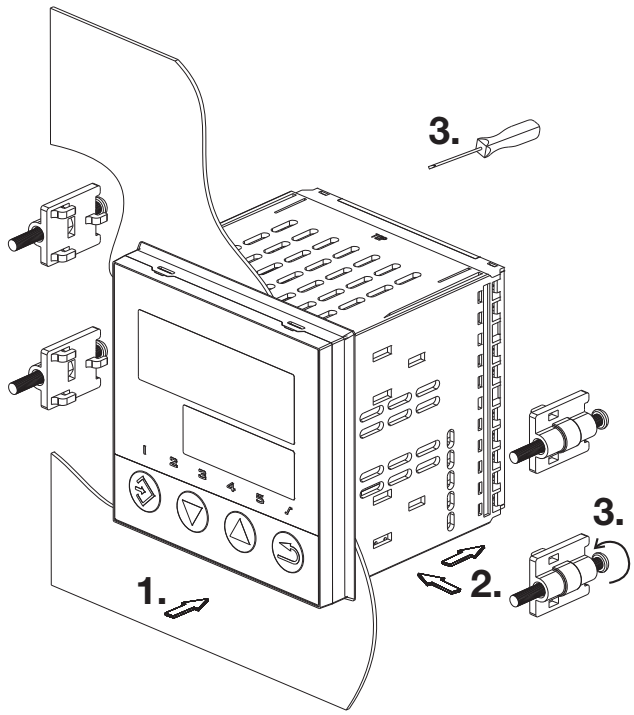
Case type	Plastic case for panel mounting as per IEC 61554 (indoor use)
Dimensions (front)	LC100: 48 mm x 48 mm; LC200: 48 mm x 96 mm (portrait format); LC300: 96 mm x 96 mm
Panel cut-out	LC100: 45 mm x 45 mm; LC200: 45 mm x 92 mm; LC300: 92 mm x 92 mm
Minimum spacing horizontal / vertical	LC100: 11 mm / 30 mm (65 mm with USB cable); LC200/LC300: 22 mm / 30 mm (65 mm with USB cable)
Depth behind panel	LC100: max. 95 mm; LC200/LC300: max. 80 mm
Ambient / storage temperature range	-5 to +55 °C / -40 to +70 °C
Ambient conditions	rel. humidity < 90% annual average, without condensation

Site altitude	up to 2000 m above sea level
Operating position	any
Protection type	as per DIN EN 60529, at the front IP 65, at the rear IP 20
Weight (fully equipped)	LC100: approx. 150 g; LC200: approx. 200 g; LC300: approx. 300 g

Electrical data

Voltage supply (switch mode PSU)	AC 110 to 240V +10/-15 %, 48 to 63Hz AC/DC 20 to 30V, 48 to 63Hz
Electrical safety	as per DIN EN 61010, part 1 overvoltage category III, pollution degree 2
Power consumption	max. 14 VA
Electrical connection	on the rear via screw terminals; with core-end ferrule of a pipe shape, open cable lug or pin cable lug
Conductor cross section	fine-strand 0.25 to 1.5 mm^2
Tightening torque	0.5 Nm
Electromagnetic compatibility	as per DIN EN 61326-1
Interference emission	Class A - Only for industrial use -
Interference immunity	Industrial requirements
Setup interface	USB socket, type Mini-B 5-pole

2.3 Installation

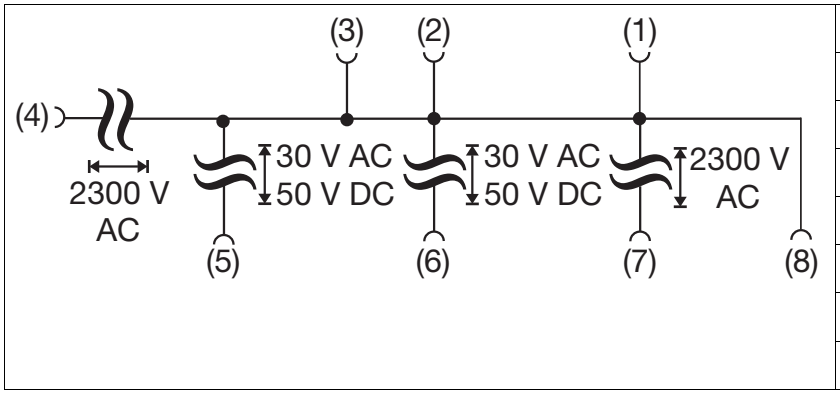
LC100	LC200 and LC300
	

Installation of LC100	Installation of LC200 and LC300
1. Insert the device from the front into the panel cut-out and ensure that the seal is correctly positioned.	1. Insert the device from the front into the panel cut-out and ensure that the seal is correctly positioned.
2. Push the fastening frame from the panel rear onto the device and press the springs against the panel rear until the lugs engage in their slots and it is sufficiently fastened.	2. Slide the mounting brackets from the panel rear into the lateral openings and push to the rear against the stop.
	3. Place the mounting brackets against the panel rear, and tighten evenly with a screwdriver.

2.4 Installation notes

- The device is not suitable for installation in explosive areas (Ex areas).
- The choice of cable material, the installation and the electrical connection of the device must conform to the requirements of DIN VDE 0100 "Installation of low-voltage power circuits" and/or the appropriate local/national regulations (e.g. based on IEC 60364).
- At maximum load, the cables must be heat resistant up to at least 80 °C.
- The electrical connection must only be carried out by qualified personnel.
- The device is intended to be installed in electrical cabinets or systems. It shall be operated by mains protected with a branch circuitry overcurrent protection device not more than 20 Amps. For servicing/repairing a Disconnecting Device shall be provided to disconnect all conductors.
- The load circuit must be fused for the maximum relay current, in order to prevent the output relay contacts from becoming welded in the event of a short circuit occurring at that point.
- The electromagnetic compatibility (EMC) meets the standards and regulations cited in the technical data.
- Run input, output and supply cables separately and not in parallel with one another.
- Sensor and interface cables should be shielded cables with twisted conductors. Do not run cables close to current-carrying components or cables. Ground the shielding on one side.
- Do not connect other consumers to the power terminals of the device.

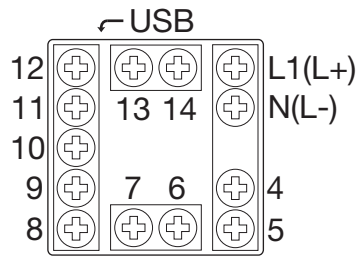
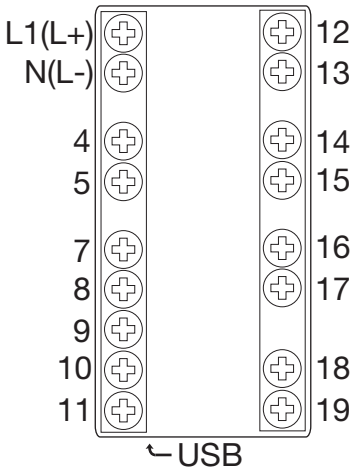
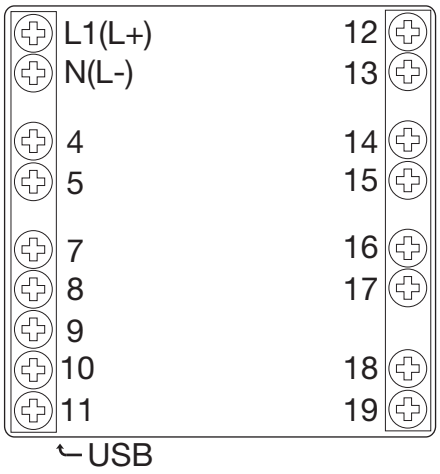
2.5 Electrical isolation



(1) Analog input
(2) Binary input
(3) Setup interface (USB)
(4) Voltage supply
(5) RS485 interface
(6) Analog output
(7) Relay outputs
(8) Logic outputs

2.6 Connection diagram

The terminal strips on the device rear are equipped with screw terminals. Please refer to the technical data for specifications concerning the conductor cross section.

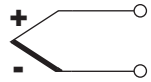
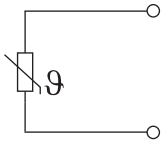
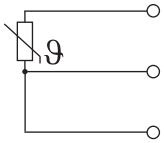
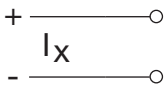
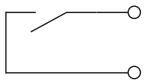
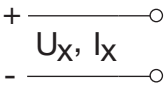
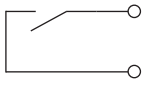
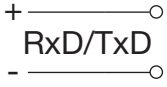
LC100	LC200	LC300
		

TIP!
The USB interface (socket Mini-B, 5-pole) is labeled on the device with "SETUP“ and is located on the case top of the LC100 and on the case bottom of the LC200 and LC300. It is used for connection to a PC that is running the setup program.

2 Installation - Electrical Connection

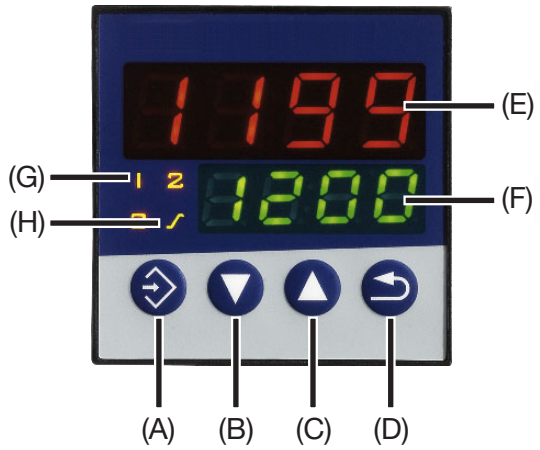
DANGER!
The electrical installation may carry voltage.
Risk of electrocution.
The electrical connection must only be performed by qualified personnel.

TIP!
Prior to starting the electrical connection, check that the device version complies with the order code.

Connections	Symbol	LC100	LC200/LC300
Analog input			
Thermocouple		9 8	10 11
RTD temperature probe, 2-wire		10 8	9 11
RTD temperature probe, 3-wire		10 9 8	9 10 11
Voltage DC 0 to 10 V		12 11	7 8
Current DC 0(4) to 20 mA		9 8	10 11
Binary input for potential-free contact		11 12	7 8
	Output:	**1 2 3**	**1 2 3 4 5**
Analog output DC 0 to 10 V, DC 0(4) to 20 mA		13 14	12 13
Relay output (N/O) (max. 3 A at AC 230 V, resistive load)		4 13 6 5 14 7	4 12 14 16 18 5 13 15 17 19
Logic output (DC 0/14 V)		13 7 14 6	12 14 16 18 13 15 17 19
RS485 interface		7 6	14 15
Output 1 as standard; Outputs 2 to 5 optional (options 1 to 4)			
Voltage supply		L1 (L+) N (L-)	L1 (L+) N (L-)
Setup interface	USB socket, type Mini-B 5-pole		

3.1 Operation

3.1.1 Display and operating elements



The software version is displayed on the device when simultaneously pressing keys (A) and (C).

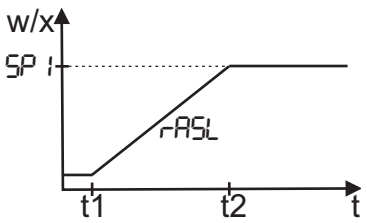
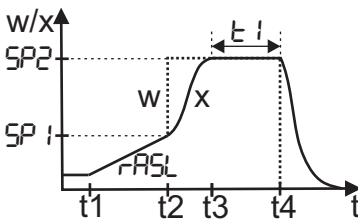
(A)	Programming / one level deeper
(B)	Value reduction / previous parameter
(C)	Value increase / next parameter
(D)	Function key / leave level
(E)	Red 7-segment display (factory-set: Actual value); 4-digit, configurable decimal place (automatic adjustment in the case of display overflow)
(F)	Green 7-segment display (factory-set: Setpoint); 4-digit, configurable decimal place; also display of level and parameter symbols
(G)	LED 1 to 3(5): Switching position of binary output (LED is lit = output active)
(H)	LED ramp function or firing curve

3.1.2 Self-optimization, setpoint and manual mode

On the basis of the **Normal display**, the following **Functions** are available:

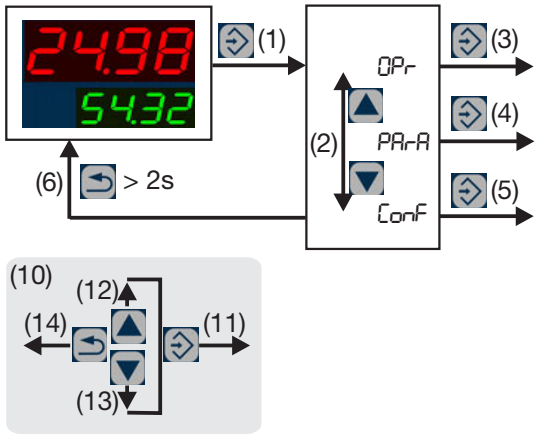
Start of self-optimization: Simultaneously press keys (B) and (C) (> 2 s) **Abort of self-optimization:** Simultaneously press keys (B) and (C)	"tUnE" flashes in the lower display. No parameters are changed by the abort.
Change setpoint using keys (B) and (C)	The longer the key is kept pressed, the faster the set point value changes. The value will be automatically applied.
Function key (D) (> 2 s) is used to **Change-over to manual mode** and to exit the manual mode	The output level (%) is displayed in the lower display and can be changed with the keys (B) and (C). (The controller automatically changes to manual mode in the event of overrange/underrange and probe break.)

3.1.3 Ramp function/firing curve

Ramp function (start after mains ON or with the binary function)		**Firing curve** (start with the binary function or using the function key)	
	t1: Start (actual value) t2: Setpoint setting was reached		t1: Start t2: SP1 -> SP2 (automatically) t3: Timer start t4: Timer end
LED (H): Is lit with the ramp function active		LED (H): Flashes in phase 1 (t1 to t2), is lit in phases 2 and 3 (t2 to t4) OFF (F): Firing curve not active	

3.1.4 Level concept

The parameters for device setting are organized at different **levels**.



If no key is pressed for 180 s (factory-setting), the device will return to its normal display. This time period can be configured.

(1)	Changeover from **normal display** to the levels
(2)	Changeover between levels
(3)	Changeover to the **operator level** (setpoints, process values, timer value and time)
(4)	Changeover to the **parameter level** (controller parameters)
(5)	Changeover to **configuration level** (analog input, controller, ramp function, limit value monitoring, timer, outputs, binary functions, display and operation, interface)
(6)	Return to the normal display
(10)	**Navigation principle**:
(11)	- one level deeper
(12)	- next parameter / increase value
(13)	- previous parameter / reduce value
(14)	- one level back

The various levels are also accessible in manual mode.

Level inhibit (factory-setting: all levels are free):

Code	Operator level	Parameter level	Configuration level
0	free	free	free
1	free	free	inhibited
2	free	inhibited	inhibited
3	inhibited	inhibited	inhibited

1. Simultaneously press (A) and (B) (> 5 s)
2. Press (A) (display flashes)
3. Enter code using (B) or (C)
4. Use (D) to return to the normal display (or automatically after 180 s)

(key designation in brackets; see chapter 3.1.1)

3.1.5 Operator level (OPr)

Depending on the configuration, the following parameters are available:

Symbol	Description
SP 1	Setpoint 1 (can be edited)
SP2	Setpoint 2 (can be edited)
t 1	Timer value (if timer or firing curve are inactive; can be edited)
tL	Timer run time (if timer or firing curve are active)
tr	Residual timer run time (if timer or firing curve are active)

Symbol	Description
rASL	Ramp rate (for firing curve; can be edited)
SPr	Current ramp setpoint (for ramp function or firing curve)
inP 1	Measured value at analog input
y	Output level

3.2 Configuration (ConF)

TIP!
The device will map out parameters unless the equipment level permits the function assigned to the parameter. Factory settings appear in **bold** in the following table.

Analog selector

With some parameters in the configuration level, the user can choose from a series of analog values. The following list contains all available signals.

Value	Description
0	Switched off
1	Analog input
2	Actual value
3	Current setpoint
4	Ramp end value
5	(reserved)
6	Setpoint 1

Value	Description
7	Setpoint 2
8	Output level display (-100 % to +100 %)
9	Controller output 1 (e.g. heating, output level 0 to +100 %)
10	Controller output 2 (e.g. cooling, output level 0 to -100 %)
11	Timer run time (time unit of the timer)
12	Timer residual time (time unit of the timer)

3.2.1 Analog input (InP)

ConF -> InP ->

Parameters	Value	Description	Value	Description
Probe type SEnS		RTD temperature probe:		Thermocouples:
	0	**Pt100 3-wire**	9	NiCr-Ni K
	1	Pt1000 3-wire	10	Pt10Rh-Pt S
	2	Pt100 2-wire	11	Pt13Rh-Pt R
	3	Pt1000 2-wire	12	NiCrSi-NiSi N
	4	KTY 2 wire	13	NiCr-CuNi E
	5	Cu-50 3-wire		Standard signals:
		Thermocouples:	14	0 to 20 mA
	6	Cu-CuNi T	15	4 to 20 mA
	7	Fe-CuNi J	16	0 to 10 V
	8	Fe-CuNi L		
	When selecting "0 to 10 V“, binary input bin1 is inactive.			

Parameters	Value	Description
Measured value offset OFFS	-1999 ... **0** ... +9999	The measured value is corrected through this value (offset), prior to being used as a controller input value and in the analog selector.
Display start SCL	-1999 ... **0** ... +9999	On transducers with standard signal, a display value is assigned to the physical signal. Example: 0 to 20 mA = 0 to 1500 °C
Display end SCH	-1999 ... **100** ... +9999	
Filter time constant dF	0.0 ... **0.6** ... 100.0 (s)	Adaptation of the digital input filter (0 = Filter OFF)
Temperature unit Unit	**1**	deg. Celsius
	2	deg. Fahrenheit
(Setup program: Adjustable resistance of the KTY at 25 °C.)		

3.2.2 Controller (Cntr)

The actual value is provided for the controller by the analog input.

ConF -> Cntr ->

Parameters	Value	Description
Controller type CtyP	**1**	**2-state controller**
	2	3-state controller
	3	Continuous controller
Action CACt	0	Direct: (The output level of the controller is > 0 when the actual value exceeds the setpoint, e.g. cooling).
	1	Inverse: (The output level of the controller is > 0 when the actual value is smaller than the setpoint, e.g. heating.)
Output value, manual mode HAnd	-100 ... 0 ... **+101**	Output level after switching to manual mode 101 = last output value
Output level at Out-of-Range rOut	-100 ... **0** ... +100	Output level in the event of overrange or underrange
Setpoint limit start SPL	**-1999** ... +9999	The setpoint limitation prevents the entry of values exceeding the default range. The setpoint limits are not effective when entering setpoints via the interface. The correction value is limited for external setpoints with offset.
Setpoint limit end SPH	-1999 ... **+9999**	
(Setup program: Manual mode and self-optimization can be inhibited.)		

3.2.3 Ramp function/firing curve (rAFC)

The device can be operated as a fixed value controller with and without ramp function. In addition, a firing curve is supported.

ConF -> rAFC ->

Parameters	Value	Description
Function FnCt	**0**	**Ramp function/firing curve switched off**
	1	Ramp function Kelvin/Minute
	2	Ramp function Kelvin/Hour
	3	Ramp function Kelvin/Day
	4	Firing curve Kelvin/Minute
	5	Firing curve Kelvin/Hour
	6	Firing curve Kelvin/Day
Ramp rate rASL	**0** ... 999	Value of the ramp rate (only for function = 1 to 6)
(Setup program: For the firing curve, timer value, time unit and setpoint can also be set here.)		

3.2.4 Limit value monitoring (Li1, Li2)

The device is equipped with two functions for limit value monitoring (Li 1, Li 2) each with eight different alarm functions (AF1 to AF8). The two output signals are available for binary functions.

ConF -> Li 1, Li 2 ->

Parameters	Value	Description
Alarm function FnCt	**0**	**Limit value monitoring switched off**
	1	AF1: Limit value above and below the setpoint (monitoring range); symmetric or asymmetric
	2	AF2: As AF1, output signal inverted
	3	AF3: Limit value below the setpoint
	4	AF4: As AF3, output signal inverted
	5	AF5: Limit value above the setpoint
	6	AF6: As AF5, output signal inverted
	7	AF7: Fixed limit value (setpoint independent)
	8	AF8: As AF7, output signal inverted
Limit value AL, AL2	-1999 ... **0** ... +9999	Limit value to be monitored For asymmetrical limit value: AL is below the setpoint, AL2 is above the setpoint. Limit value range for AF1 and AF2: 0 to 9999
Switching differential HYSt	0 ... **1** ... 9999	Switching differential in respect to the limit value

Parameters	Value	Description
Response at Out-of-Range / symmetry of limit value ACrA	**0**	**Off / symmetric (only AL is active)**
	1	On / symmetric (only AL is active)
	2	Off / asymmetric (AL and AL2 are active)
	3	On / asymmetric (AL and AL2 are active)
		Switching state in the event of overrange or underrange ("Out-of-Range“) / symmetry of alarm functions AF1, AF2
Switch-on delay tOn	**0** ... 9999	Switch-on delay of the output signal (in seconds)
Actual value AFPr	**2**	Signal to be monitored; **2 = actual value** ⇨ "Analog selector", page 15
Setpoint value AFSP	**3**	Setpoint for limit value monitoring (reference signal for AF1 to AF6); **3 = current setpoint** ⇨ "Analog selector", page 15

3.2.5 Timer (tFCt)

The timer provides an output signal available for the binary functions. This signal can be used, e.g. to realize a time-limited control or a time-dependent setpoint changeover.

The timer value is not saved during a mains failure. After the mains connection is restored, the timer remains inactive.

ConF -> tFCt ->

Parameters	Value	Description
Function FnCt	**0**	**Timer switched off**
	1	Timer signal is "high“ while the timer is running
	2	Timer signal is "low“ while the timer is running
Start condition Strt	**0**	Manual start via function key or binary signal (no restart after mains failure)
	1	Automatic start after mains ON (restart after mains failure); manual start is also possible
Time unit Unit	**0**	**mm:ss**
	1	hh:mm
	2	hhh.h
Timer value t1	**00.00.** ... 999.9.	Timer run time (in the time unit set)
Tolerance band toLt	**0** ... 9999	Tolerance band for timer start The timer only starts once the actual value has reached the tolerance band. 0 = Start without tolerance band

3.2.6 Outputs (OutL, OutA)

The configuration of the device outputs is subdivided in binary outputs (OutL) and analog output (OutA). The switching states of binary outputs 1 to 3 (5) are displayed by LEDs K1 to K3 (K5) (LED is lit = output active).

Binary outputs

The device is equipped with a relay output (N/O, output 1) as standard and can be optionally equipped with two (four) additional binary outputs (relay or logic output; outputs 2 to 5).

ConF -> OutL ->

Parameters	Value	Description
Output 1 ... 5 Out 1 Out2 Out3 Out4 Out5	**0**	**Output not active** (factory setting for Out2 ... Out5)
	1	**Controller output 1** (factory setting for Out1)
	2	Controller output 2
	3	Binary input
	4	Limit value monitoring 1
	5	Limit value monitoring 2
	6	Timer signal
(Setup program: The output signal can be inverted.)		

Analog output

The device can be optionally equipped with an analog output (output 2).

ConF -> OutA ->

Parameters	Value	Description
Function FnCt	**9**	Function of the output; **9 = Controller output 1** ⇨ "Analog selector", page 15
Type of signal Sign		Physical output signal
	0	**0 ... 20 mA**
	1	4 ... 20 mA
	2	0 ... 10 V
Value at Out-of-Range rOut	**0** ... 101	Signal (in percent) at overrange or underrange 101 = last output signal
Zero point OPnt	-1999 ... **0** ... +9999	Value range of the output variable for the physical output signal
End value End	-1999 **...** **100** ... +9999	

3.2.7 Binary functions (binF)

The binary signals of the binary output, the limit value monitoring and the timer can be used to trigger different functions.

The binary functions for start and abort react to the rising flank of the triggering signal, all other binary functions are state-dependent controlled and active with "High".

ConF -> bi nF ->

Parameters	Value	Description
Binary input bin1	**0**	**Signal without function**
	1	Start self-optimization
	2	Abort self-optimization
Limit value monitoring 1 and 2 Li 1, Li 2	3	Change to manual mode
	4	Switch off controller (controller outputs inactive)
	5	Switch on controller
	6	Inhibit manual mode
Timer signal tF1	7	Stop ramp/firing curve
	8	Abort ramp/firing curve
	9	Restart ramp, start/abort firing curve
	10	Switch over from setpoint 1 to setpoint 2
	11	Lock keypad
	12	Inhibit parameter and configuration level, inhibit self-optimization start
	13	Switch off the display
	14	Start timer
	15	Abort timer
	16	Stop timer
	17	Start/abort timer

3.2.8 Display and operation (diSP)

Both displays and the function key can be individually adapted to the respective requirements.

ConF -> di SP ->

Parameters	Value	Description
Upper display diSU	2	Display value for the upper display; **2 = Actual value** ⇨ "Analog selector", page 15
Lower display diSL	3	Display value for the lower display; **3 = current set point value** ⇨ "Analog selector", page 15

Parameters	Value	Description
Display change when timer is started di St		Time appears in the bottom display once the timer is started
	0	No display change
	1	**Residual timer time**
	2	Timer run time
Time-out tout	0 ... **180** ... 255	Time period in seconds, after which the device automatically returns to its normal display (if no key is pressed). 0 = Function switched off
Decimal place dECP	**0**	**No decimal place**
	1	One decimal place
	2	Two decimal places
Function key, press briefly (< 2 s) tAS	0	No function
	1	Start timer/firing curve
	2	Abort timer/firing curve
	3	Stop/continue timer/firing curve run
	4	**Start/abort timer/firing curve**
	5	Timer display (timer run time or residual timer time)
(Setup program: The function of pressing the function key longer (> 2 s) can also be configured.)		

3.2.9 Interface (IntF)

An optional RS485 interface can be used to integrate the device in a data network. When the communication takes place via the setup interface, the RS485 interface is inactive.

ConF -> IntF ->

Parameters	Value	Description
Baud rate bdrt	**0**	**9600 baud**
	1	19200 baud
Device address Adr	0 ... **1** ... 254	Address in data network

For further information about the RS485 interface, the Modbus protocol and the communication with other devices, please refer to the interface description B 702030.2.0 available as a PDF document under www.jumo.net.

3 Operation - Configuration - Parameterization

3.3 Parameterization (PArA)

Enter the controller parameters here.

PArA ->

Parameters	Value	Description
Proportional band Pb 1, Pb2 [1]	**0** ... 9999	Range of the proportional band The larger the proportional band the lower the controller amplification. The controller structure is not effective with Pb = 0 (behavior identical to limit value monitoring). For the continuous controller, ensure that Pb is > 0.
Derivative time dt	0 ... **80** ... 9999 (s)	Influences the differential portion of the controller output signal The larger the derivative time the higher the effectiveness of the D portion. 0 = derivative time switched off (no D portion)
Reset time rt	0 ... **350** ... 9999 (s)	Influences the integral portion of the controller output signal The larger the reset time the lower the effectiveness of the I portion. 0 = reset time switched off (no I portion)
Cycle time Cy 1, Cy2 [1]	0.0 ... **20.0** ... 999.9 (s)	When using a switched output, the cycle time should be chosen so that the energy flow to the process is as continuous as is practicable without overloading the switching elements.
Contact spacing db	**0.0** ... 999.9	Spacing between the two control contacts of a 3-state controller
Hysteresis HyS 1, HyS2 [1]	0.0 ... **1.0** ... 999.9	Hysteresis for a switching controller with proportional range Pb = 0 (behavior identical to that for limit value monitoring)
Working point y0	-100 ... **0** ... +100	The output level for P and PD controllers (if x = w then y = y0)
Output level limiting y 1, y2	0 ... **100** (%)	y1: Maximum output level limitation
	-100 ... +100 (%)	y2: Minimum output level limitation (only effective when Pb > 0)

[1] Only available for 3-state controllers (controller output 2)

The display of parameters depends on the controller type. For some parameters, the decimal place depends on the device setting.

Factory settings appear in **bold**.

4.1 Additional information about installation

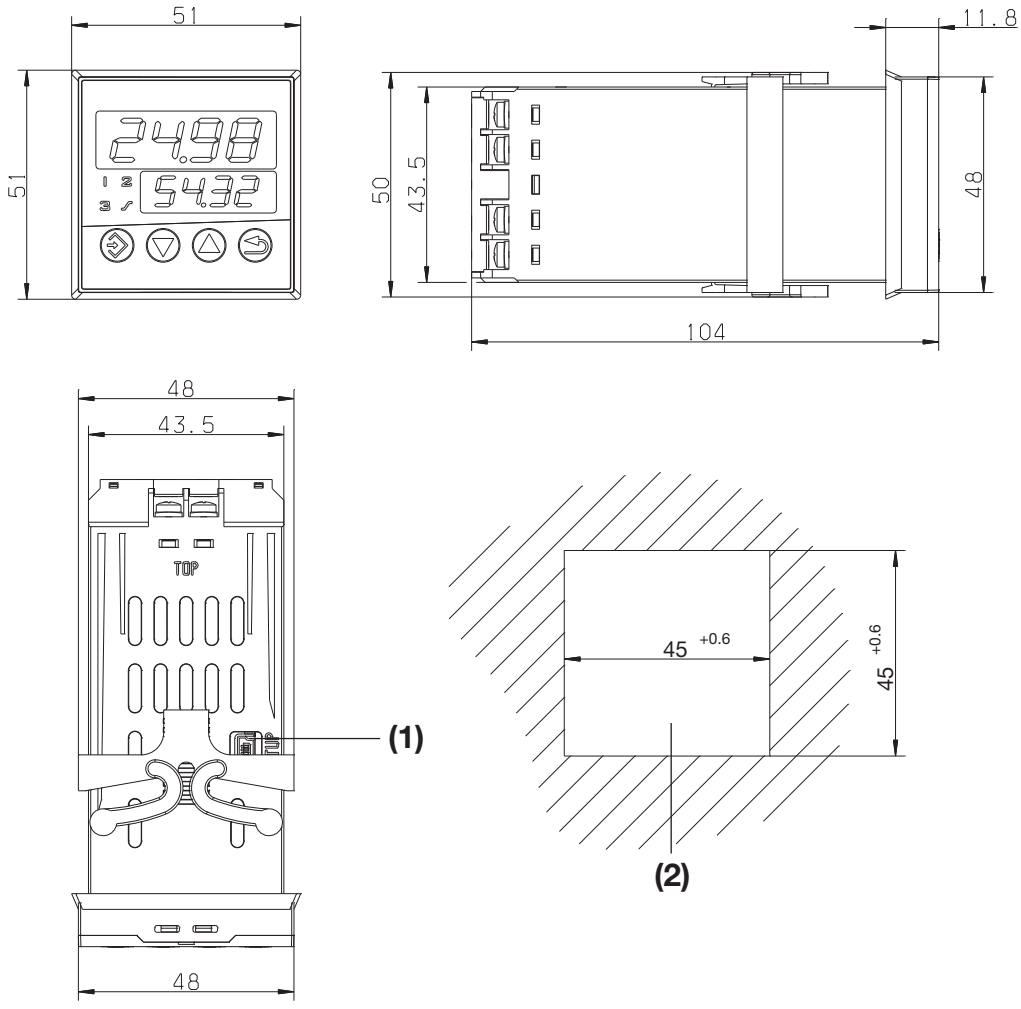
TIP!
The information given in this chapter is exclusively contained in this operating manual provided as PDF document. It supplements the information contained in the previous chapters of this operating manual as well as in the brief instructions added to every device as a print out.

The ambient conditions at the installation site must meet the requirements specified in the technical data.

The device is not suitable for installation in explosive areas (Ex areas).

4.1.1 Device representation including dimensions

LC100

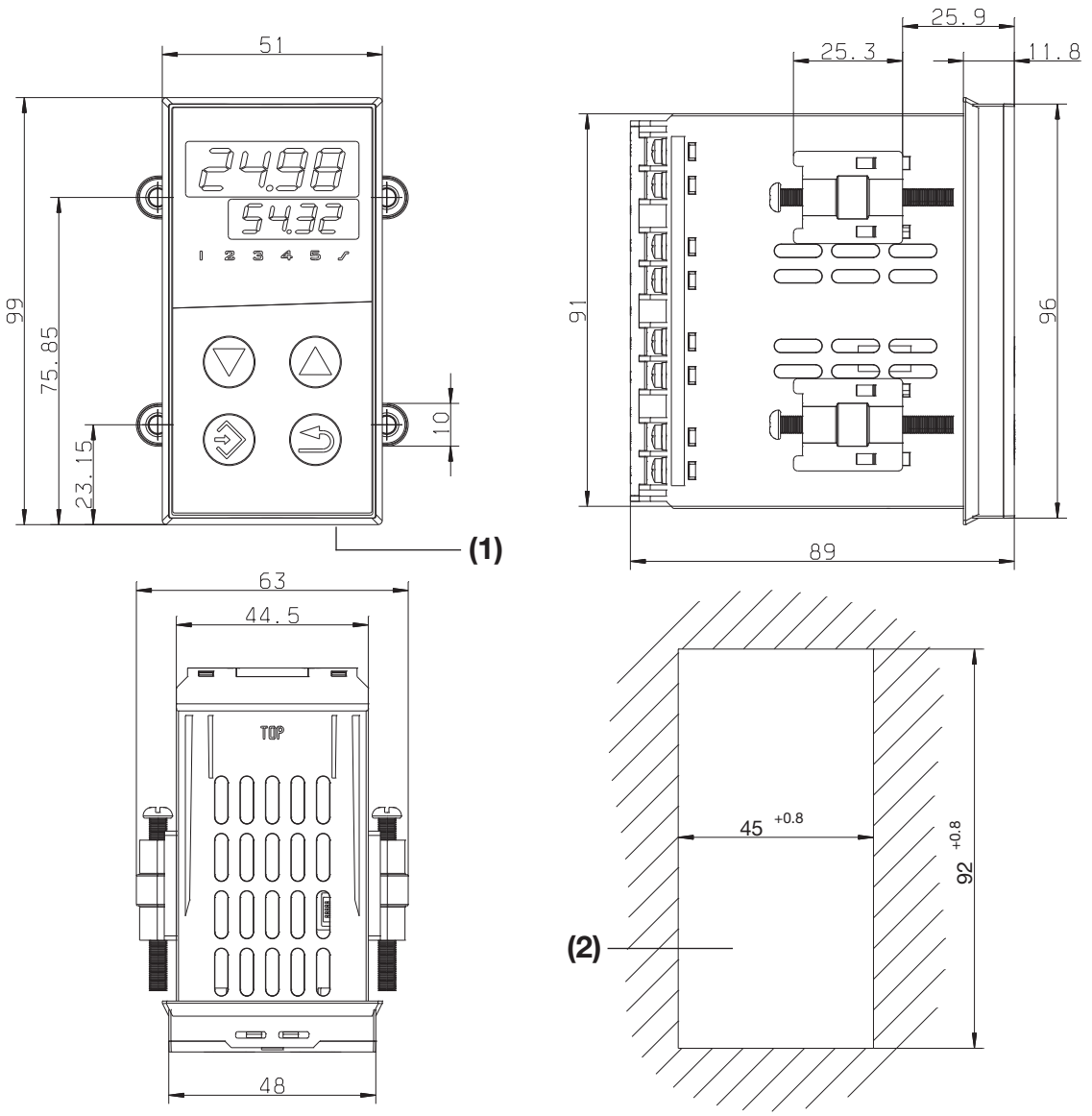


(1) Setup interface (USB) on the device top

(2) Panel cut-out

4 Supplement

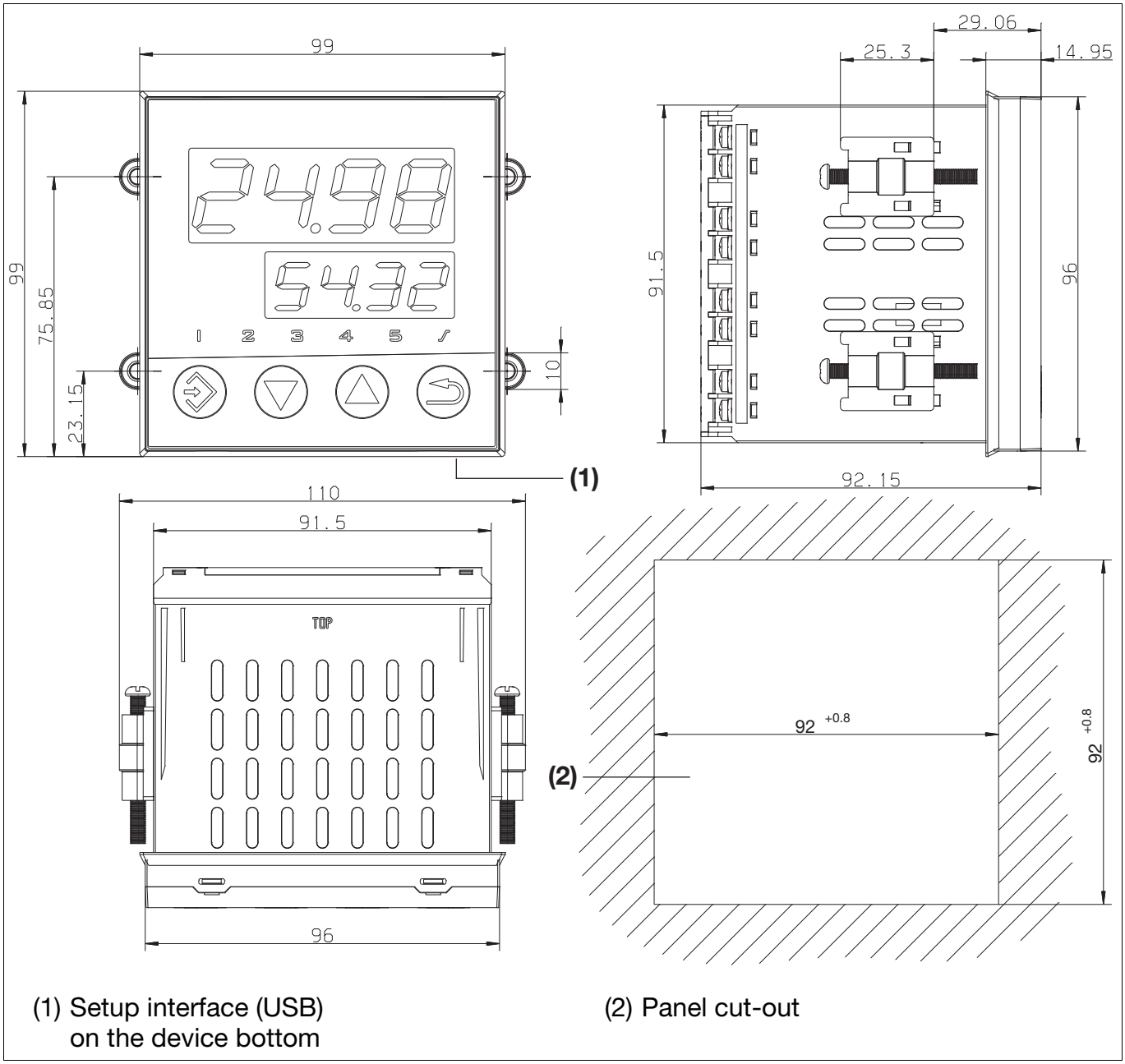
LC200



(1) Setup interface (USB) on the device bottom

(2) Panel cut-out

LC300



(1) Setup interface (USB) on the device bottom

(2) Panel cut-out

Minimum spacing of panel cut-outs

Type	without USB cable		with USB cable	
	horizontal	vertical	horizontal	vertical
LC100	11 mm	30 mm	11 mm	65 mm
LC200	22 mm	30 mm	22 mm	65 mm
LC300	22 mm	30 mm	22 mm	65 mm

4.1.2 Cleaning the device front

The device front panel can be cleaned with commercial cleaning and rinsing agents. It has a limited resistance to organic solvents (such as ethyl alcohol, turpentine substitute, P1, xylol and similar). Do not use high-pressure cleaning equipment.

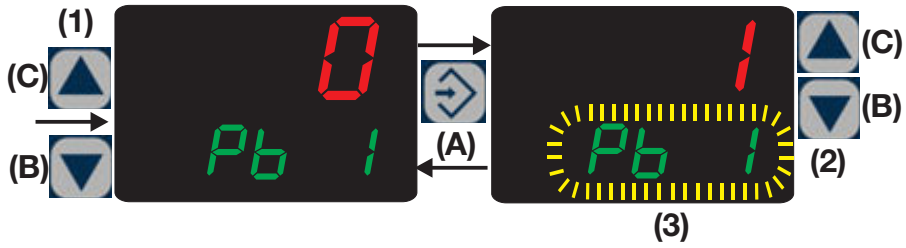
4.2 Additional information about the device functions

TIP!
The information given in this chapter is exclusively contained in this operating manual provided as a PDF document. It supplements the information contained in the previous chapters of this operating manual as well as in the brief instructions added to every device as a print out.

4.2.1 Entries and operator prompting

Value entry

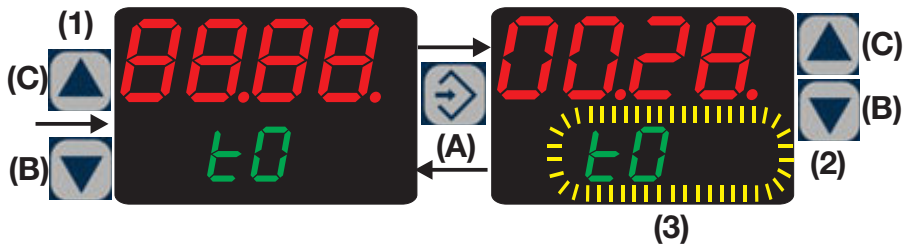
When entries are made within the levels, the parameter symbol appears in the lower display.



(1) Select parameter (lower display - green)
(2) Change value (upper display - red)
(3) Parameter flashes

Time entry

A decimal place is mapped in the centre and on the right to display times. The time unit can be configured.



(1) Select parameter (lower display - green)
(2) Change value (upper display - red)
(3) Parameter flashes

Procedure

1.	Select parameter with key (B) or (C)
2.	Change-over to the input mode with key (A): The lower display flashes.
3.	Change value with key (B) or (C) The longer the key is kept pressed, the faster the value changes.
4.	Apply setting with key (A) (value is automatically applied after 2 s) - or cancel entry using key (D) (value will not be applied)

TIP!
When pressing function key (D) for more than 2 seconds, the device will return to the normal display

4.2.2 Analog input

Measured value offset

A measured value correction (offset) can be carried out to correct system specific deviations. The offset value is added to the measured value with the correct prefix (the measured value is reduced by entering a negative offset value).



CAUTION!
Measured value offset: The controller uses the corrected value for calculation (= displayed value). When the measured value has been offset, the corrected value does no longer correspond to the value measured at the measuring point.
Incorrect use can cause inadmissible values of the control variable.
Only carry out a measured value offset within the admissible range.

Filter time constant

The filter time constant serves to adapt the digital input filter (filter of second priority). At a step change of the input signal, approx. 26 % of the change is detected after the elapse of a time period corresponding to the filter time constant dF (2 x dF: approx. 59 %; 5 x dF: approx. 96 %).

A high filter time constant means:
- High damping of interference signals
- Slow reaction of the actual value display to actual value changes
- Low limit frequency

4.2.3 Analog output

Zero point and end value

The factory setting corresponds to an output level of 0...100 % for the continuous controller (controller output 1): zero point = 0, end value = 100

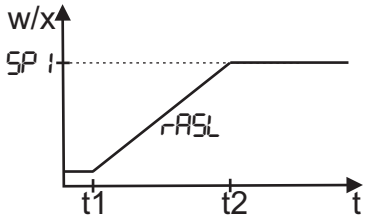
If the analog output is used as controller output 2 for the 3-state controller (e.g. for cooling), the following setting is required: zero point = 0, end value = -100

If, for example, the actual value is to be put out, which can be within the range of 150 °C to 500 °C, select the limits so that they correspond to the minimum and maximum temperature: zero point = 150, end value = 500

4.2.4 Ramp function and firing curve

Ramp function

This function allows the continuous change of the setpoint up to the ramp end value (setpoint setting SP 1 or SP2). Depending on the actual value at ramp start, this results in a rising or falling ramp with identical gradient (adjustable ramp ratio rASL).



LED "Ramp“ (H): Is lit with active ramp function (until it is cancelled)

The ramp starts after mains ON (or through the binary function) at time t1 and starts at the actual value. The setpoint SP 1 (or SP2) is moved to at ramp ratio rASL and is reached at time t2.

When switching over or changing the setpoint, the new setpoint is also moved to at ramp ratio rASL.

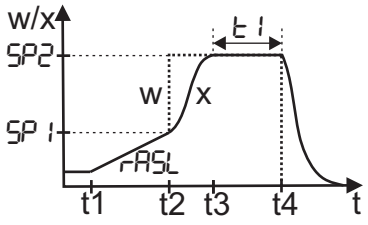
The ramp can be stopped or aborted using the binary function. When aborted, the setpoint setting SP 1 (or SP2) is used to control.

TIP!
The ramp function is interrupted in the event of a probe break, probe short-circuit, overrange/underrange or changeover to manual mode. Once the event is remedied (or after switching to automatic mode), the ramp function continues at the current actual value.
After the power supply is restored, the ramp function starts at the current actual value.

Firing curve

For use in small kilns, a firing curve can be saved for controlled start-up and time-dependent firing.

With this function, the parameters setpoint 1 (SP 1), setpoint 2 (SP2), ramp rate (rASL) and timer value (t 1) are automatically linked to each other.



LED "Ramp“ (H):

Flashes in phase 1,
is lit in phase 2 and 3

Phase 1 (t1 to t2): The firing curve is started by using the function key or with the binary function (time t1) and starts at the actual value. The setpoint SP 1 is moved to at ramp ratio rASL.

Phase 2 (t2 to t3): Once the current ramp value has reached the setpoint SP 1 (t2), the device automatically switches over to setpoint SP2 (w). The actual value (x) approaches the new setpoint (the ramp ratio is of no importance).

Phase 3 (t3 to t4): The timer starts when the actual value has reached the setpoint SP2 (t3) and keeps running for the set time (timer value t 1). Once the timer has elapsed (t4), the controller switches off (setpoint display = 0).

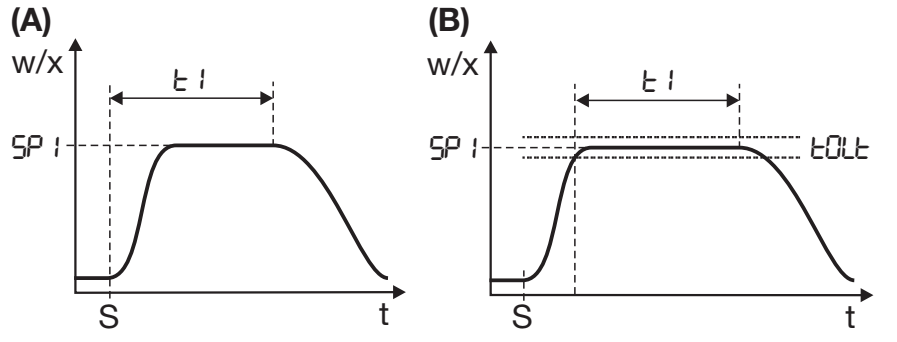
TIP!
The firing curve can only be started when the actual value is smaller than setpoint 1.
The firing curve is aborted in the event of a probe break, probe short-circuit, over-range/underrange or change-over to manual mode (controller switched off).
After the power supply is restored, the firing curve is not active (controller switched off).
When the firing curve is not active, OFF appears in the lower display.

4.2.5 Timers

The following functions can be realized when using the binary functions.

Time-limited control

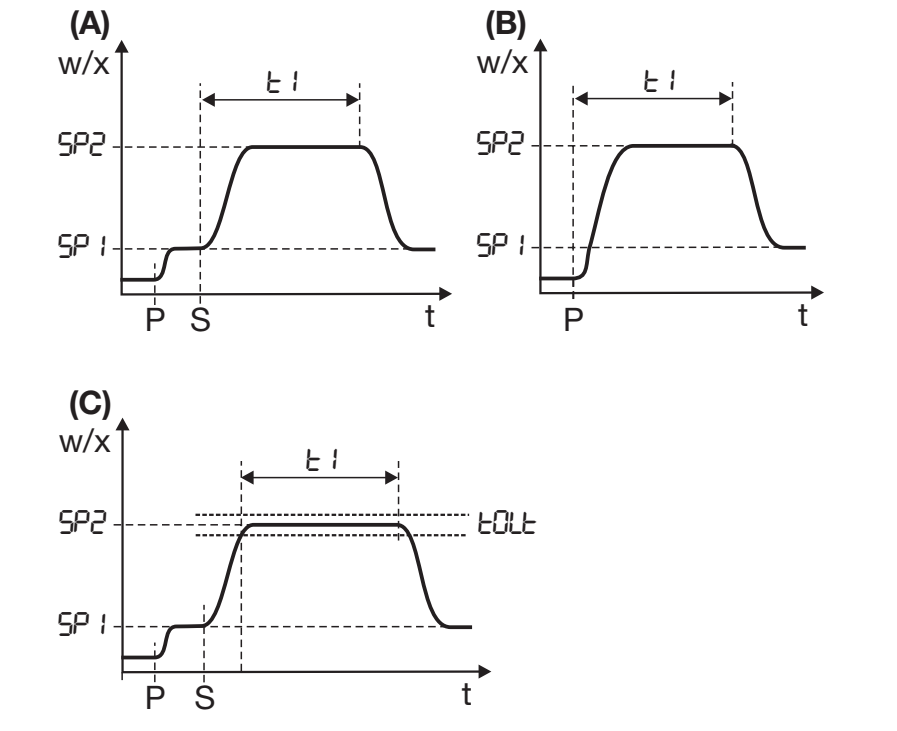
The control is switched off once the timer has elapsed (output level 0 %).



(A)	Without tolerance band
(B)	With tolerance band
SP 1	Setpoint 1
tOLt	Tolerance band
t 1	Timer value
S	Start (manual)

Time-dependent setpoint changeover

After the timer is started, the controller is automatically set to setpoint SP2. Once the timer has elapsed, the controller automatically switches to SP1.



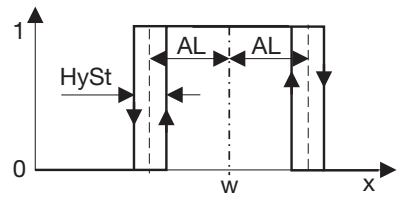
(A)	Manual start
(B)	Automatic start after power ON
(C)	Manual start with tolerance band
SP 1	Setpoint 1
SP2	Setpoint 2
tOLt	Tolerance band
t 1	Timer value
P	Power ON
S	Start (manual)

4.2.6 Limit value monitoring

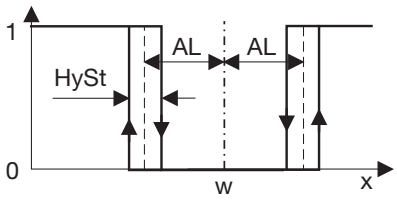
The following representations show the function of limit value (AL, AL2) for the various alarm functions AF1 to AF8. The hysteresis (HySt) is always symmetrical in relation to the limit value.

Limit value referring to setpoint w

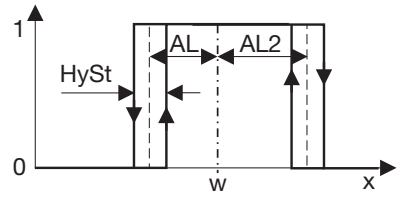
AF1 symmetric



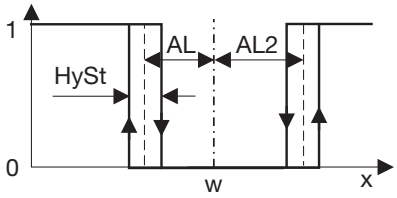
AF2 symmetric



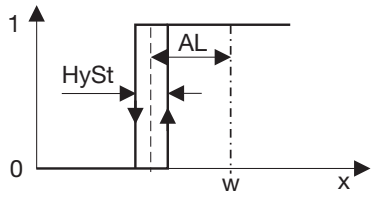
AF1 asymmetric



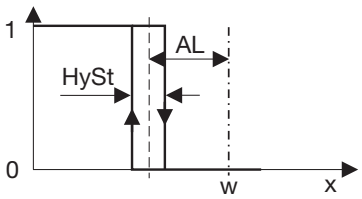
AF2 asymmetric



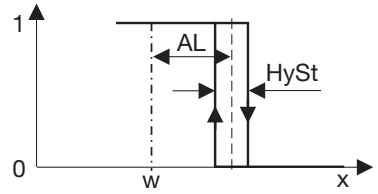
AF3



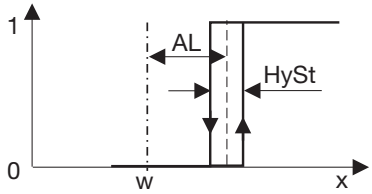
AF4



AF5

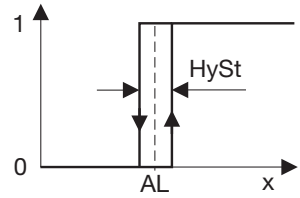


AF6

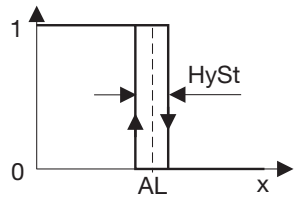


Fixed limit value

AF7



AF8

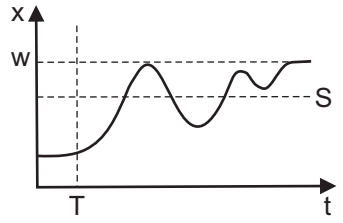
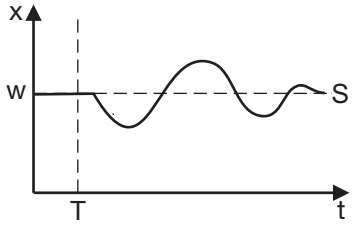


4.2.7 Self-optimization (TUNE)

Self-optimization operates according to the oscillation method and determines the optimum parameters for a PID or PI controller.

The following parameters are optimized depending on the controller type configured (2-state, 3-state, continuous controller) and the controller structure (parameterization):
Proportional band (Pb1, Pb2), derivative time (dt), reset time (rt), cycle time (Cy1, Cy2), filter time constant (dF; parameter of the analog input).

Depending on the value of the control deviation, the controller selects between two self-optimization methods:

Self-optimization in the start-up-phase	Self-optimization at the setpoint	
		w Setpoint S Switching curve T Start time of self-optimization

Prerequisites

The following prerequisites must be fulfilled to be able to start self-optimization:

- Self-optimization start is not inhibited by the binary function (binF)
- Controller is in the automatic mode, not in the manual mode
- No parameter level inhibit active via setup program
- Ensure that keys (B) and (C) are not pressed one after the other. They must always be pressed simultaneously.

Furthermore, the following points should be taken into consideration, checked and, if necessary, adjusted, prior to starting self-optimization:

- Is the suitable controller type configured?
- Check and/or adjust the control action of the controller
- Is it possible to sufficiently influence the actual value in the manual mode?
- Only for continuous controller: The function of the output (OutP -> OutA) must be configured as controller output 1 and scaled to 0 ... 100 %. This means:
  Function (FnCt) = Controller output 1 (9)
  Zero point (0Pnt) = 0
  End value (End) = 100

Depending on the controller type and parameter setting, the controller structures and specific parameters are optimized:

Controller type	**Parameter setting**	**Optimized controller structure**	**Optimized parameters**
2-state controller	rt > 0; dt = 0; Pb1 = any	PI	Pb1, rt, Cy1, dF
	all other settings	PID	Pb1, dt, rt, Cy1, dF
3-state controller	rt > 0; dt = 0; Pb1 = Pb2 = any	PI	Pb1, Pb2, rt, Cy1, Cy2, dF
	all other settings	PID	Pb1, Pb2, dt, rt, Cy1, Cy2, dF
Continuous controller	rt > 0; dt = 0; Pb1 = any	PI	Pb1, rt, dF
	all other settings	PID	Pb1, dt, rt, dF

4 Supplement

Start of self-optimization



Simultaneously press keys (B) and (C) (> 2 s):

"tUnE“ flashes in the lower display.

Self-optimization is completed when the display automatically changes to the normal display. The duration of self-optimization depends on the control process.

Abort of self-optimization

Simultaneously press keys (B) and (C)

No parameters are changed by the abort.

4.3 Error messages

Display	Cause	Fault remedy
- 1999 (flashing!)	Underrange of the displayed value.	Is the medium being measured within the range (too hot? too cold?) Check probe for break and short-circuit. Check the probe connection and the terminals. Check cable. Check that the connected probe complies with the configured probe type
9999 (flashing!)	Overrange of the displayed value.	
PErr	Firing curve start is impossible because the actual value is ≥ than the setpoint 1	The firing curve can be started when the actual value is < than the setpoint 1

Overrange / underrange covers the following events:

- Probe break/short-circuit
- Measured value outside the probe measuring range
- Display overflow

No keyboard operations are possible during device initialization (all displays are switched on, the upper 7-segment display flashes).

4.4 Technical Data

Thermocouple input

Designation	Standard	Measuring range[a]	Measuring accuracy[b]	Ambient temperature influence
Fe-CuNi „L“		-150 to +900 °C	≤ 0.4 %	≤ 100 ppm/K
Fe-CuNi „J“	EN 60584	-200 to +1200 °C	≤ 0.4 %	≤ 100 ppm/K
Cu-CuNi „T“	EN 60584	-200 to +400 °C	≤ 0.4 %	≤ 100 ppm/K
NiCr-Ni „K“	EN 60584	-200 to +1372 °C	≤ 0.4 %	≤ 100 ppm/K
NiCr-CuNi „E“	EN 60584	-200 to +1000 °C	≤ 0.4 %	≤ 100 ppm/K
NiCrSi-NiSi „N“	EN 60584	-100 to +1300 °C	≤ 0.4 %	≤ 100 ppm/K
Pt10Rh-Pt „S“	EN 60584	-40 to +1768 °C	≤ 0.4 %	≤ 100 ppm/K
Pt13Rh-Pt „R“	EN 60584	-40 to +1768 °C	≤ 0.4 %	≤ 100 ppm/K
Cold junction: KTY internal				

[a] The specifications refer to an ambient temperature of 20°C.

[b] Including measuring accuracy at the internal cold junction.
The accuracy values refer to the measuring range.

RTD temperature probe input

Designation, connection type	Measuring range	Measuring accuracy[a]	Ambient temperature influence
Pt100 DIN EN 60751	-200 to +650 °C		≤ 50 ppm/K
2-wire connection		≤ 0.4 %	
3-wire connection		≤ 0.4 %	
Pt1000 DIN EN 60751	-200 to +650 °C		≤ 50 ppm/K
2-wire connection		≤ 0.4 %	
3-wire connection		≤ 0.4 %	
KTY, R_{25} = 1000 Ω	-50 to +150 °C		≤ 50 ppm/K
2-wire connection		≤ 1.0 %	
KTY, R_{25} = 2000 Ω	-50 to +80 °C		≤ 50 ppm/K
2-wire connection		≤ 1.0 %	
Cu-50	-50 to +200 °C		≤ 50 ppm/K
3-wire connection		≤ 1.0 %	
Probe wire resistance: max. 30Ω per wire with 3-wire circuit			
Measured current: Pt100 approx. 1 mA; Pt1000 and KTY approx. 100 µA			
Lead compensation: Not required for 3-wire circuit. For a 2-wire circuit, the lead resistance can be compensated by correcting the actual value.			

[a] The accuracy values refer to the measuring range.

Input for standard signals

Measuring range	Measuring accuracy[a]	Ambient temperature influence
Voltage 0 to 10 V Input resistance > 650 kΩ	≤ 0.4 %	≤ 150 ppm/K
Current 0(4) to 20 mA voltage drop > 2.2 V	≤ 0.4 %	≤ 100 ppm/K

[a] The accuracy values refer to the maximum measuring range.

Binary input

Input for potential-free contact	open = inactive; closed = active

Measuring circuit monitoring

In the event of a fault, the outputs adopt a defined (configurable) status.

Measuring probe	Overrange / underrange	Probe / cable short circuit	Probe / cable break
Thermocouple	•	-	•
RTD temperature probe	•	•	•
Voltage 0 to 10V	-	-	-
Current 4 to 20 mA	•	•	•
Current 0 to 20 mA	-	-	-

• = detected - = not detected

Outputs

Relay (N/O) Contact rating Contact life	 max. 3 A at 230 V AC resistive load 150,000 operations at nominal load 350,000 operations at 1A 310,000 operations at 1A and cos φ > 0.7
Logic output	0/14V / 20mA max.
Voltage (option) Output signal Load resistance Accuracy	 0 to 10V > 600 Ω < 0.5 %
Current (option) Output signals Load resistance Accuracy	 0 to 20 mA / 4 to 20 mA < 450 Ω < 0.5 %

Controller

Controller type	2-state controller, 3-state controller, continuous controller
Controller structures	P/PI/PD/PID
Sampling time	250 ms
A/D converter	16 bit resolution

Timers

Accuracy	0.8 % ± 10 ppm/K ± 250 ms

Electrical data

Voltage supply (switch mode PSU)	AC 110 to 240V +10/-15 %, 48 to 63Hz AC/DC 20 to 30V, 48 to 63Hz
Electrical safety	as per DIN EN 61010, part 1 overvoltage category III, pollution degree 2
Power consumption	max. 14 VA
Electrical connection	on the rear via screw terminals; with core-end ferrule of a pipe shape, ope-n cable lug or pin cable lug
Conductor cross section	fine-strand 0.25 to 1.5 mm^2
Tightening torque	0.5 Nm
Electromagnetic compatibility	as per DIN EN 61326-1
Interference emission	Class A - Only for industrial use -
Interference immunity	Industrial requirements
Setup interface	USB socket, type Mini-B 5-pole

Requirements for core-end ferrules and cable lugs

Core-end ferrule	pipe shape, without plastic sheath as per DIN 46228 part 1, with plastic sheath as per DIN 46228 part 4
Cable lug	open crimp cable lug, dimensionally adapted to DIN 46237 for closed crimp cable lugs
Pin cable lug	as per DIN 46231
With UL applications	use of the cable lugs or ferrules acc. to UL 486A-B (UL listed or recognized)

Case

Case type	plastic case for panel mounting as per IEC 61554 (indoor use)
Dimensions (front)	LC100: 48 mm x 48 mm; LC200: 48 mm x 96 mm (portrait format); LC300: 96 mm x 96 mm
Panel cut-out	LC100: 45 mm x 45 mm; LC200: 45 mm x 92 mm; LC300: 92 mm x 92 mm
Minimum spacing horizontal / vertical	LC100: 11 mm / 30 mm (65 mm with USB cable); LC200/LC300: 22 mm / 30 mm (65 mm with USB cable)
Depth behind panel	LC100: max. 95 mm; LC200/LC300: max. 80 mm
Ambient / storage temperature range	-5 to +55 °C / -40 to +70 °C
Ambient conditions	rel. humidity < 90% annual average, without condensation

Site altitude	up to 2000 m above sea level
Operating position	any
Protection type	as per DIN EN 60529, at the front IP 65, at the rear IP 20
Weight (fully equipped)	LC100: approx. 150 g; LC200: approx. 200 g; LC300: approx. 300 g

Interface

Interface type	RS485
Protocol	Modbus RTU
Baud rate	9600, 19200
Data format	8 data bits, no parity bit, 1 stop bit
Device address	0 to 254
No. of subscribers	max. 32

7-segment displays

Digit height	
LC100, LC200	upper display: 10 mm; lower display: 7 mm
LC300	upper display: 20 mm; lower display: 13 mm
Color	upper display: red; lower display: green
Places	4 (including decimal places)
Decimal places	0, 1, 2 (configurable)
Display range	-1999 to 9999

Approvals/approval marks

Approval marks	Inspection authority	Certificate / Inspection number	Inspection/test basis	Valid for
c UL us	Underwriters Laboratories	E201387	UL 61010-1, CAN/CSA C22.2 No. 61010-1	all versions

4 Supplement

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