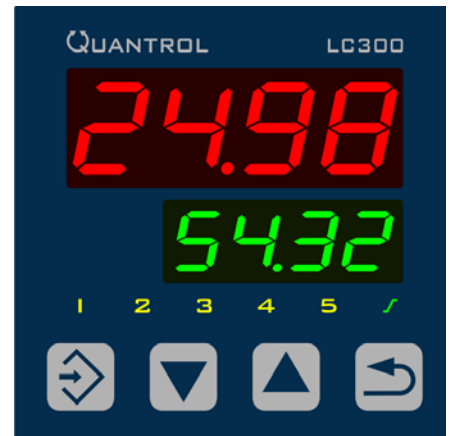


Quantrol LC100 / LC200 / LC300

Universal PID Controller Series



B 702020.7

Brief Instructions

Safety information

These instructions contain 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 these instructions as follows.

Please read these instructions before starting up the device. Keep the instructions in a place accessible to all users at all times.

All necessary settings are described in these instructions. Manipulations not described in these instructions or expressly forbidden will jeopardize your warranty rights.



DANGER!

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



TIP!

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

Information about documentation

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 702020.0 available as PDF document. This manual also contains the complete technical data of the device.

For the optional RS485 interface, the interface description B 702020.2.0 is available as PDF document. It contains information about the RS485 interface, the Modbus protocol and the communication with other devices.



TIP!

The PDF documents are available for download under www.quantrol.org.

Scope of delivery

- Controller (including seal and fastening elements)
- Brief instructions B 702020.7 in DIN A3 format

E-mail: info@quantrol.org
Internet: www.quantrol.org

Technical support:
Phone: +86 411 8718 9010-198
Fax: +86 411 8718 9020
E-mail: info@jumo-china.com

1 Installation - Electrical Connection

1.1 Identifying the device version

	Basic type																																														
702021	QUANTROL LC100 (format 48 mm x 48 mm)																																														
702022	QUANTROL LC200 (format 48 mm x 96 mm, portrait format)																																														
702024	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)																																														
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/ - - **Order code**
 702024 / 8 - 3 4 1 2 - 23 **Example**

1.2 Excerpt from the technical data

Case

Case type	plastic case for panel mounting as per IEC 61554
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

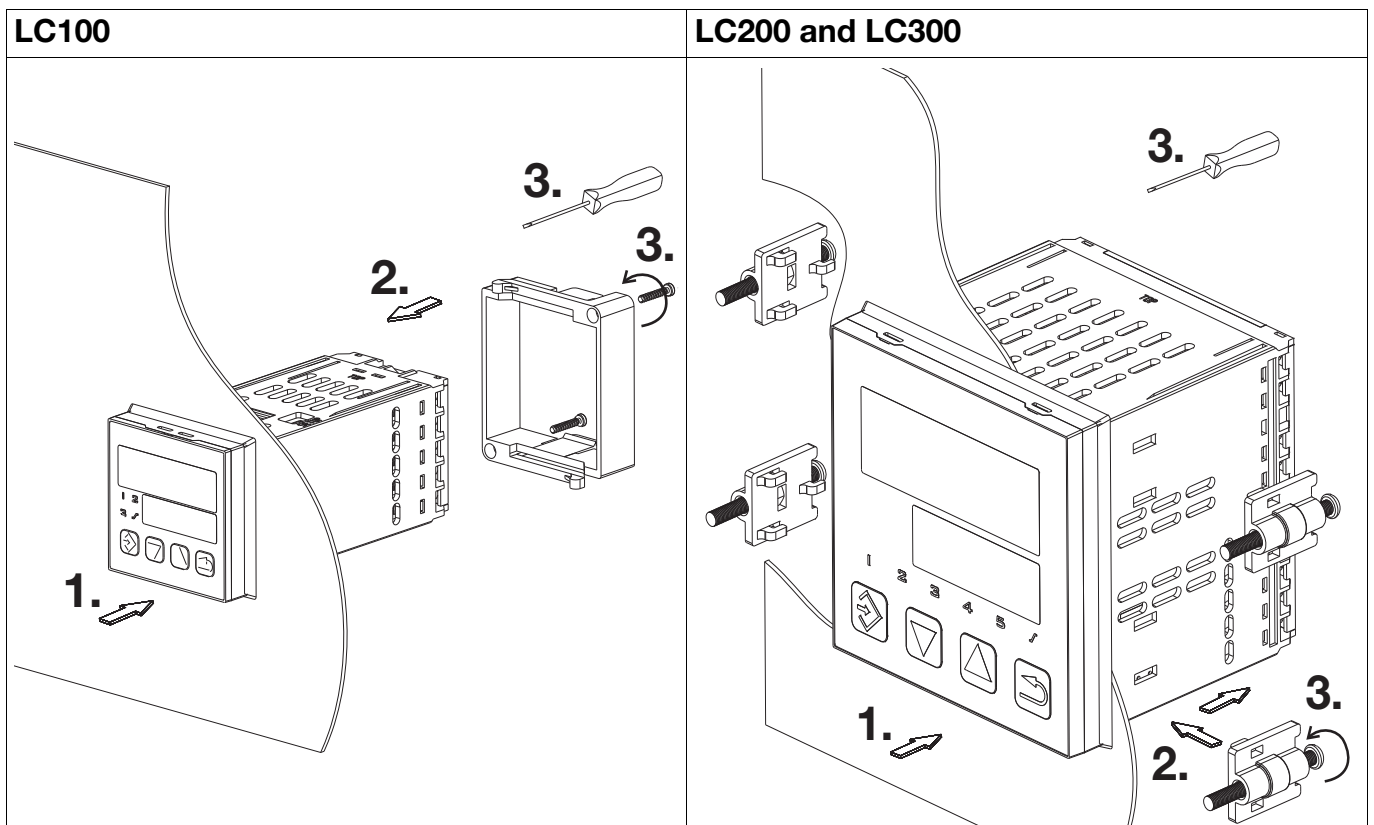
1 Installation - Electrical Connection

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 up to max. 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

1.3 Installation

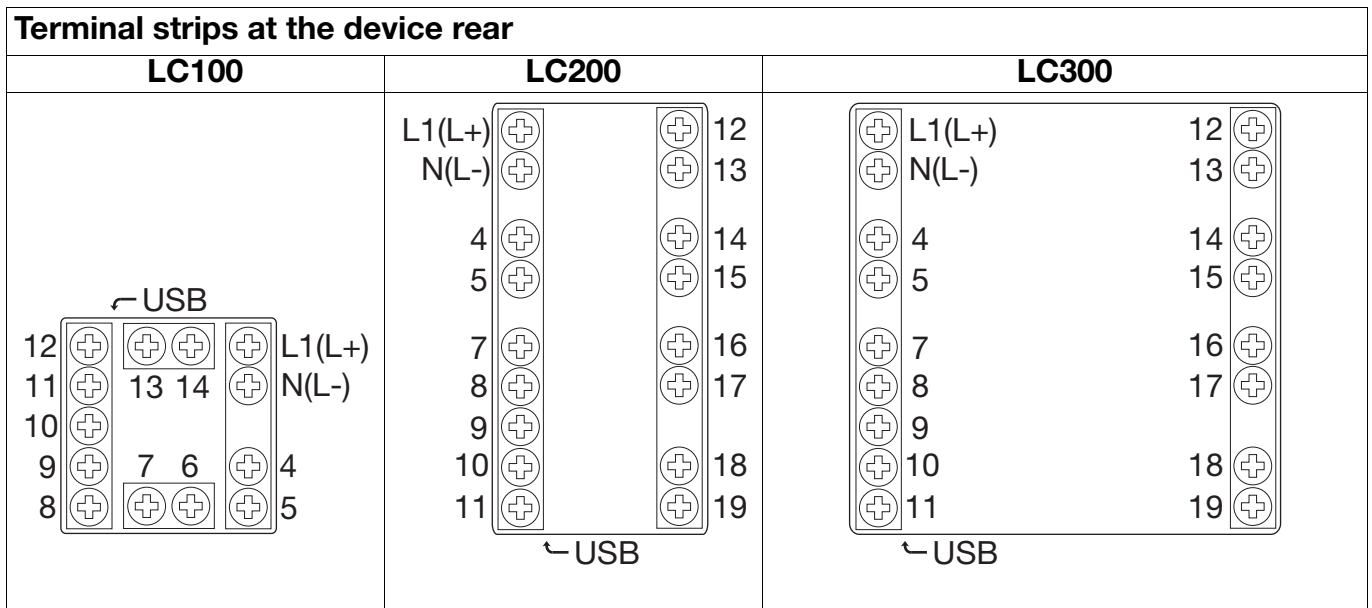
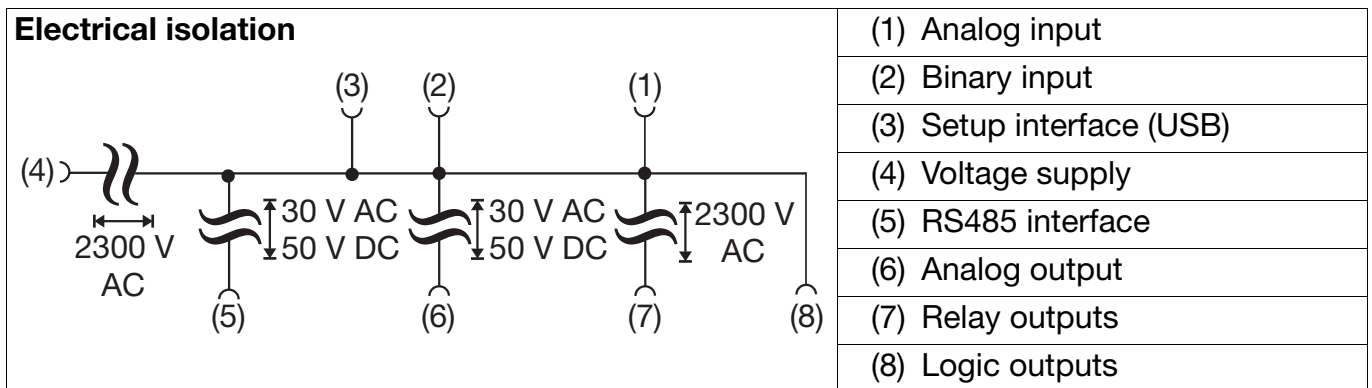


1 Installation - Electrical Connection

1.4 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).
- 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.

1.5 Electrical isolation and connection diagram



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

2 Operation - Configuration - Parameterization

2.1 Operation

2.1.1 Display and operating elements

	(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

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

2.1.2 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 setpoint 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.)

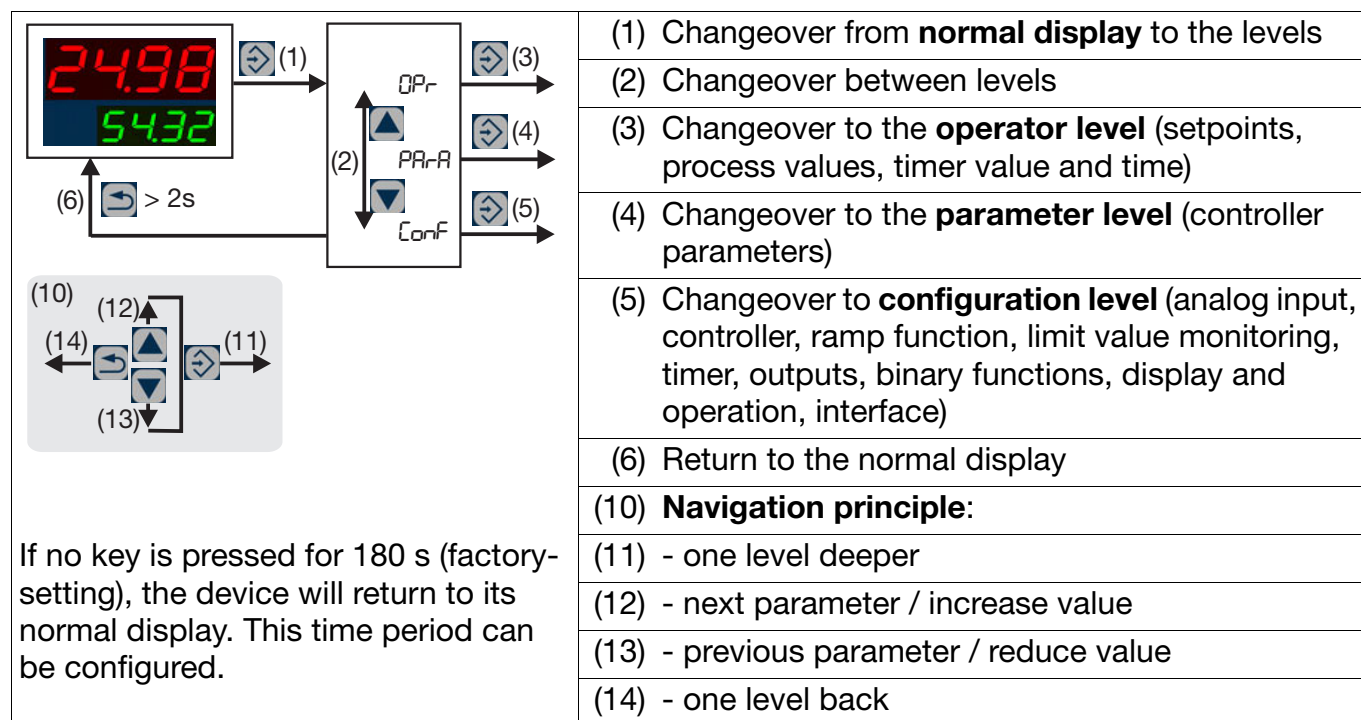
2.1.3 Ramp function/firing curve

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

2 Operation - Configuration - Parameterization

2.1.4 Level concept

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



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. 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 2.1.1)
1	free	free	inhibited	
2	free	inhibited	inhibited	
3	inhibited	inhibited	inhibited	

2.1.5 Operator level (OPR)

Depending on the configuration, the following parameters are available:

Symbol	Description	Symbol	Description
SP1	Setpoint 1 (can be edited)	rASL	Ramp rate (for firing curve; can be edited)
SP2	Setpoint 2 (can be edited)	SPr	Current ramp setpoint (for ramp function or firing curve)
t1	Timer value (if timer or firing curve are inactive; can be edited)	inP1	Measured value at analog input
tL	Timer run time (if timer or firing curve are active)	y	Output level
tR	Residual timer run time (if timer or firing curve are active)		

2 Operation - Configuration - Parameterization

2.2 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	Value	Description
0	Switched off	7	Setpoint 2
1	Analog input	8	Output level display (-100 % to +100 %)
2	Actual value	9	Controller output 1 (e.g. heating, output level 0 to +100 %)
3	Current setpoint	10	Controller output 2 (e.g. cooling, output level 0 to -100 %)
4	Ramp end value	11	Timer run time (time unit of the timer)
5	(reserved)	12	Timer residual time (time unit of the timer)
6	Setpoint 1		

2.2.1 Analog input

CONF -> InP ->

Parameters	Value	Description	Value	Description	
Probe type SEn5		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 $b_i n l$ is inactive.				

2 Operation - Configuration - Parameterization

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.)		

2.2.2 Controller

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 ACT	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.
Setpoint limit end SPH	-1999 ... +9999	The setpoint limits are not effective when entering setpoints via the interface. The correction value is limited for external setpoints with offset.
(Setup program: Manual mode and self-optimization can be inhibited.)		

2 Operation - Configuration - Parameterization

2.2.3 Ramp function/firing curve

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.)

2.2.4 Limit value monitoring

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 -> L 1, L 2 ->

Parameters	Value	Description
Alarm function FnCt	0	Limit value monitoring switched off
	1	AF1: Limit value above and below the setpoint (monitoring range)
	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)
Limit value AL	-1999 ...	Limit value to be monitored
	0 ... +9999	Limit value range for AF1 and AF2: 0 to 9999
Hysteresis HYSL	0 ... 1 ... 9999	Hysteresis in respect to the limit value
Behavior at Out-of-Range ALrA	0	OFF
	1	On
		Switching state in the event of overrange or underrange ("Out-of-Range")

2 Operation - Configuration - Parameterization

Parameters	Value	Description
Switch-on delay t_{On}	0 ... 9999	Switch-on delay of the output signal (in seconds)
Actual value AFP_r	0	Signal to be monitored; 0 = switched off ⇒ "Analog selector", page 9
Setpoint $AFSP$	0	Setpoint for limit value monitoring (reference signal for AF1 to AF6); 0 = switched off ⇒ "Analog selector", page 9

2.2.5 Timers

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 F_nCt	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 $StCt$	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 $Un t$	0	mm:ss
	1	hh:mm
	2	hhh.h
Timer value $t t$	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

2 Operation - Configuration - Parameterization

2.2.6 Outputs

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	0	Output not active (factory setting for Out2 ... Out5)
Out1	1	Controller output 1 (factory setting for Out1)
Out2	2	Controller output 2
Out3	3	Binary input
Out4	4	Limit value monitoring 1
Out5	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 Fnc	9	Function of the output; 9 = Controller output 1 ⇒ "Analog selector", page 9
Type of signal S, En		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	

2 Operation - Configuration - Parameterization

2.2.7 Binary functions

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 -> b, nF ->

Parameters	Value	Description
Binary input b, n i	0	Signal without function
	1	Start self-optimization
	2	Abort self-optimization
Limit value monitoring 1 and 2 L 1, L 2	3	Change to manual mode
	4	Switch off controller (controller outputs inactive)
	5	Switch on controller
	6	Inhibit manual mode
Timer signal tF i	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

2.2.8 Display and operation

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

[conf -> d, SP ->

Parameters	Value	Description
Upper display d, SU	2	Display value for the upper display; 2 = Actual value ⇒ "Analog selector", page 9
Lower display d, SL	3	Display value for the lower display; 3 = current set point value ⇒ "Analog selector", page 9

2 Operation - Configuration - Parameterization

Parameters	Value	Description
Display change when timer is started <i>dSt</i>		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 <i>tout</i>	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 <i>dECP</i>	0	No decimal place
	1	One decimal place
	2	Two decimal places
Function key, press briefly (< 2 s) <i>tAS</i>	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.)		

2.2.9 Interface

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 <i>bdr</i>	0	9600 baud
	1	19200 baud
Device address <i>Adr</i>	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 702020.2.0 available as a PDF document under www.quantrol.org.

2 Operation - Configuration - Parameterization

2.3 Parameterization (PARA)

Enter the controller parameters here.

PARA ->

Parameters	Value	Description
Proportional band $Pb1, Pb2^1$	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 d_t	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 r_t	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 $CY1, CY2^1$	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 $HYS1, HYS2^1$	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 y_0	-100 ... 0 ... +100	The output level for P and PD controllers (if $x = w$ then $y = y_0$)
Output level limiting $y1, y2$	0 ... 100 (%)	y1: Maximum output level limitation
	-100 ... +100 (%)	y2: Minimum output level limitation (only effective when $Pb > 0$)
<p>¹ Only available for 3-state controllers (controller output 2)</p> <p>The display of parameters depends on the controller type. For some parameters, the decimal place depends on the device setting.</p> <p>Factory settings appear in bold.</p>		