

Electronic Temperature Controller

70304 for Front-Panel Mounting, Top-Hat Rail Mounting (Optional)

Instruction Manual
Version 1.03.00



Dear customer,

Thank you for buying our product. In this instruction manual you will find all necessary information about this M&C product. The information in the instruction manual is fast and easy to find, so you can start using your M&C product right after you have read the manual.

If you have any question regarding the product or the application, please don't hesitate to contact M&C or your M&C authorized distributor. You will find all the addresses in the appendix of this manual.

For additional information about our products and our company, please go to M&C's website www.mc-techgroup.com. There you will find the data sheets and manuals of our products in German and English.

This Operating Manual does not claim completeness and may be subject to technical modifications.

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With the release of this version all older manual versions will no longer be valid. The German instruction manual is the original instruction manual. In case of arbitration only the German wording shall be valid and binding.

Version: 1.03.00

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1 General Information

The product described in this manual has been built and tested in our production facility.

All M&C products are packed to be shipped safely. To ensure the safe operation and to maintain the safe condition, all instructions and regulations stated in this manual need to be followed. This manual includes all information regarding proper transportation, storage, installation, operation and maintenance of this product by qualified personnel.

Please follow all instructions and warnings closely.

Please read this manual carefully before commissioning and operating the device. If you have any questions regarding the product or the application, please don't hesitate to contact M&C or your M&C authorized distributor.

2 Declaration of Conformity



CE - Certification

The product described in this operating manual complies with the following EU directives:

EMC-Instruction

The requirements of the EU directive 2014/30/EU "Electromagnetic compatibility" are met.

Low Voltage Directive

The requirement of the EU directive 2014/35/EU "Low Voltage Directive" are met.

The compliance with this EU directive has been examined according to DIN EN 61010.

Declaration of conformity

The EU Declaration of conformity can be downloaded from the **M&C** homepage or directly requested from **M&C**.

3 Safety Instructions

Please take care of the following basic safety procedures when mounting, starting up or operating this equipment:

Read this operating manual before starting up and use of the equipment. The information and warnings given in this operating manual must be heeded.

Any work on electrical equipment is only to be carried out by trained specialists as per the regulations currently in force.

Attention must be paid to the requirements of VDE 0100 (IEC 364) when setting high-power electrical units with nominal voltages of up to 1000 V, together with the associated standards and stipulations.

Check the details on the type plate to ensure that the equipment is connected to the correct mains voltage.

Protection against touching dangerously high electrical voltages:

Before opening the equipment, it must be switched off and hold no voltages. This also applies to any external control circuits that are connected.

The device is only to be used within the permitted range of temperatures and pressures.

Check that the location is weather-protected. It should not be subject to either direct rain or moisture.

The temperature controller 70304 must not be used in hazardous areas.

Installation, maintenance, monitoring and any repairs may only be done by authorized personnel with respect to the relevant stipulations.

4 Warranty

If the equipment fails, please contact **M&C** directly or else go through your **M&C** authorised dealer.

We offer a one year warranty as of the day of delivery as per our normal terms and conditions of sale, and assuming technically correct operation of the unit. Consumables are hereby excluded. The terms of the warranty cover repair at the factory at no cost or the replacement at no cost of the equipment free ex user location. Reshipments must be send in a sufficient and proper protective packaging.

5 Used Terms and Signal Indications



Danger

This means that death, severe physical injuries and/or important material damage will occur in case the respective safety measures are not fulfilled.



Warning

This means that death, severe physical injuries and/or important material damage **may occur** in case the respective safety measures are not fulfilled.



Caution

This means that minor physical injuries **may occur** in case the respective safety measures are not fulfilled.

Caution

Without the warning triangle means that a material damage may occur in case the respective safety measures are not met.



Note

These are important information about the product or parts of the operating manual which require user's attention.

Qualified Personnel

These are persons with necessary qualification who are familiar with installation, use and maintenance of the product.



High voltages!

Protect yourself and others against damage which might be caused by high voltages.

6 Introduction

The compact microprocessor controlled temperature controller type **70304** is mainly used for **M&C** components that have no temperature controller in their standard specification. If the temperature controller is ordered together with an **M&C** component, he already is parameterized and preprogrammed. Additionally to the controllers in dependence on the **M&C** device a relais with sufficient switching capacity is necessary.

The controller has an adjustable sensor input for all common temperature sensors and they can be used as an programmable two or three step or continuous and self-optimization controller with PID structure.

7 Receipt of Goods and Storage

The temperature controller **70304** is a complete pre-installed unit.

- Please take the temperature controller and possible special accessories carefully out of the packaging material immediately after arrival, and compare the goods with the items listed on the delivery note!
- Check the goods for any damage caused during delivery and, if necessary, notify your transport insurance company without delay of any damage discovered!



Note

The equipment should be stored in a protected, frost-free room!

8 Description

The controller type **70304** is intended for front-panel mounting and inside the optional frame for top-hat rail mounting.



- | | |
|--|--|
| <p>(1) Actual value display
red, 10mm high, 4 digits</p> | <p>(4) PGM-key in order to select parameters
 ☐ in order to change values
 ☐ in order to change values
 Exit-key in order to leave the levels</p> |
| <p>(2) Active Setpoint
Factory setting SP1</p> | <p>(5) Indication
yellow for
 - Switch status of binary outputs 1 – 6
 (display lights up = on)
 - ramp/programm function is active
 - manual operation is active</p> |
| <p>(3) Setpoint
Four digit, green; decimal place is configurable;
Also used for operator prompting (display of parameter and level symbols)</p> | <p>(6) 16-segment display for the unit °C / °F
factory setting °C</p> |

Figure 1 Display/control elements

9 Dimensions and Installation

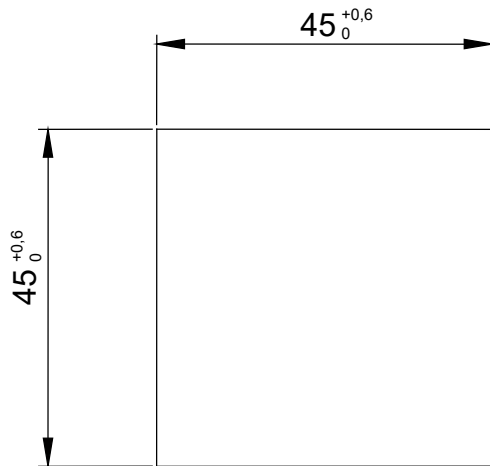


Figure 2 Mounting cutout for controller 70304 for front-panel mounting

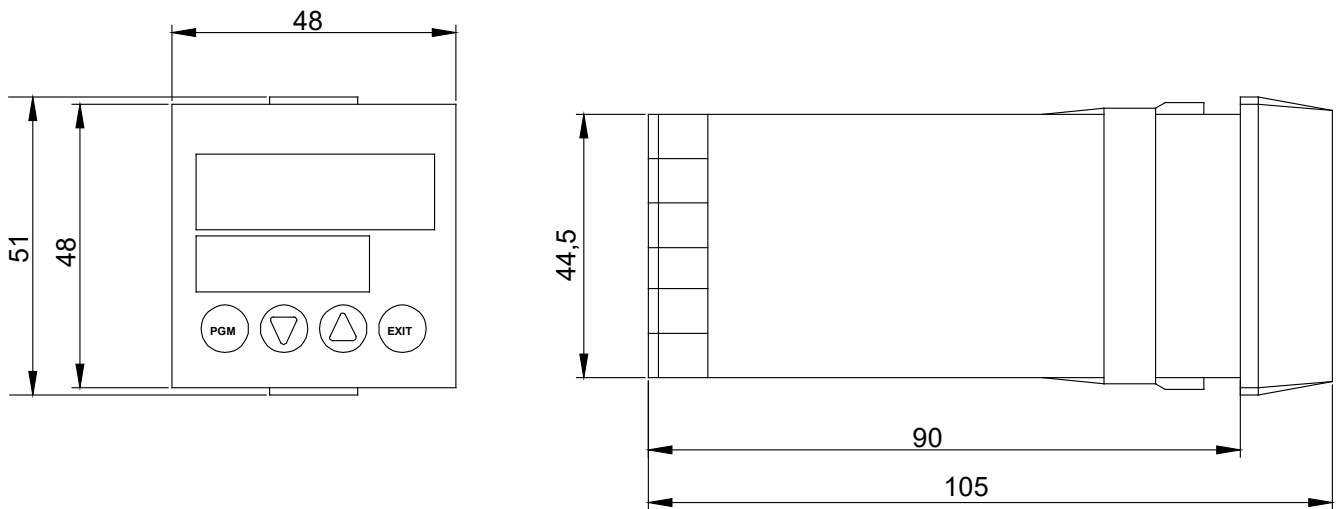


Figure 3 Housing and mounting dimensions for controller 70304 for front-panel mounting

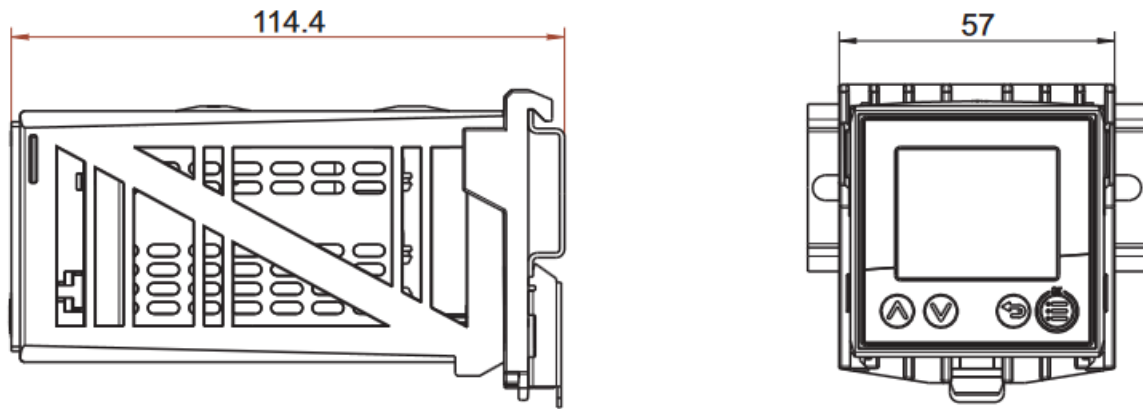


Figure 4 Housing and mounting dimensions for controller 70304 for top-hat rail mounting



Figure 5 Controller type 70304 inside frame for top-hat rail mounting

10 Technical Data

Temperatue controller type	70304
Part No.	01B8401
Temperature sensor	Resistance thermometer, thermocouple
Logic output	0/12 V DC, max. 30 mA to an external solid state relay
Switching capacity solid state relais	External
Control mode	PID
Status alarm	High temperature limiter with continious cutoff, low temperature alarm: 1 contact NO each, potential free, contact rating 250 V AC, 3 A
Indicators	Measuring temperature: 4 digits 7 Seg LED red 10 mm; setting value: as listed before but 7.0 mm; ON operation, ramp function on, 2 alarms
Temperatures	Ambient 0 -55 °C; storage -30 to +70 °C
Climatic conditions	< 90% r.H., dew not allowed
Electrical connections	Terminals 1.5 mm ²
Power supply	110-240 V +10/-15 %, 48-63 Hz, 8 VA
Housing material	Synthetic material
Housing version	Front panel mounting Top-hat rail mounting: part No. 01B8380, frame for top-hat rail mounting 48 x 48 mm
Weight / Protection	200 g / terminals IP20, housing IP20, front plate IP65 EN 60529
Options	
01B8380	Top-hat rail mounting frame for controllers in the format 48 x 48 mm
01B8411	Controller with mA-outlet for actual value

11 Electrical Connections



Warning

An incorrect system voltage can damage the unit. When establishing electrical connection, ensure that the system voltage corresponds to the voltage specified on the rating plate!



Note

For the erection of power installations with rated voltages up to 1000V, the requirements of VDE 0100 and relevant standards and specifications must be observed! The supply circuit of the unit must be provided with a fuse of 16 AT (time-delay fuse, overcurrent protection); the electrical values are shown in the technical data.

The electrical connection terminals of the controller **70304** are on the rear side of the housing.

Wiring plan controller 70304				
Connector block / terminal	Function			Indication in the display at normal operation
3/1	Mains L	AC 110-240 V		
3/2	Mains N	50/60 Hz 8 VA		
3/7	Alarm 2	3 A 250 V AC resistive load	Opens exceeding the actual value by +10 °C	2 (closed)
3/8	High temperature limiter with continuous cutoff			
3/4	Alarm 1	3A 250 V AC resistive load	Closes reaching the set value –10 °C	1 (closed)
3/5	Low temperature			
2/6	Triggering	+ 12 V 30 mA		3 (triggered)
2/8	Solid State Relais	0V		
2/2	Connection sensor	+ Thermo couple	Pt100 two wire	
2/3		- Thermo couple		
2/4			Pt100 two wire	

For controller with mA-output (optional):

Connector block / terminal	Function	
1/6	mA output	+
1/7	mA output	-

11.1 Replacing Controller 703 with Controller 70304

Terminals old controller 703	Terminals new controller 70304
L1	3/1
N	3/2
242	3/7
243	3/8
142	3/4
143	3/5
81	2/6
80	2/8
111	2/2
112	2/3
113	2/4

12 Operating Principle

Operating and programming of the controller takes place on two levels. On the first level for normal operation, alarms can be reset or in case of startup a control circuit, self-optimization is activated.

Underneath there is the user level. All important adjustments of the controller are combined on the user level and can be changed after removing the level inhibit.

12.1 Parameter of the User Level with Factory Settings

- Setpoint **SP**, factory setting = **180 °C**
- Max. excess temperature difference to the setpoint **ALSE**, factory setting = **10 °C**. In case of exceeding, a cutoff of the controller with lock and an alarm signal takes place.
- Max. low temperature difference to the setpoint **Lo-t**, factory setting = **10 °C**. In case of falling below, an alarm signal takes place
- Limit comparator **Lfun**, factory setting = **2** : for controller with ramp function, 6 : for controller without ramp function, other values are not adequate for the operation of M&C products
- Function of the controller **Fnct**, factory setting = **1**: ramp function, 0 : fixed-setpoint controller. Other values are not adequate for the operation of M&C products.
- Ramp slope resp. increase of temperature in °C/min (°F/min) **rASL**, factory setting = **30**
- Sensor type **SenS**, factory setting = **2**: Resistance thermometer in 2-wire circuit
 - 0**: no function
 - 1**: Resistance thermometer in 3-wire circuit
 - 2**: Resistance thermometer in 2-wire circuit
 - 3**: Resistance thermometer in 4-wire circuit
 - 4**: Thermocouple
 - 5**: resistance transmitter
 - 6**: Heater current 0...50 mA AC (analog input 2 only)
 - 7**: 0...20 mA
 - 8**: 4 ... 20 mA
 - 9**: 0...10 V
 - 10**: 2...10 V
 - 11**: 0 ... 1 V

- Linearization **Lin**, factory setting = **1**, Pt100
- 0:** Linear
- 1:** Pt100
- 2:** Pt500
- 3:** Pt1000
- 4:** KTY11-6
- 5:** W5Re_W26Re C
- 6:** W3Re_W25Re D
- 7:** NiCr-CuNi E
- 8:** Cu-CuNi T
- 9:** Fe-CuNi J
- 10:** Cu-CuNi U
- 11:** Fe-CuNi L
- 12:** NiCr-Ni K
- 13:** Pt10Rh-Pt S
- 14:** Pt13Rh-Pt R
- 15:** Pt30Rh-Pt6Rh B
- 16:** NiCrSi-NiSi N
- 17:** W3Re_W26Re
- 18:** customized linearization

13 Changing Parameters

To change parameters the level lock on the user level has to be removed.

13.1 Removing and Activating the Level Lock

To remove the level lock, act as follows:

- Standard display (below setpoint, up actual value) has to be visible
- Press key PGM and  simultaneously for 5 sec.,
display = **Code 3** (all levels are locked)
- Press PGM
- Change value from **3** to **2** with key 
- The value is blinking after 2 sec. and the change is applied
- The user level is unlocked now
- Press **EXIT**

To activate the level lock, act as follows:

- Standard display (below setpoint, up actual value) has to be visible
- Press key PGM and  simultaneously for 5 sec.,
display = **Code 2** (all levels are locked)
- Press PGM
- Change value from **2** to **3** with key 
- The value is blinking after 2 sec. and the change is applied
- The user level is locked now
- Press **EXIT**

13.2 Menu Structure

Generally:

- Changing to the user level with PGM-key (display = User)
- To choose the first parameter press PGM-key again (display = SP)
- Changing to the next parameter with ▾-key
- Back to the standard display press EXIT-key (2 x)

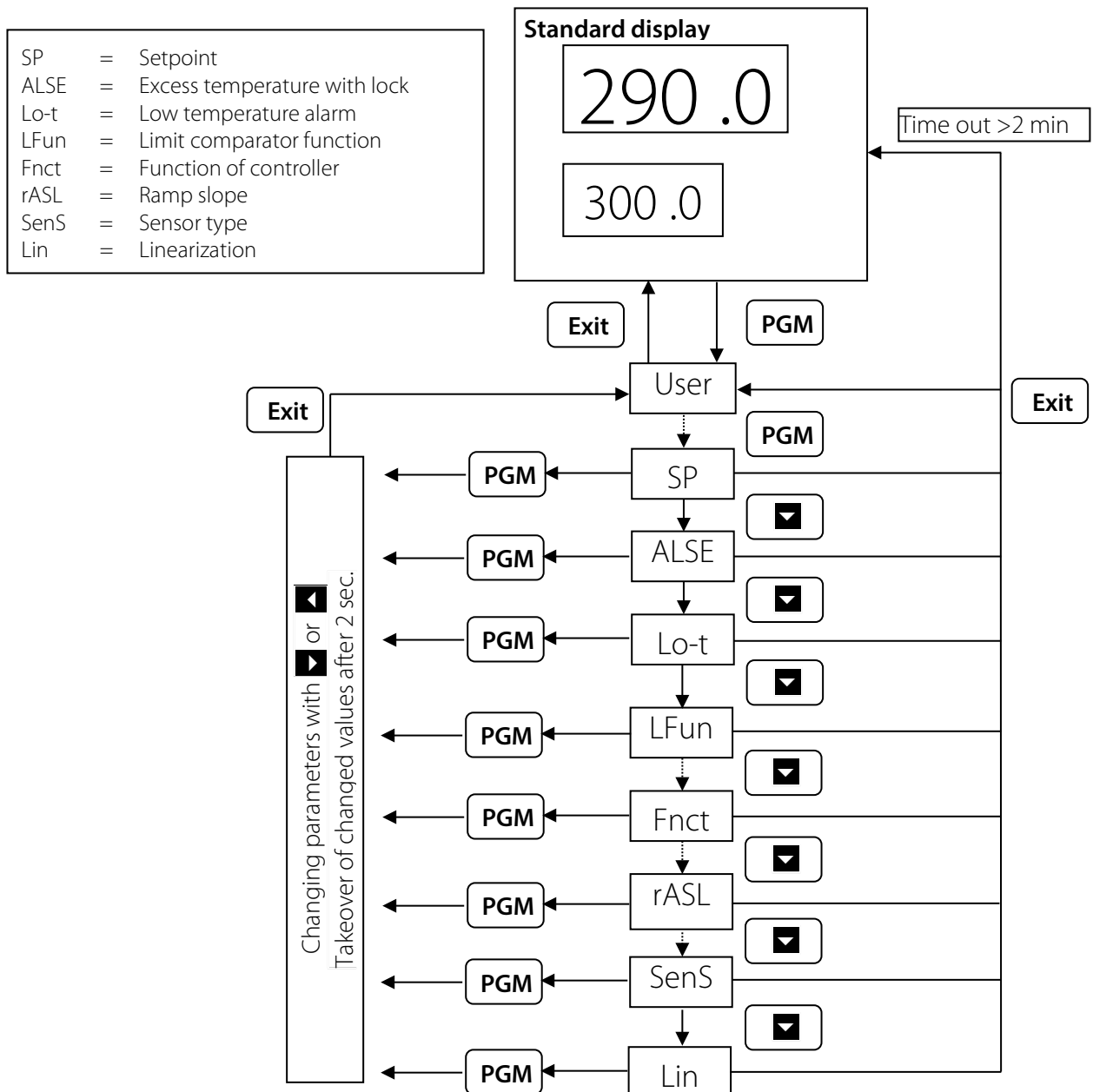


Figure 6 Menu structure

13.3 Time Out

If no operation takes place, the controller automatically returns to the standard display after about 2 minutes using any changed parameters.

14 Change of the Setpoint



Warning

Observe the maximum temperature of the device to be controlled to avoid damaging the same.

The setpoint value should not be reduced in one step by more than the entered alarm value, as the setpoint value will be outside the set alarm window. This will result in the generation of an overtemperature alarm, which will permanently deactivate the heating circuit.

For restart:

- Let cool down the device below the new setpoint;
- Press **EXIT** and -key or
- Reset of the low temperature alarm by switching of and on of the mains voltage.

15 Comissioning

15.1 Entry and Check of Controller Parameters



Note

For the entry and check of the controller parameters, the heating of the respective M&C component must not yet be connected.

In any event prior to commissioning, the parameters SP (setpoint), SenS (sensor type) and Lin (linearization depending on the particular M&C unit must be entered. The remaining parameters should correspond with the factory setting.



Warning



If the heating should already be connected, isolate the unit from the supply before disconnecting the heating!

15.2 Self-optimization (PID Action) of Control Loop

The controller type **70304** includes the function for self-optimization. This must be carried out for all M&C components during initial commissioning.



Note

For self-optimization of the control loop, the heating of the respective M&C component must be reconnected to the appropriate controller terminals.



Warning

Before connecting the heating, isolate the unit from the supply!



Before self-optimization the ramp function has to be deactivated first (**Fnct = 0**) and the parameter for the limit comparator has to be changed (**Lfun = 6**). See also chapter 13.

The self-optimization function can be activated as follows:

- After cable connection, switch on the supply.
- When the actual value (top display, red indicator) reaches the setpoint value (bottom display, green indicator), press  +  keys simultaneously for longer than 2 seconds. The word "tUnE" now flashes in the setpoint value display and the self-optimization function is activated.
- Self-optimization has finished when the display changes to the standard display. The time of self-optimization depends on the control loop.
- To cancel the self-optimization press the keys  +  simultaneously.

After self-optimization reactivate the ramp function (**Fnct = 1**) and reset the parameter for the limit comparator (**Lfun = 2**).

15.3 Commissioning with Heated Foreign Components

Commissioning takes place as described in chapters 15.1 and 15.2. The parameters for **SP**, **ALSE**, **Lo-t**, **Lfun**, **Fnct**, **rASL**, **SenS** and **Lin** must be entered for the respective component (see chapter 12 and 13).

The parameter **rASL** must be determined. For this purpose the time for heating the unit until the setpoint temperature is reached must be measured.

This is then followed by (empirical value): **rASL = 0.8 (setpoint temperature/rate of temperature rise)**

The calculated rASL value must be entered rounded.

After entering the parameters a self optimization, described in chapter 15.2, has to be operated.

16 Low Temperature Alarm and Excess Temperature Limitation

The controller type **70304** is adjusted and wired so that it uses relay 2 as an low temperature alarm output and relay 1 as an excess temperature limitation with permanent deactivation.

Both alarms are indicated on the controller front panel by the respective number (1 or 2) **extinguishing**. This takes place if the setpoint temperature is higher or lower than 10 °C.

Operating state	1	2	3
Heating up	off	on	on/off
Normal	Heating on	on	on
	Heating off	on	off
Alarm	X	off	X

16.1 Restarting after Excess or Low Temperature Alarm

In order to restart the unit after a temperature alarm with permanent deactivation, the cause of the alarm must initially be remedied.

With not programmed ramp functions, an alarm reset must take place as follows:

- Press **EXIT** and  keys simultaneously or
- Switch off and on the mains voltage.

With programmed ramp functions, an alarm reset must take place as follows:

- If the actual value is $< \pm 10$ °C to the setpoint press **EXIT** and  keys simultaneously or
- Switch off and on the mains voltage.

In case of an alarm reset by switching off and on the mains voltage the ramp start value is equivalent to the actual value.

17 70304 with mA-Output

The controller **70304** is also available with a mA-output. This output is also configurable. The output signal and the temperature range are adjustable.

17.1 Adjusting Signal Type and Temperature Range

To adjust the signal type and temperature range:

PGM-key, **USEr**,  up to **Conf**, PGM-key,  up to **OutP**, PGM-key,  up to **OutA**, PGM-key, **Out6**, PGM-key, **Fnct**,  **SiGn**, PGM-key, **SiGn** blinking, with  or  choose signal type:

0 = 0-10 V

1 = 2-10 V

2 = 0-20 mA

3 = 4-20 mA (factory setting)

Takeover of the adjusted value takes place after 2 seconds.

 up to **OPnt** (zero point of the temperature range): PGM-key, **OPnt** blinking, with  or  adjust zero point (0,0 = factory setting).

 up to **End** (end point of the temperature range): PGM-key, **End** blinking, with  or  adjust end point (200,0 = factory setting).

18 Decommissioning



Note

The place of installation of the temperature controller must be protected from frost also in the time in which the unit is deactivated.

No particular measures are necessary for brief decommissioning of the temperature controller.

19 Maintenance

Before carrying out maintenance work, the system and process-specific safety measures must be observed!



Warning

High voltage.

Before opening the housing, isolate the temperature controller from the supply!

The temperature controller does not require any special maintenance.

The temperature controller should be cleaned with compressed air from time to time depending on the degree of pollution of the ambient air.

20 Proper Disposal of the Device

At the end of the life cycle of our products, it is important to take care of the appropriate disposal of obsolete electrical and non-electrical devices. To help protect our environment, please follow the rules and regulations of your country regarding recycling and waste management.

21 Spare Part List

Temperature controller 70304 (C) Consumable parts, (R) Recommended spare parts, (S) Spare parts		C/R/S	Recommended quantity being in operation [years]		
			1	2	3
01B8401	Electronic PID temperature controller type 70304 with self-optimization and LED display, in front-panel housing, sensor input: resistance thermometer, thermocouple, controlling outlet: 0/12 V to an external solid state relays, status signal output: 1 contact NO for high and low temperature alarm, alarm relay capacity: 250 V AC, 3 A, dimensions (W x H x D): 48 x 48 x 100 mm, power: 230/115 V, 50/60 Hz	S			
EZR0013	Relais for controller 70304, 230 V AC	S			
EZR0010	Relais for controller 70304, 110 V AC	S			
01B8380	Rail mounting frame for controllers in the format 48 x 48 mm	S			

22 Appendix



For further product documentation, please see our internet catalogue:
www.mc-techgroup.com