Programmable PID multichannel temperature controller

MRFC-3 ...
MRHC-3 ...

Operating instructions for plant engineering companies

Software version V1.9

WELBA

welba.de

Programmable via configuration software WELBA „KONSOFT"

Content

1. Introduction

1.1 Information about this operating instructions

These operating instructions are intended for the use by plant engineers, installers or service technicians of the MRFC-3 | MRHC-3 programmable PID multichannel temperature controller. This manual contains all necessary suggestions, information, recommendations and advice for the safe and proper installation and commissioning of the controller. It is only with the knowledge of this operating instruction that faults in the controller can be avoided and a trouble-free operation is guaranteed.

Read the assembly instructions carefully and adhere to the recommendations described in order to ensure proper operation. In addition, the local accident prevention regulations and general safety regulations are to be observed for the field of application of the regulator.

⚠ **WARNING**

When delivered, the parameterization of the MRFC-3 | MRHC-3 does not necessarily correspond to the intended use. This must be adjusted accordingly during the installation.

Setting or changing of parameters may only be carried out by the system manufacturer or the service technician!

Basically, the installer of the system is responsible for the commissioning of the control.

Operation instruction for the operator

<u>The plant engineers, the installer or the service technician must prepare operating instructions for the operator of the controller.</u> In this case the parameterization of the delivery state must be clearly documented.

We recommend to only document those parameters which the operator of the controller needs.

When preparing the operating instructions for the operator the local regulations have to be observed – see chapter "Safety".

These operating instructions include important technical and safety information. It is vital to carefully study all these instructions before the installation of the control or in case of any other work with the control!

These instructions have been compiled with maximum care and attention. However, their content does not constitute an assurance of product features.

The manufacturer cannot be held liable for errors and may at any time make changes serving technical progress. All rights reserved.

NOTICE

NOTICE for storing the operating instructions

This instruction manual is part of the product and must always be readily available for the service technician.

1.2 Limitation of liability

The proper function of the MRFC-3 | MRHC-3 depends on many external factors on which the manufacturer has no influence. The manufacturer assumes no liability for damage to connected components or downstream process components.

All information and instructions in this manual have been compiled taking into account the applicable standards and regulations, the state of the art and our long-term experiences.

WELBA GmbH does not assume any liability for damages due to:

- Non-observance of the installation instruction
- Improper use
- Installation by unqualified staff
- Non-professional installation by third parties
- Unauthorized modifications
- Technical modifications

Otherwise, our general terms and conditions as well as the terms of delivery of WELBA GmbH and the legal regulations valid at the time of conclusion of the contract are applicable.

We reserve the right to make technical changes in the context of improving the properties of use and further developments.

1.3 Warning notices in these operating instructions

Important safety information in these assembly instructions are identified by symbols. These instructions on occupational safety must be adhered to and followed. In these cases, behave particularly carefully in order to avoid accidents, personal injury and property damage.

In addition to the information in these assembly instructions, the general and local safety and accident prevention regulations must also be observed and instructed!

Nature and source of danger
This warning signs warns of an imminent danger to health and life of people. Failure to comply with this warning will result in extremely serious injuries, including death.

Nature and source of danger
This warning signs warns of a possibly dangerous situation for the health of people. Failure to observe these warning notices can result in serious injuries, including death.

Nature and source of danger
This warning sign warns of a possibly dangerous situation for the health of people. Failure to observe these warnings can lead to minor or moderate injuries.

Note
General notes contain application tips and particularly useful information, but no warnings about dangers.

1.4 Device description

Controllers in the MRF-2 | MRH-2 series are universal four-channel PID temperature controllers used to regulate and control industrial heating and cooling applications.

The four built-in controller components offer complex setting options for optimum performance of the widest possible range of different control tasks. This means that two-point and three-point control operations, continuous and pulsed PID control operations, multi-zonal control, absolute and difference temperature control, and other complex control tasks up to and including compressor rotation in composite systems are all possible.

The four autonomous control channels can be combined with external items such as digital inputs, fault indicators, temperature alarms or button functions. The controller architecture circuit diagram illustrates the full range of combination options offered by the modular hardware concept.

The MRFC-3 | MRHC-3 has up to four analogue temperature sensor inputs, one or two analogue inputs and up to six digital inputs. Temperature sensor types KTY, PT-100 (2 or 3 leads) or PT1000 can be connected to it. The analogue inputs can be configured to 0..10 V or 4..20 mA.

External plant components such as heating systems, condensing units, control valves, mixing valves, pumps, fans, signal transmitters etc. can be controlled through up to six relay outputs or one or two freely configurable analogue outputs.

The operation and the pre-setting of the parameters of the MRFC-3 | MRHC-3 can be accessed from the controller's main menu. From this main menu you can access further submenus, in which all parameters are stored which should be visible and adjustable for the end customer during later operation.

As interference with the basic configuration by the end user can result in dangerous changes to functions, the access authorization for the service submenu can be secured by the system manufacturer with a password.

A type RS-485 interface is provided for communication with higher-level systems.

WELBA „KONSOFT"

The configuration software available as an option offers a simple way to set parameters and update the temperature controller. The values measured by the sensors, the analogue input and the analogue output control signal can be transmitted to a PC.

1.5 Model / type plate
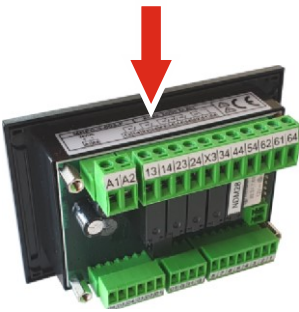
These operating instructions apply to all regulators of the MRFC-3 | MRHC-3 series. Here the operation and parameterization of all different variants are described in detail.

The type designation and the exact connection diagram for your controller can be found on the controller as a connection sticker.

Example:
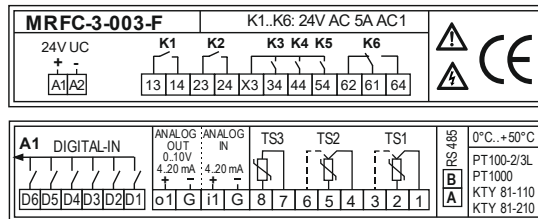
Controller type designation:
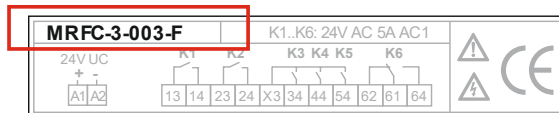
and
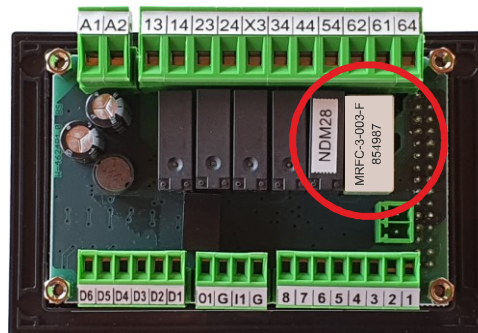
You can find a more detailed connection diagram for your controller on the accompanying device documentation.

Example:

1.6 Items supplied

- Controller MRFC-3 | MRHC-3
- Holder
- Rubber seal
- Fixing screws
- Accompanying documentation
- Software "WELBA-KONSOFT" (for download at www.welba.de)

1.7 Disposal

For the purposes of disposal, the device is classified as waste electronic equipment within the meaning of European Directive 2002/96/EC (WEEE) and must not be included with household waste. It must be disposed of through the correct channels.

Local and current legislation must be observed.

1.8 Cleaning instructions

The enclosure front (front foil) can be cleaned with usual detergents.

NOTICE

ATTENTION: The enclosure front is not resistant to aggressive acids and alkalis, abrasive cleaners and cleaning with high-pressure cleaners!

The use of these cleaners and cleaning methods may lead to damages!

1.9 Dimensions

1.9.1 MRFC-3

Panel cutout
87 x 56 mm

1.9.2 MRHC-3

Panel cutout
87,5 x 66,5 mm

Pin size welding studs M3
96 x 53 mm
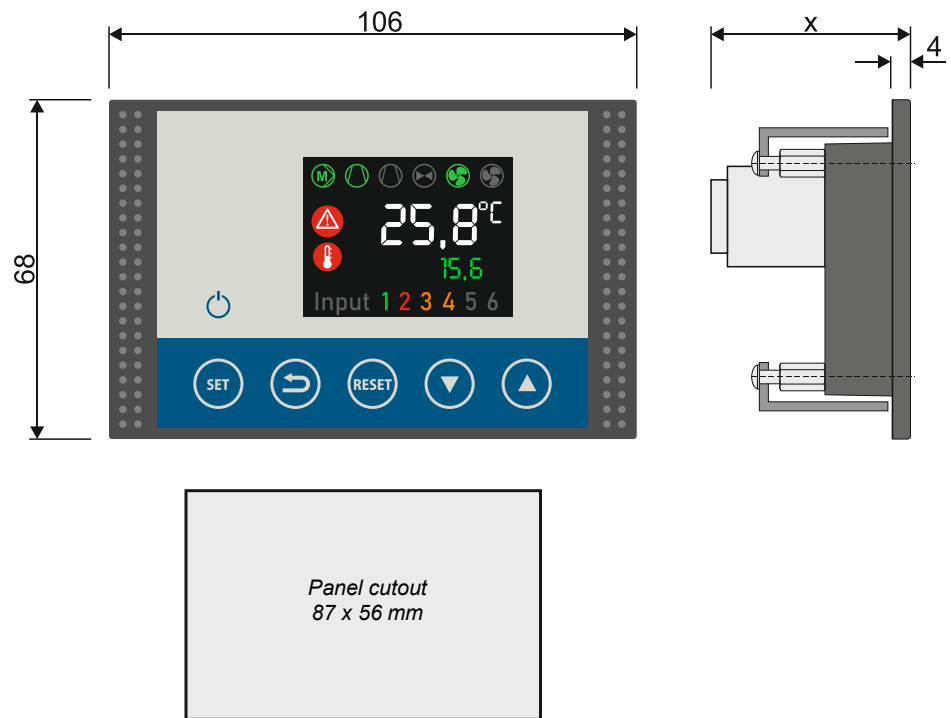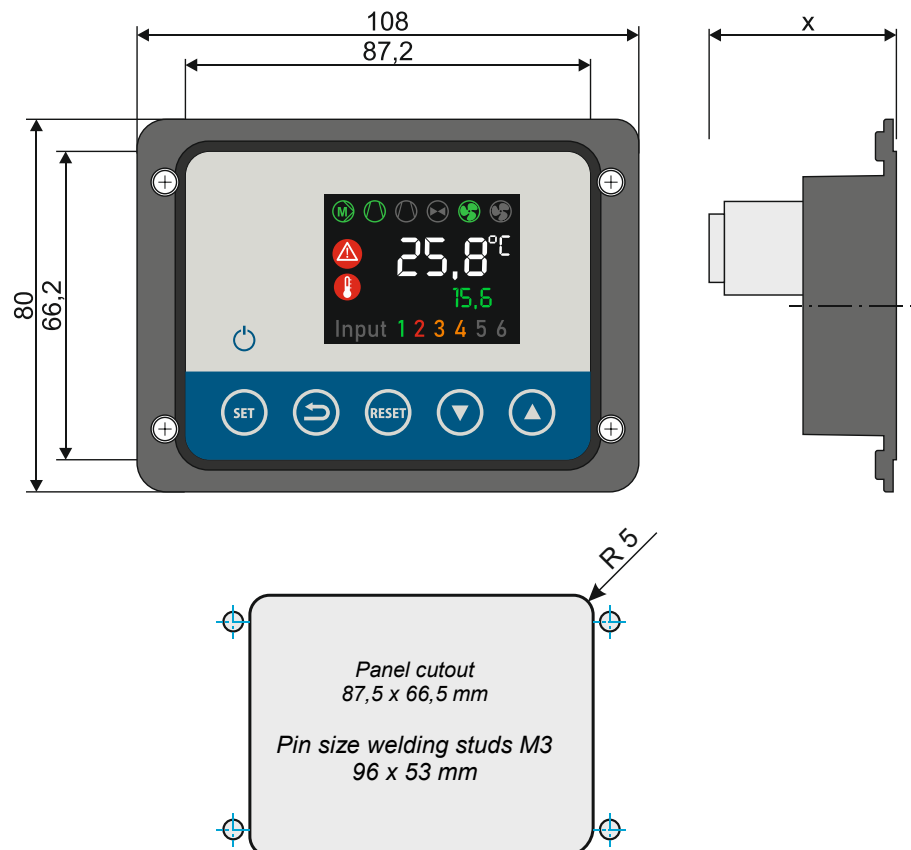
1.10 Technical data

Operating voltage	230V AC +/-10%, 50/60 Hz 24V UC +/-10%, 50/60 Hz (see connection diagram)
Relay contact	depending of version - see connection diagram
max. switching current	depending of version - see connection diagram
max. switching voltage	depending of version - see connection diagram
Display	240 x 320 pixel full colour TFT display - 2,0 inch
Active display area	ca. 30,6 x 40,8 mm
Number of sensor inputs	2 or 3 (depending of version)
Usable sensors	KTY 81-210 KTY 81-110 PT 100 (2- or 3- wires) PT 1000
Measurement range - KTY 81-210 - KTY 81-110 - PT 100 - 2 wire - PT 100 - 3 wire - PT 1000	 -50° to +150°C -50° to +150°C -50° to +400°C -50° to +400°C -50° to +400°C
Interface	RS-485 (WE-BUS / Modbus)
Digital inputs	4
Analogue input - Current 4-20 mA	Ri =< 100Ohm
Analogue output - Voltage 0-10 V or - Current 4-20 mA	(depending of version) Load resistance > 1 kOhm Load resistance < 500 Ohm
Temperature alarms	2 (independently)
Control mode	two step control / three step control / PID
Housing MRFC-3 (Front panel mounting)	- Front size 106 x 68 mm - Front panel cut 87 x 56 mm
Housing MRHC-3 (Rear wall mounting)	- Front size 108 x 80 mm - Front panel cut 87,2 x 66,2 mm
Installation conditions	build-in-appliance - installation depth 45 mm
Protection class - Housing front - Rear	 IP 64 IP 00
Electrical safety - pollution degree - rated impulse voltage	Overvoltage category III to 250 V 2 1500 V
Connection	Plug-in screw connections for cables up to 2,5 mm² / 1,5 mm²
Environment specifications - Operation temperature - Storage temperature - max. humidity	 0° to +50°C -20° to +70°C 75% (no dew)
Pollution degree	Electrically conductive pollution must not enter the housing interior

Technical data subject to change.

2. Safety

2.1 General Information

⚠ WARNING	*The plant engineering company must prepare operating instructions for the operator, taking account of the controller's parameters as supplied.*
	We recommend referring only to the parameters which the end user needs for safe operation.
	In preparing the operating instructions for the end user, especially the chapter on "Safety", account must be taken of local regulations.

	IMPORTANT
NOTICE	*The parameter settings of the MRFC-3	MRHC-3 as supplied do not correspond to the intended use (e.g. compressor output is pulsed).*
	This can lead to undefined behaviour by individual components when the system is commissioned.
	For this reason, no actuators should be connected when starting operation. Load circuits should be separated.
	The general principle is that the plant constructor is responsible for putting the controller into operation.

2. Safety

WARNING

These operating instructions contain important technical and safety information. Please read carefully before installation and before any work on or with the regulator.

It is the duty of the party commissioning the system to ensure compliance with the following guidelines.

The PID multichannel temperature controller may only be installed by an authorised specialist, observing all local safety requirements.

Access to the environment when connected must be restricted to specialised personnel.

PID multichannel temperature controllers contain live components. They must be built into the plant in such a way that contact with such live components is impossible.

Precise technical data can be found in the accompanying documentation or on the stickers affixed to the controller.

The controller is not suitable for use in explosive atmospheres. Danger of explosion. Use only outside areas subject to explosive atmospheres.

The device must <u>not</u> be used if the housing or connection terminals are damaged.

No fluids must penetrate the housing!

2.2 Intended use

Programmable PID multichannel temperature controllers MRFC-3 | MRHC-3 are intended for use in industrial systems. They are designed to control heating systems, condensing units, alarms, fans, etc. Any other use of the device is permitted only with prior written permission from the manufacturer.

They must not be used by private individuals, for example to control domestic heating or air-conditioning systems.

The temperature controller is intended only for incorporating into machinery, display panels or switchboxes etc. and when fitted correspond to protection class 2 (double or reinforced insulation). It may only be put into operation when installed. The use of the controller is permitted in devices of protection class 1 and 2. The entire product must not be changed or converted!

The temperature controller is ready for use only when the parameters have been set appropriately. Its use before this has been done would have no benefits and could also damage the equipment or adversely affect the medium to be temperature-controlled.

The responsibility for the correct functioning of connected equipment lies with the plant engineering company.

The controller is not suitable for use in explosive atmospheres. Danger of explosion. Use only outside areas subject to explosive atmospheres.

The PID multichannel temperature controller fulfils the EC requirements for electromagnetic compatibility (EMC) and the Low Voltage Directive (LVD).

The safety components meet the VDE regulations.

2.3 Wiring, screening, earthing

When selecting wiring materials and installing and connecting the temperature controller to the electricity supply, account must be taken of DIN VDE 0100 "Erection of power installations with rated voltages below 1000" or the relevant national regulations (e.g. based on IEC 60364).

- Wherever possible, keep input, output and supply leads and sensor cable physically separate from each other and do not lay them parallel to each other.
- Use screened and twisted interface and sensor cables.
- Earth the screening of temperature sensors unilaterally in the switchbox.
- Ensure correctly wired potential equalisation.

2.4 Electrical safety

- All control and load circuits must be fused in accordance with local regulations.
- In order to prevent destruction of the relay or semiconductor relay outputs in the event of a short-circuit, the load circuit should be fused to the maximum permissible output current.
- As well as incorrect installation, wrong parameter settings can also adversely affect the correct functioning of the controller. For this reason, safety devices that are independent of the controller should always be used, e.g. high and low pressure valves or temperature limiters. Account should be taken of the local safety regulations in this connection.

3. Installation

3.1 Location and climatic conditions

It is essential not to install the device under the following conditions:
- severe jolting, vibration or magnetic fields
- permanent contact with water
- relative humidity of more than 90%
- sharply fluctuating temperatures (condensation)
- dust, flammable gases, vapors, solvents,
- operation in an aggressive atmosphere (ammonia or sulphur fumes) - risk of oxidation
- operation in the immediate vicinity of radio transmitters with high levels of spurious radiation.

A physical separation between the device and inductive consumers is recommended.

3.2 Unpacking and storage

If the packaging is damaged or something is missing, do not fit the temperature controller. In this case please contact Welba.

If you keep the temperature controller for a period before using it, store it in a clean dry place at a temperature of between -20°C and +70°C.

3.3 Installation of housing

3.3.1 MRFC-3

For fixing the MRFC-3 housing please follow the instructions:
- Place the seal carefully in the groove. Ensure it is not twisted.
- Insert the housing from the front through the switchboard cut-out.
- Attach the holding frame in the rear position as shown by the picture.
- Fasten the housing by using the screws provided.
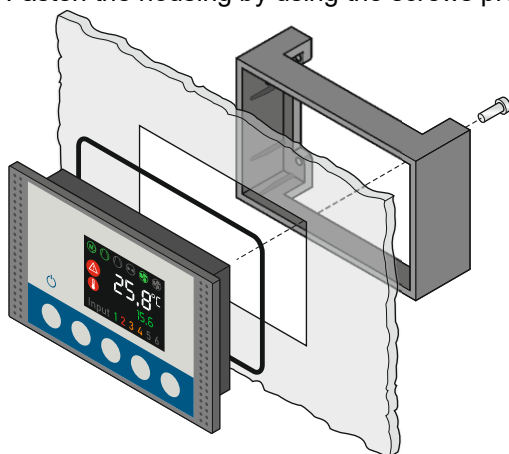
Panel cutout
87 x 56 mm

3.3.2 MRHC-3

For fixing the MRHC-3 housing please follow the instructions:
- Place the seal carefully in the groove. Ensure it is not twisted.
- Push the housing onto the stud bolts from behind.
- Fasten the housing by using the hex nuts provided.

R 5

Panel cutout
87,5 x 66,5 mm

Pin size welding studs M3
96 x 53 mm
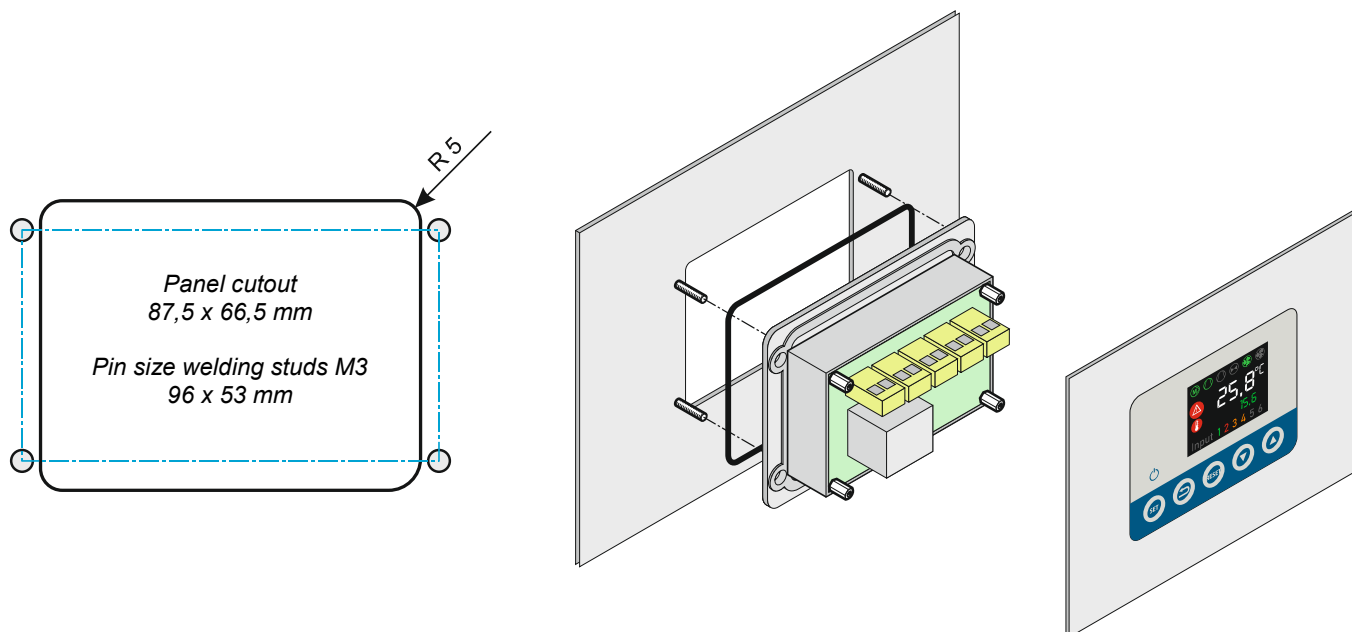
3.4 Fitting the sensor

⚠ **WARNING**

The sensor cable must not be chafed or kinked.

Do not place the sensor and the high-voltage cable in the same cable conduit (not even within the switchbox).

The MRFC-3 | MRHC-3 has been designed for connection to various types of sensor (see technical data). It can function properly only if one of those sensor types is installed and the parameters are correctly set.

When setting the temperature controller parameters (and whenever the sensor is replaced) the "actual value correction" [Parameter T91 / T93 / T95 / T97] must be adjusted so that the temperature measured corresponds to that shown on the display. A reference thermometer should be used for this purpose.

See the section 9.1 "Setting the actual value correction".

Pay attention to the permitted temperature range for sensor cable exposure.

4. Electrical connection

4.1 Safety during installation

WARNING

Before connecting ensure that the mains voltage is the same as indicated on the device's type plate.

Incorrect electrical connection can cause damage to the regulator and to the equipment.

The temperature controller should be disconnected from the mains voltage while connecting plant components or the sensor.

No appliances with current levels in excess of the maximum values indicated at the technical data should be connected to the relay contacts

Use contactors.

Downstream contactors must be fitted with an RC protection circuit. (see also section 9.4)

No other consumers may be connected to the controller's mains terminals.

4.2 Procedure

WARNING

In order to avoid injury to persons or damage to connected components, connections must in all cases be undertaken in the following order!

This is to prevent an unsuitable pre-configuration damaging components when the mains voltage is connected - e.g. compressor output is pulsed.

- Pull out all the controller's plug-in terminals.
- Put the controller in position in the housing or switchboard. (Section 3.3)
- Connect all components and sensors in accordance with section 4.4 (Circuit diagram) to the plug-in terminals.
  (Do not yet plug the terminals into the controller!)
- Connect the mains cable to plug-in terminal A1 / A2.
- Plug terminal A1/ A2 into the controller.
- Close the switchbox and turn on the mains voltage.

- Switch on the temperature controller and set the parameters (possibly using the optional WELBA-KONSOFT configuration software).
- Disconnect the system from the mains and open the switchbox.
- Plug the pre-cabled plug-in terminals of the components into the controller.
- Close the switchbox.

4.3 Wiring

Correct wiring in accordance with the information in the accompanying description and local regulations is essential. Take particular care to ensure that the AC supply is not connected to the sensor input or other low-voltage inputs or outputs.

The various relay contacts may only be connected with uniform tension.

Use copper wire (except for the sensor connection) and ensure that all supply leads and connection terminals are dimensioned to suit the relevant current rating.

When connecting the controller and selecting the wiring materials to be used, it is essential to comply with the provisions of DIN VDE 0100 "Erection of power installations with rated voltages below 1000" or the relevant national regulations.

Furthermore, all connections must comply with the relevant VDE regulations or corresponding national regulations.

4.4 Circuit diagram

The correct circuit diagram for your controller is affixed to the housing and is also included in the Accompanying Device Documentation.

- All components (heating and cooling units, fans, alarms etc.) must be connected in accordance with the circuit diagram in the Accompanying Device Documentation of the controller.

NB:
- The electrical connection must comply with the technical data in the Accompanying Device Documentation of the controller.
- Use cable bushes.
- Make sure that cables cannot chafe!

5. Controller architecture / function blocks

5.1 General Hints and Tips

IMPORTANT:

Before starting operation, all the controller's parameters should be adjusted to suit the system requirements.

Wrongly set parameters can lead to serious operational disruptions!

There follows a description of all the stages necessary for programming the various controller configurations. Depending on the configuration, some parameters are hidden.

IMPORTANT:

When designing a control system, you should consider the consequences of a malfunction. For example, in the case of a temperature control system there is the possibility of a heating unit not cutting out, leading to the possibility of injuries to persons or damage to equipment. Protect yourself and your equipment by additional protective measures.

TIP:

We recommend you to note the values set on the controller before delivery to the end user. In this way it is possible for you to deliver a pre-programmed controller in the event of a spare part delivery.

When changing the controller at the end user's establishment, you will then only need to re-set the actual value correction.

TIPP:

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The configuration software available as an option can be used to set and update the temperature controller's parameters. The values measured by the sensors, the analogue input and the analogue output control signal can also be transmitted to a PC.

5.2 General controller structure

Power supply:

230 V AC or 24 V UC

Timer module:

versatile useable for inputs and outputs.

Saving of external time relays!!

Temperature alarms:

4 independent temperature alarms, extensively configurable

Digital inputs:

Monitoring of external system components.

Fault message via Display and relay output.

Internal logic operation with timer module

Triggering of functions by external occurrences.

Collective fault indicator

can be linked to digital inputs or temperature alarms.

Function modules

- Pump control
- Compound control
- Counter module

Relay outputs

for controlling system components, e.g. pumps, compressors, etc.

A potential-free changeover contact, e.g. for a fault message output.

controller example

Dig. inputs

RS485

A1 A2 13 14 23 24 X3 34 44 54 62 61 64

K1 K2 K3 K4 K5 K6

D6 D5 D4 D3 D2 D1 O1 G I1 G 8 7 6 5 4 3 2 1

ANALOG-OUT ANALOG-IN

B
A

Modbus-RTU over RS-485

Universal sensor inputs:

Inputs configurable for PT-100 2- or 3-wire, PT-1000, KTY 81-210 and KTY 81-110

Analog input:

as current input (4-20 mA)

Analog output:

as a voltage output (0-10V) or as current output (4-20 mA)

PC parameterizable

I/O-Bus *(optional)*

(RS485)
to connect an I/O extension module

5.3 Displays and controls

5.3.1 Graphic display (working level)

At the working level, the system status can be seen at a glance on the display.

Relay indicators

Relay status displays can be parameterized extensively.

Fault indicator

Temperature alarm

Digital inputs

Status displays
green = functional input
red = active fault
orange = stored fault

Actual value display

(parameterizable in parameter [U1].)

Actual or target value display

(parameterizable in parameter [U2].)
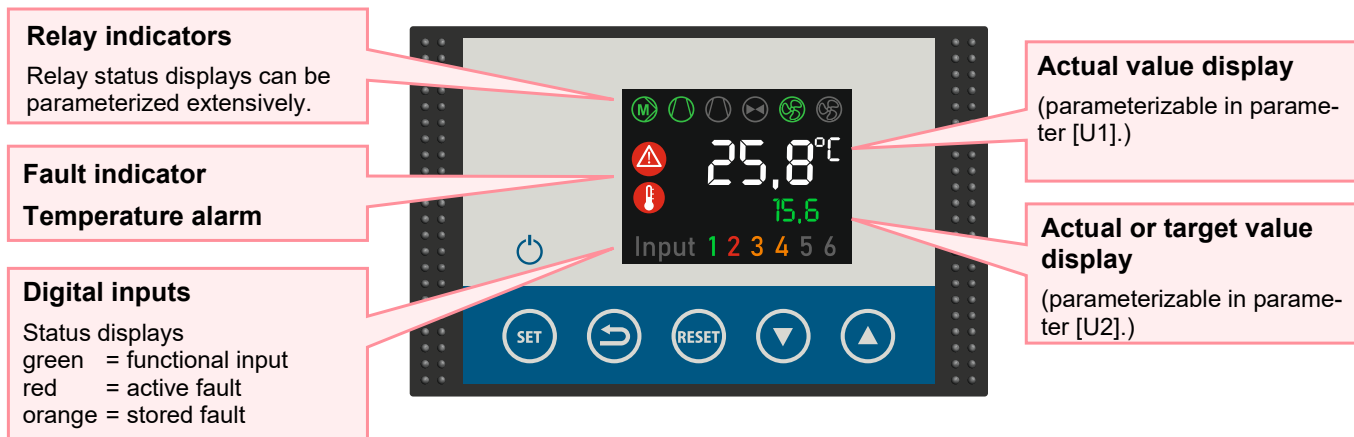
5.3.2 Key functions (working level)

⏻	**ON / OFF - button**	Switching the controller on and off (if not parameterized differently)
SET	**SET – button =** *from the working level* *from the main menu* *from the submenu* *in the parameter levels*	Call up the main menu Calling up the marked submenu Editing the marked value... … Leave the parameter **with** saving
↩	**RETURN button** *in the parameter levels*	Return to the previous menu Leave the parameter **without** saving
RESET	**RESET button**	Confirm / reset fault messages
▼	**Button „arrow DOWN"**	Display of measured sensor temperature 1 - 4 or value of analogue input (is defined in [U4])
▲	**Button „arrow UP"**	as before - is defined in [U3].

5.4 Controller architecture

The MRFC-3 | MRHC-3 includes

- 4 independent temperature controllers - hereafter called „controller blocks"
- 2 function blocks "Temperature alarms"
- function blocks „digital inputs"
- function blocks „pump control"
- function blocks „compound / zone control"
- function blocks „counter module"

All blocks and functions can be set via the parameterization and are linkable.
Overview see next page.

Overview controller architecture MRFC-3 | MRHC-3

4 separate temperature controller blocks

INPUTS

e.g.:
KTY
PT-100
PT-1000

Sensor F1

Sensor F2

Sensor F3

Sensor F4

Analog input

e.g.
Transducer
(thermocouple)
External setpoint
specification

Controller block 1
can be: - *2-point control*
- *PID clocked*
- *PID analogue*

INPUTS	**OUTPUTS**
Setpoint (can be)	(can be):
☐ Fixed value	Relay K1 ☐
☐ Sensor 1.. 4	Relay K2 ☐
☐ Analog input	Relay K3 ☐
☐ from contr. block X	Relay K4 ☐
Actual value (can be)	Relay K5 ☐
☐ Sensor 1.. 4	Relay K6 ☐
☐ analog input	analog output ☐

Controller block 2
can be: - *2-point control*
- *PID clocked*
- *PID analogue*

INPUTS	**OUTPUTS**
Setpoint (can be)	(can be):
☐ Fixed value	Relay K1 ☐
☐ Sensor 1.. 4	Relay K2 ☐
☐ Analog input	Relay K3 ☐
☐ from contr. block X	Relay K4 ☐
Actual value (can be)	Relay K5 ☐
☐ Sensor 1.. 4	Relay K6 ☐
☐ analog input	analog output ☐

Controller block 3
can be: - *2-point control*
- *PID clocked*
- *PID analogue*

INPUTS	**OUTPUTS**
Setpoint (can be)	(can be):
☐ Fixed value	Relay K1 ☐
☐ Sensor 1.. 4	Relay K2 ☐
☐ Analog input	Relay K3 ☐
☐ from contr. block X	Relay K4 ☐
Actual value (can be)	Relay K5 ☐
☐ Sensor 1.. 4	Relay K6 ☐
☐ analog input	analog output ☐

Controller block 4
can be: - *2-point control*
- *PID clocked*
- *PID analogue*

INPUTS	**OUTPUTS**
Setpoint (can be)	(can be):
☐ Fixed value	Relay K1 ☐
☐ Sensor 1.. 4	Relay K2 ☐
☐ Analog input	Relay K3 ☐
☐ from contr. block X	Relay K4 ☐
Actual value (can be)	Relay K5 ☐
☐ Sensor 1.. 4	Relay K6 ☐
☐ analog input	analog output ☐

OUTPUTS

Analog output

e.g.
Pump
Heater
Compressor
Valve
etc.

4 function blocks „temperature alarms"

Function temp. alarm 1 + 2
can be: - *act directly on relays*
- *act on controller block*
- *message on fault indicator*
- *with user menu entry*

INPUTS	**OUTPUTS**
(can be):	*(can be):*
☐ Sensor 1..4	☐ Relay K1 to K 'x'
☐ Analog input	☐ Contr. block 1..4
☐ from contr. block X	☐ Fault indicator

Function temp. alarm 3 + 4
can be: - *act directly on relays*
- *act on controller block*
- *message on fault indicator*
- *without user menu entry*

INPUTS	**OUTPUTS**
(can be):	*(can be):*
☐ Sensor 1..4	☐ Relay K1 to K 'x'
☐ Analog input	☐ Contr. block 1..4
☐ from contr. block X	☐ Fault indicator

e.g.
Switch
Float switch
High pressure monitor
Low pressure monitor
Machine output

Digital input 1

Digital input 2

Digital input 3

Digital input …

Digital input …

Digital input ‚x'

Func. block. dig. inputs

Function digital input 1 to ‚x'
can be: - *act directly on relays*
- *act on controller block*
- *Operational release*
- *Switch setpoint*
- *Collective fault message*

INPUT *(can be):*	**OUTPUT** *(can be):*
☐ Digital input 1..'x'	☐ Relay K1.. K 'x'
	☐ Contr. block 1..4
	☐ Collec. fault indic.

Func. block relay output

Function Relay output 1 to ‚x'
- *act directly on relays*

INPUT *(can be):*	**OUTPUT** *(can be):*
☐ Digital input 1..'x'	☐ Relay K1 to K 'x'
☐ Contr. block	
☐ Temp. alarms	
☐ Contr. block	
☐ Collec. fault indic.	

Relay K1

Relay K2

Relay K3

Relay K…

Relay K…

Relay K ‚x'

Other function blocks

Function block „pump control"	see section 5.5.5
Function block „compound / zone control"	see section 5.5.6
Function block „counter module"	see section 5.5.7

,x' depending on the version

5.5 Explanation of controller and function blocks

5.5.1 Explanation „Temperature controller block 1 to 4"

Controller block 1
can be: - 2-point control
- PID clocked
- PID analogue

INPUTS	OUTPUTS
Setpoint (can be)	(can be):
☐ Fixed value	Relay K1 ☐
☐ Sensor 1.. 4	Relay K2 ☐
☐ Analog input	Relay K3 ☐
☐ from contr. block X	Relay K4 ☐
Actual value (can be)	Relay K5 ☐
☐ Sensor 1.. 4	Relay K6 ☐
☐ analog input	analog output ☐

Via [‚R' parameter] you determine:

which type of control	- 2-step-regulation - PID pulsed - PID analogue
which input	- sensor 1 to 4 (2 sensors also possible) - analogue input
link	- absolute value control on sensor - difference temperature control - control with external setpoint specification

Adjustment see parameter list.

The setting for which OUTPUTS are to be controlled is defined on the relevant relays [‚P'-parameter] or the analogue output [A-parameters].

5.5.2 Explanation „Function blocks temperature alarm 1 to 4"

Function temp. alarm 1 + 2
can be: - act directly on relays
- act on controller block
- message on fault indicator
- **with user menu entry**

INPUTS	OUTPUTS
(can be):	*(can be):*
☐ Sensor 1..4	☐ Relay K1 to K 'x'
☐ Analog input	☐ Contr. block 1..4
☐ from contr. block X	☐ Fault indicator

Via [‚H' parameter] you determine:

which alarm type	- limit alarm - high or low temperature alarm - each with relative or absolute limits
which input	- sensor input 1 to 4 - analog input - controller block 1 to 4
link	- act directly on relays - act on analog output - act on controller block - message on fault indicator - entry in fault memory - time delay fault indication
Fault display	- see section 9.2
Fault RESET	- see section 9.2

Adjustment see parameter list.

Function temp. alarm 3 + 4
can be: - act directly on relays
- act on controller block
- message on fault indicator
- **without user menu entry**

INPUTS	OUTPUTS
(can be):	*(can be):*
☐ Sensor 1..4	☐ Relay K1 to K 'x'
☐ Analog input	☐ Contr. block 1..4
☐ from contr. block X	☐ Fault indicator

The setting as to which OUTPUTS are to be controlled is made:

- at the respective temperature alarm ['H' parameter],
- for the respective relay ['P' parameter]
- at the analog output ['A' parameter]

5.5.3 Explanation „Function blocks for digital inputs 1 to X"

Function digital input 1 to ‚x'
can be: - *act directly on relays*
            - *act on controller block*
            - *Operational release*
            - *Switch setpoint*
            - *Collective fault message*

INPUT *(can be):*	**OUTPUT** *(can be):*
☐ Digital input 1..'x'	☐ Relay K1.. K 'x'
	☐ Contr. block 1..4
	☐ Collec. fault indic.

Via [‚D' parameter] you determine:

which function	- switches relays on and off - triggers fault reports - switches to alternative setpoint - operational release (wake up from stand-by)
which input	- digital input 1 to ‚x'

link	- act directly on relays
	   - act on controller block
	   - message on fault indicator
	   - entry in fault memory
	   - time delay digital input signal

Fault display	- see section 9.2
Fault RESET	- see section 9.2

Adjustment see parameter list.

The setting for which OUTPUTS are to be controlled is defined firstly in [‚D' parameters] and secondly on the relevant relay [‚P' parameters].

5.5.4 Explanation „Function blocks for relay outputs 1 to X"

Function relay output 1 to ‚x'
            - act directly on relays

INPUT *(can be):*	**OUTPUT** *(can be):*
☐ Digital input 1..'x'	☐ Relay K1 to K 'x'
☐ Contr. block	
☐ Temp. alarms	
☐ Contr. block	
☐ Collec. fault indic.	

Via [‚P' parameter] you determine:

which function	- switches relays on and off
which input	- digital input 1 to ‚x' - controller block 1 to 4 - temperature alarms 1 to 4 - function block pump control - function block compound / zone control - collective fault indicator
output	- act directly on relays
link	- power on delay - blocking time - time functions (Timer A + B)

Adjustment see parameter list.

The setting for which OUTPUTS are to be controlled is defined in [‚P' parameters].

5.5.5 Explanation „Function block pump control"

MRFC-3 knows different control modes for the pump control:

1) Operation with one pump (independent of function block "pump module")
Connection to one of the relay contacts K1 to K'x' => setting 14*
- Pump runs in continuous operation
- No pump lag time adjustable
- Various stand-by functions can be set
- Freeze protection functions can be set
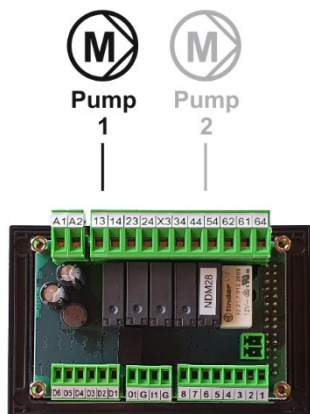
2) Operation with one pump (with use of "pump module")
This operating mode offers an extended option for the behaviour in stand-by as well as an adjustable pump lag time.
Connection to one of the relay contacts K1 to K'x' => setting 15*: Pump
- Setting behaviour in stand-by [E12]
- Setting desired pump lag time [E13]

3) Operation with two pumps (independent of function block "pump module")
Connection to two of the relay contacts K1 to K'x' = Setting both on 14*
- Same as 1)
- Both pumps are controlled independently of each other!

4) Operation with two pumps (with use of "pump module" = redundant operation)
Connection to two of the relay contacts K1 to K'x' => Setting 1x 15* / 1x 16*

If two relay outputs are set as pump A + B, the controller automatically controls the pumps in "redundant operation" - i.e. after an adjustable total runtime [E14] of the pump 1, the pump operation automatically switches to pump 2 (and back to pump 1).

Pump failure:

If a pump is reported as defective via a digital input, operation switches permanently to the other pump. A fault message is displayed.

If both pumps are reported as defective via digital inputs, see parameters [E17 and E18].

Other settings
- Setting of the desired pump lag time [E13]
- Setting of the desired pump lag time [E14] (time after which the other pump is used).
- If both pumps are reported as defective via digital inputs, the switching state of the relay outputs K1 to K'x' can be predefined. See section 9.4
- Fault message activation and fault memory [E18]

* Parameter [P10 / P20 / P30 / P40 / P50 / P60]

5.5.6 Explanation "Function block compound / zone control"

The compound / zone control is used to intelligently control several connected compressors or heating elements via two temperature ranges (zones).

Controlled are:
- Compressor or heating element rotation to achieve even use of the components.
- Adding of further compressors or heating elements to achieve a better power distribution.

	Function
Switching step **S1 ON**	If the temperature exceeds the set **zone 1**, the first switching step S1 (relay contact 1) is switched on.
Switching step **S2 ON**	After the time [E27] has elapsed, the second switching step S2 (relay contact 2) is switched on.
Switching step **S1 OFF**	If the temperature drops, both switching steps remain switched on until **zone 1** is undercut. Now switching step **S1** is switched off
Switching step **S2 OFF**	After the time [E27] has elapsed, the second switching step **S2** is then switched off
Switching step **S3 ON**	If the temperature exceeds the set **zone 2**, the third switching step S3 (relay contact 3) is switched on.
Switching step **S4 ON**	After the time [E28] has elapsed, the fourth switching step S4 (relay contact 4) is switched on.
Switching step **S3 OFF**	If the temperature drops, both switching steps remain switched on until **zone 2** is undercut. Now switching step **S3** is switched off
Switching step **S4 OFF**	After the time [E28] has elapsed, the second switching step **S4** is then switched off
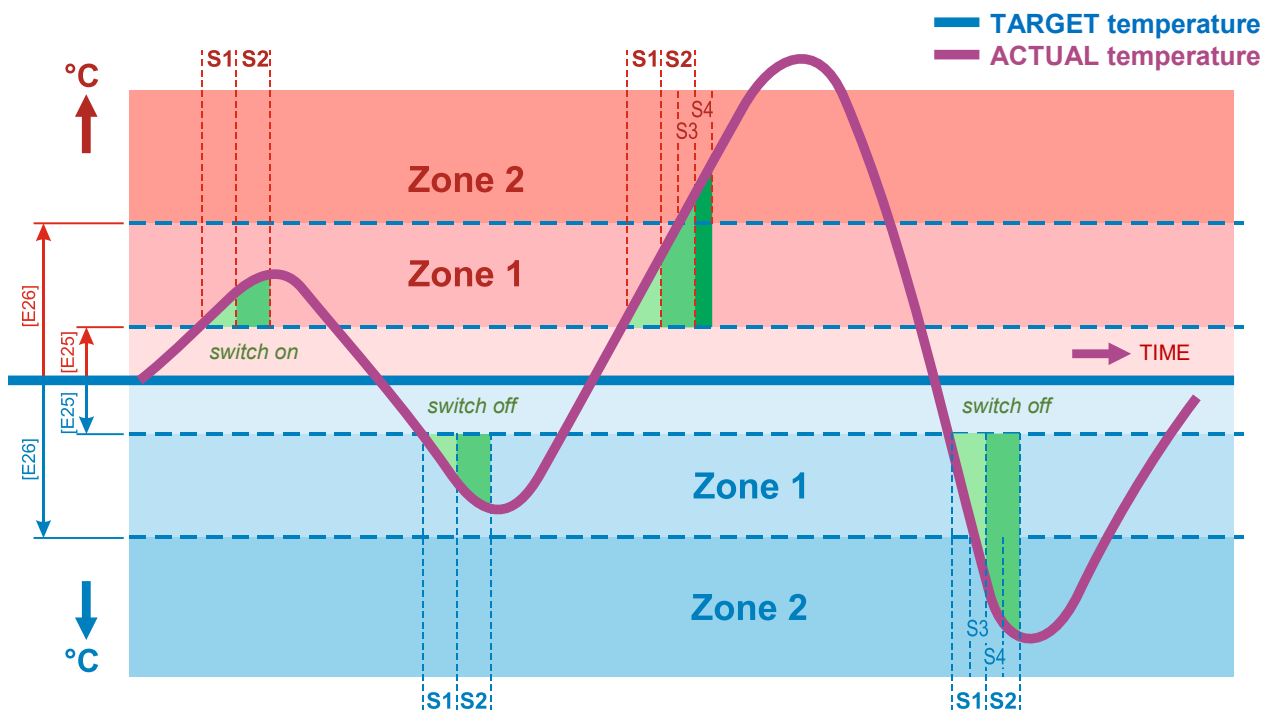
to section 5.5.6:   Explanation "Function block compound / zone control"

Parameterisation

Proceed as follows to parameterise the function block "compound / zone control":
- Use parameter [P10 / P20 / ... / P60] to set a compound control for the relay contacts (1..6) as follows:
  5: Assignment compound control
  6: Assignment prioritised compound control
     (this "relay output" is preferably switched ON)
- Assign compound / zone control to any control unit 1..4 [E21].
- Set maximum running time difference between non-prioritised compressors or heaters [E23]
- Set the temperature distance of zone 1 to the setpoint [E25]
- Set the temperature distance of zone 2 to the setpoint [E26]
- Set the time delay of the switching on or off of the switching stages (relay outputs) in zone 1 [E27].
- Set the time delay of the switching on or off of the switching stages (relay outputs) in zone 2 [E28].

Compressor or heating element rotation

If several compressor or heating elements are controlled via the compound / zone control, they are not switched on in sequence, there is an automatic switch-on rotation:
- the unit with the longest running time is switched OFF first,
- the unit with the shortest running time is switched ON first.

NOTICE

NOTE: If compressors or heating elements are parameterised as 'prioritised' via the parameters [P10 / P20 / ... / P60], a switch-on rotation does not take place!

5.5.7   Explanation „Function block counter module"

The function block "counter module" has 4 separate counters for
  -   operating hours and
  -   switch-on cycles

A relay output can be assigned to each of the 4 counters, whose total operating hours (total switch-on time) as well as the number of switch-on cycles are recorded and stored.

The counters are recorded by the second. The recorded data is saved every 6 minutes.

Visibility

The menu item OPERATING HOURS only appears in the main menu if this was allowed in parameter [E41] (or service-level was activated).

Delete counter

The values of each counter can be deleted by entering a password. The password for deleting the counter values is **4 3 2 1**

For all settings see section 7.9

5.6 The quick way to set parameters

The general rule is to determine the following before setting parameters:
- Which components (pumps, compressors, heaters, fans, alarms etc.) do you wish to control or regulate with the controller?
- Which factors (temperatures or external events) are decisive for controlling the connected appliances?
- How must the factors (inputs) be connected with the control components (outputs)?
- Are alarm or fault reporting functions to be defined?

Step 1:   **Activate required hardware components**

Parameterise connected temperature sensors 1 to 4 ['T' parameters] and perform sensor calibration.

Enable analog inputs/outputs ['A' parameters] and set them to the desired mode of operation.

Step 2:   **Parameterizing the controller blocks**

The connected sensors / analogue input are connected with the relevant control component via [‚R' parameters] and the type of control determined.

Step 3:   **Assignment of output relays / analogue output**

The relay outputs / analogue output are connected with the relevant control or functional components via [‚P' parameters].

Step 4:   **Assignment of the digital inputs**

The digital inputs are linked to the collective fault indicator or to the output relay via the ['D' parameters].

Step 5:   **Configuration of temperature alarms**

Via ['H' parameters] determine:

- the nature of the temperature alarms,

- assignment to the control components,

- optional additional functions,

- connection with the output relays.

Step 6:   **Configuration of a collective fault reporting contact**

A collective fault report can be triggered:

- by a temperature alarm [‚H' parameter] or

- a digital input [‚D' parameter].

5.6.1 Parameter Quick-Guide

INPUTS

F1
F2
F3
F4
analog

Dig. 1
Dig. 2
Dig. 3
Dig. 4
Dig. 5
Dig. 6

Function block Temp.alarm 1 **H11..H29**
Function block Temp.alarm 2 **H31..H49**
Function block Temp.alarm 3 **H51..H69**
Function block Temp.alarm 4 **H71..H89**

Controller block 1 **R1 .. R19**
Controller block 2 **R21 .. R39**
Controller block 3 **R41 .. R59**
Controller block 4 **R61 .. R79**
Altern. setpoint **R81 .. R87**

Function block digital input 1 **D10 .. D19**
Function block digital input 2 **D20 .. D29**
Function block digital input 3 **D30 .. D39**
Function block digital input 4 **D40 .. D49**
Function block digital input 5 **D50 .. D59**
Function block digital input 6 **D60 .. D69**

Collective-fault reporting-block

Function block comp./zone control. **E21 .. E28**
See section 5.5.6

Function block pump control **E12 .. E18**
See section 5.5.5

Counter module 1 **E45 .. E46**
Counter module 2 **E50 .. E51**
Counter module 3 **E55 .. E56**
Counter module 4 **E60 .. E61**
See section 5.5.7

OUTPUTS

analog **A50..A76**

K1 **P10..P19**
K2 **P20..P29**
K3 **P30..P39**
K4 **P40..P49**
K5 **P50..P59**
K6 **P60..P69**

6.   Menu navigation and operation

6.1 Operating states

The controller differentiates between three operating states:

OFF

The controller is completely switched off.
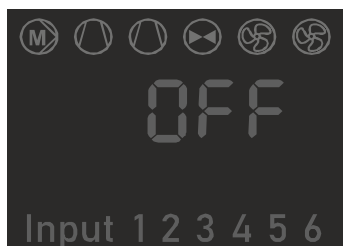
- es there is no temperature measurement
- there is no regulation
- the display is grayed out

STANDBY

The controller is in STANDBY mode.
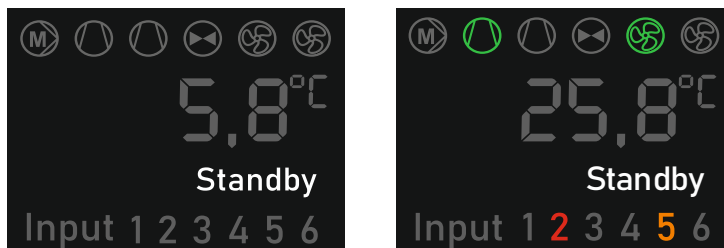
- temperature measurement works
- control is waiting for release by digital input
- the display is shown in gray => Standby is shown in white
- depending on the parameter setting 'Behaviour in standby', "relay inputs" or "digital inputs" are displayed and activated..

ON

The controller is fully switched on.
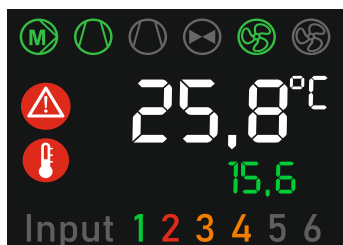
- temperature measurement works
- regulation works
- working level is shown on the display.

6.2 Working level

6.2.1 Standard display

The standard display is used to provide an overview of the system status.

Relay outputs →
Display properties can be set in different ways

Warning icon fault indicator →

Warning icon temperature alarm →

Digital inputs →
Display properties can be set in different ways

25.8°C
15.6
Input 1 2 3 4 5 6

Versatile adjustable:

← Temperature display 1
(Main temperature)

← Temperature display 2
(Auxiliary temperature or setpoint)

SET
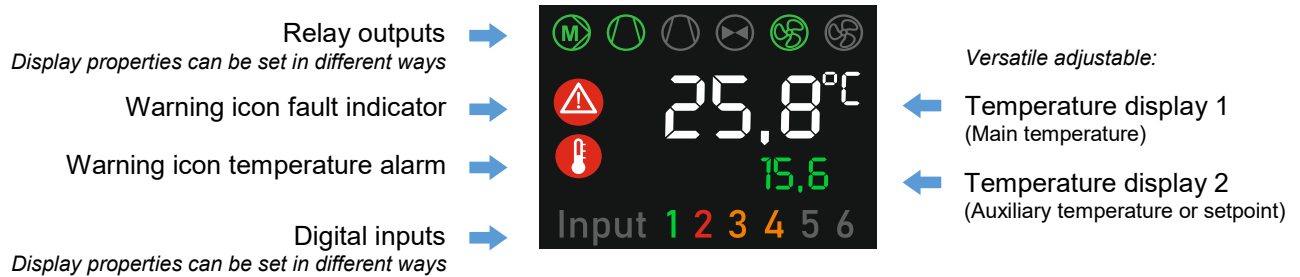
- Pressing the SET button takes you to the MAIN MENU

6.2.2 Display in the event of a sensor fault

In the event of a sensor fault, the defective sensor is shown on the display. If the defective sensor is replaced, the fault display is automatically reset.

F 1H
Brocken Sensor
Input 1 2 3 4 5 6

← Sensor fault display
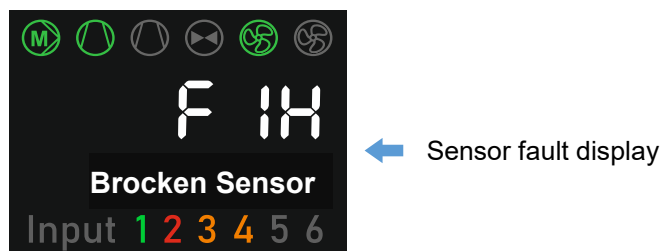
Display	Fault
F1L F2L F3L F4L	**Sensor short circuit:** The sensor or sensor cable is faulty and must be replaced or repaired. Parameter [T90 / T92 / T94 / T96] "Sensor correction" must then be adjusted at programming level.
F1H F2H F3H F4H	**Brocken sensor:** The sensor or sensor cable is faulty and must be replaced or repaired. Parameter [T90 / T92 / T94 / T96] "Sensor correction" must then be adjusted at programming level.
F1F F2F F3F F4F	**Measurement range exceeded** The connected sensor can only record temperatures between -50 and +150°C or between -50 and +400°C.

The number indicates the corresponding temperature sensor.

6.3 Selecting and changing parameters in general

Current menu ➡

Menu name		
C1	Setpoint 1	17.5
C2	Setpoint 2	15.0
C3	Setpoint 3	15.5
C21	Hysteresis 1	12.0
C22	Hysteresis 2	15.0
C98	Software V	1.5
	1/1	

Parameter ➡

Side X of Y ➡

⬅ Set value
(Arrow = further submenu)

⬅ marked value for editing
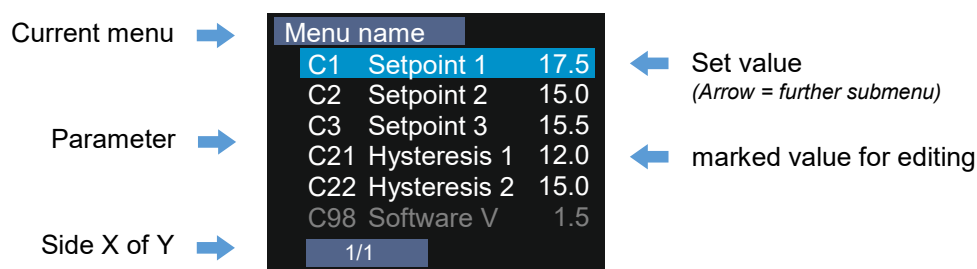
Select and edit parameters:
(Parameters displayed in gray CANNOT be edited)
- Use the ARROW KEYS to select the desired parameter.
  (If the menu consists of several pages, the parameter display automatically jumps to the next page).
- Press the SET button: The selected parameter has a white background.
- Use the ARROW KEYS to set the desired value.

Save and return:
- Press the SET button: The changed value is saved

DO NOT save and go back:
- Press the BACK ARROW key:
  The parameter is exited - the changed value is <u>NOT</u> saved

NOTICE

If neither the SET nor the BACK ARROW key is pressed for 1 minute, the display jumps back to the working level WITHOUT SAVING THE CHANGED PARAMETER!

6.4 Main menu

Main menu	
User menu	→
Fault memory	→
Service	🔒
Device info	→
Operating hours	→
DE / EN	DE
1/1	

← to the user menu
← to the fault memory
← to the service menu *
← to the device infos
← to the hour counters
← Switching display language

locked - only after entering a password
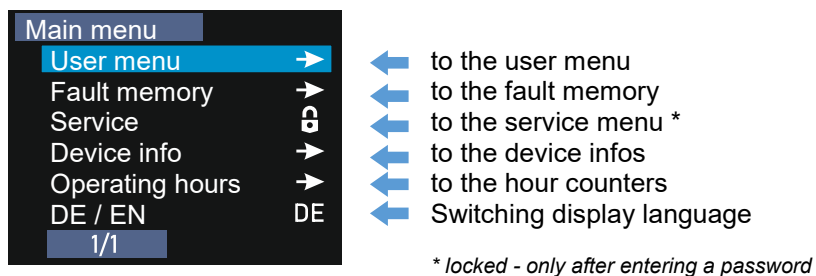
Five submenus and the change of the display language can be selected via the MAIN MENU:

User menu   *see section 6.5*

The user menu is accessible to the end user. Here - depending on the configuration - all parameters can be viewed or changed (without entering a password).

Fault memory   *see section 6.6*

Display of the last max. 63 fault messages (if available).

Service menu   *see section 6.7*

The service menu is used by the plant engineer for the basic configuration of the controller.

Here, display options are set, controller functions such as alarms, function of the digital inputs, function of relays etc. are determined and the hardware of the controller is configured.

NOTICE

Since interventions by the end customer can result in dangerous functional changes (which do not necessarily have to be directly noticeable), access to the service menu can be blocked by entering a password.

Device info   *see section 6.8*

The device info shows the type and version of the multi-channel temperature controller and - if connected - also of the IO expansion module.

Operating hours / event counter   *see section 5.5.7*

The controller has 4 integrated operating hours / event counters. Each of these counters records the switch-on cycles and the total switch-on time for the assigned relay output.

The menu is only accessible to the end customer if this was allowed in parameter [E41].

6.4.1 DE/EN -> Switching of the display language

Proceed as follows:
- Select DE/EN with the ARROW KEYS.
- Press the SET key: the display language is switched from German to English or vice versa.

6.5 User menu

In the ['B' parameters] (section 7.11), the plant manufacturer specifies which parameters are to be displayed or editable for the end customer in the user menu..

This is how you can set for each parameter:
- 0: not visible
- 1: visible, not adjustable (parameter is displayed 'GRAY')
- 2: visible and adjustable

User menu		
C1	Setpoint 1	17.5
C2	Setpoint 2	15.0
C3	Setpoint 3	15.5
C4	Setpoint 4	12.0
C6	Alt. setpoint	15.0
C7	SW. toggle	1
	1/3	

User menu		
C21	Hysteresis 1	17.5
C22	Hysteresis 2	15.0
C23	Hysteresis 3	15.5
C24	Hysteresis 4	12.0
C25	Dist. zone 1	0.3
C26	Dist. zone 2	0.6
	2/3	

User menu		
C40	U-T. alarm	-3.0
C41	O-T. alarm	3.0
C42	U-T. alarm	-3.0
C43	O-T. alarm	3.0
C98	Software V	1.4
	3/3	

Select and edit parameters see section 6.3.

6.6 Display / delete fault memory

A prerequisite for saving faults is the corresponding parameterization
- Digital inputs 1..'x'   -> parameter [D18, D28 .. D68]
- Sensor inputs   -> if sensors are parameterised, this input is automatically monitored
- Temperature alarms 1..4 -> parameter [H28 / H48 / H68 / H88]
- Pump module   -> parameter [E18]

Display fault memory:

The last 63 fault messages are stored in the device's internal fault memory and can be read out as follows:
- Select "Fault memory" in the main menu
- Press the SET button: The fault list with the frequency of the corresponding faults is displayed.

Fault memory		
01:	Fault 15	1x
02:	Fault 11	1x
03:	Fault 05	1x
04:	Fault 20	1x
05:	Fault 21	1x
06:	Fault 20	1x
1/2		

Fault memory		
07:	Fault 13	1x
08:	Fault 17	1x
09:	Fault 04	1x
10:	Fault 12	1x
2/2		

Display faults in detail:
- Select the corresponding fault and press the SET button:
  The fault is displayed in detail.

Fault memory	
No. 52	
Sensor short circuit	
Sensor 1	
Number	1
1/1	

An overview of the fault numbers can be found on the next page.

- You can now use the arrow keys to scroll through the faults.

- Press the RETURN key: Back to the fault overview
- If no button is pressed for a while: Back to the standard display.

to section **Fehler! Verweisquelle konnte nicht gefunden werden.**:   Fault memory

List of fault displays:

Fault => digital inputs

01 = digital input 1	=> Fault
02 = digital input 2	=> Fault
03 = digital input 3	=> Fault
04 = digital input 4	=> Fault
05 = digital input 5	=> Fault
06 = digital input 6	=> Fault

Fault => Temperature alarm 1 to 4

21 = Temp. alarm 1	=> Under cut
22 = Temp. alarm 1	=> Overstepping
23 = Temp. alarm 2	=> Under cut
24 = Temp. alarm 2	=> Overstepping
25 = Temp. alarm 3	=> Under cut
26 = Temp. alarm 3	=> Overstepping
27 = Temp. alarm 4	=> Under cut
28 = Temp. alarm 5	=> Overstepping

Fault => Pump module

31 = pump failure	=> Fault

Fault => Sensor- and analog inputs

51 = Broken sensor	=> Sensor 1
52 = Sensor short circuit	=> Sensor 1
53 = Overstepping of the range	=> Sensor 1
54 = Broken sensor	=> Sensor 2
55 = Sensor short circuit	=> Sensor 2
56 = Overstepping of the range	=> Sensor 2
57 = Broken sensor	=> Sensor 3
58 = Sensor short circuit	=> Sensor 3
59 = Overstepping of the range	=> Sensor 3
60 = Broken sensor	=> Sensor 4 (optional)
61 = Sensor short circuit	=> Sensor 4 (optional)
62 = Overstepping of the range	=> Sensor 4 (optional)
63 = Cable break	=> analogue input 1 (optional)
64 = Cable break	=> analogue input 2 (optional)

Delete fault memory completely:
The fault messages stored in the internal fault memory can be completely deleted as follows:
- Select "SERVICE" in the main menu.
- Select "System Settings".
- Select "General Settings".
- Enter the code >2 3 4 5< in parameter U23 "Delete fault".
- Press the SET button => the fault memory is completely erased.

6.7 Service menu

All functions and display properties of the controller can be parameterized via the service menu.

6.7.1 Service menu -> Password entry

NOTICE

Since interventions by the end customer can result in dangerous functional changes (which do not necessarily have to be directly noticeable), access to the service menu can be blocked by entering a password.

As subsequent interference by the end user (after configuration) can result in dangerous changes that are not immediately apparent, access to the configuration level is made more difficult by means of coding (level codes).

In the factory setting, the setting "0 0 0 0" is stored here. This disables the password query!

Main menu	
User menu	→
Fault memory	→
Service	🔒
Device info	→
Operating hours	→
DE/EN	DE
1/1	
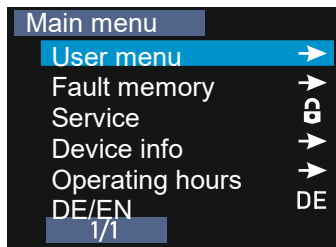
Set up a password query:
- Select "Service" in the main menu and press the SET button.
- „Select "System settings" and press the SET button.

Service	
Control functions	→
Temp. Alarms	→
Digital inputs	→
Relay outputs	→
Analogue I/O	→
Sensor config.	→
1/2	

Service	
Function modules	→
System settings	→
User menu config.	→
2/2	
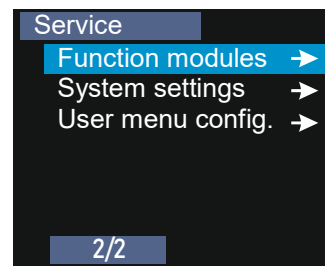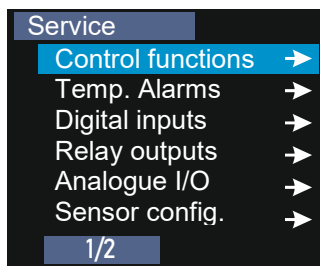
- Select "General Settings" and press the SET button.

System settings	
Display settings	→
General Settings	→
Modbus settings	→
Modbus releases	→
	→
	→
1/2	
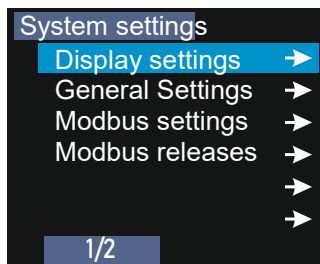
- Select "U25 Password" and press the SET button.

General settings	
U20 Language set.	→
U21 Expert mode	→
U23 Delete fault	→
U25 Password	→
U30 Time change	→
	→
1/2	

```
General settings
  U25 Password        0000



         1/1
```
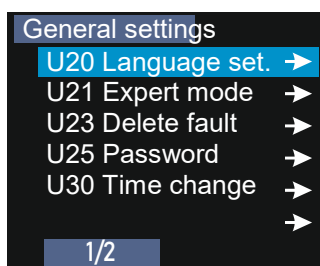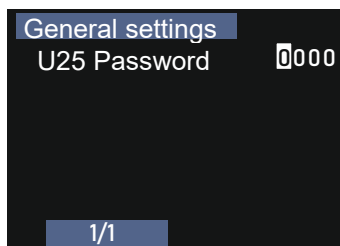
- '0 0 0 0' appears - the first zero flashes.
- Use the arrow keys to enter the first digit of the password.
- Press SET - the 2nd zero flashes.
- Use the arrow keys to enter the second digit of the password.
- Enter the third and fourth digit accordingly and confirm with SET:
  The "System settings" menu appears again".

If a password was stored:

If the service menu is unlocked with this password, this level remains unlocked for 30 minutes. During this time, the service menu can be exited and called up again without having to re-enter a password.

⚠ **ATTENTION**

Attention: Unauthorized persons can change the settings of the controller within this half hour!

6.7.2   Service menu -> Control functions ("R" parameters)

For a detailed description of the parameters, see section 7.3
- Block 1   -> Input of all control parameters for control block 1
- Block 2   -> Input of all control parameters for control block 2
- Block 3   -> Input of all control parameters for control block 3
- Block 4   -> Input of all control parameters for control block 4
- Altern. setpoint   -> Input of all control parameters for the altern. setpoint

6.7.3   Service menu -> Temperature alarms ("H" parameters)

For a detailed description of the parameters, see section 7.4
- Temp. alarm 1   -> Input of all control parameters for temp. alarm 1
- Temp. alarm 2   -> Input of all control parameters for temp. alarm 2
- Temp. alarm 3   -> Input of all control parameters for temp. alarm 3
- Temp. alarm 4   -> Input of all control parameters for temp. alarm 4

to section 6.7: Service menu

6.7.4 Service menu -> Digital inputs ("D" parameters)

For a detailed description of the parameters, see section 7.5
- Off button   -> Selection of the function for the OFF button
- Special functions   -> input special functions
- Display settings   -> Enter the display settings
- Input 1   -> Enter all parameters for input 1
- Input 2   -> Enter all parameters for input 2
- Input …   -> Enter all parameters for input …
- Input 6   -> Enter all parameters for input 6

6.7.5 Service menu -> Relay outputs ("P" parameters)

For a detailed description of the parameters, see section 7.6
- Oppos. OnDela   -> Input Relay + Delay Time
- Display settings   -> Enter the display settings
- Relay 1   -> Enter all parameters for relay 1
- Relay 2   -> Enter all parameters for relay 2
- Relay ...   -> Input of all parameters for relay ...
- Relay 6   -> Enter all parameters for relay 6

6.7.6 Service menu -> Analog I/O ("A" parameters)

For a detailed description of the parameters, see section 7.7
- Analog input   -> Input of all parameters for 'Analog input'
- Analog output   -> Input of all parameters for 'Analog output'

6.7.7 Service menu -> Sensor configuration ("T" parameters)

For a detailed description of the parameters, see section 7.8
- General settings   -> input of sensor type
- Sensor 1 setting   -> input of the setting parameters for 'sensor 1'
- Sensor 2 setting   -> input of setting parameters for 'sensor 2'
- Sensor 3 setting   -> input of setting parameters for 'sensor 3'
- Sensor 4 setting   -> input of setting parameters for 'sensor 4' (optional)
- Calibrat. sensor 1 -> input actual and correction value for 'sensor 1'
- Calibrat. sensor 2 -> input actual and correction value for 'sensor 2'
- Calibrat. sensor 3 -> input actual and correction value for 'sensor 3'
- Calibrat. sensor 4 -> input actual and correction value for 'sensor 4' (optional)

6.7.8 Service menu -> Function modules ("E" parameters)

For a detailed description of the parameters, see section 7.9
- Pump module   -> Entry of all parameters for the pump module
- Compound control   -> Entry of all parameters for compound control
- Counter module   -> Entry of all parameters for the operating hours counter

to section 6.7:   Service menu

6.7.9 Service menu -> System settings ("U" parameters)

For a detailed description of the parameters, see section 7.10
- Display settings   -> Enter the standard display and key assignment
- I/O module set.   -> Enter configuration settings (optional)
- Modbus settings   -> Entry of Modbus settings
- Modbus releases   -> Entry of Modbus releases

6.7.10 Service menu -> User menu configuration ("B" parameters)

See section 7.11

Configuration setpoints
- Setpoint C1   -> Input of setpoint C1 including input limits below/above
- Setpoint C2   -> Input of setpoint C2 including input limits below/above
- Setpoint C3   -> Input of setpoint C3 including input limits below/above
- Setpoint C4   -> Input of setpoint C4 including input limits below/above
- Alt. setpoint C6   -> Input of altern. setpoint C6 incl. input limits below/above
- SP changeover C7 -> Input setpoint changeover C7

Configuration hysteresis
- Hysteresis C21   -> Input of hysteresis C21 incl. input limits below/above
- Hysteresis C22   -> Input of hysteresis C22 incl. input limits below/above
- Hysteresis C23   -> Input of hysteresis C23 incl. input limits below/above
- Hysteresis C24   -> Input of hysteresis C24 incl. input limits below/above

Configuration compound zone control *see section 5.5.6*
- Dist. zone1 C25   -> Input temperature distance zone 1 (C25)
                              including input limits below/above
- Dist. zone2 C26   -> Input temperature distance zone 2 (C26)
                              including input limits below/above

Configuration temperature alarms*
- U-T. alarm C40   -> Input under temperature alarm C40 incl. input limits b./a.
- O-T. alarm C41   -> Input over temperature alarm C41 incl. input limits b./a.
- U-T. alarm C42   -> Input under temperature alarm C42 incl. input limits b./a.
- O-T. alarm C43   -> Input over temperature alarm C43 incl. input limits b./a.

* The setting of temperature alarms in the user menu only possible for temperature alarms 1 + 2.

6.8 Device info

```
Device info
 MRFC-3-005  v1.9
 ES-IO-001  v0.5


                    1


      1/1
```
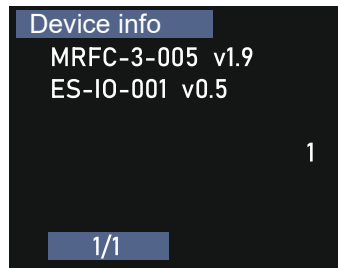
The device information shows the type and version of the multi-channel temperature controller and - if connected - also of the IO expansion module.

7. Parameter lists

7.1 Overview parameter levels

User menu   („C" parameters)   *Section 7.2*
- Temperature settings
- Hysteresis Settings
- Settings for compound / zone control
- Alarm settings

Control functions   („R" parameters)   *Section 7.3*
- Settings control modules 1 - 4
- Settings alternative setpoint

Temperature alarms   („H" parameters)   *Section 7.4*
- Settings temperature alarms 1 - 4

Digital inputs   („D" parameters)   *Section 7.5*
- ON/OFF button
- Special functions
- Settings display properties
- Settings digital inputs 1 - 6

Relay outputs   („P" parameters)   *Section 7.6*
- Settings display properties
- Settings relay contacts 1 - 6

Analog I/O   („A" parameters)   *Section 7.7*
- Settings analog input 1 + 2
- Settings analog outputs 1 + 2

Configuration temperature sensors („T" parameters)   *Section 7.8*
- Settings General settings
- Settings for temperature sensors 1 - 4
- Calibration of sensors 1 - 4

Function modules („E" parameters)   *Section 7.9*
- Pump module
- Compound / zone control
- Counter module

System settings („U" parameters)   *Section 7.10*
- Display settings
- I/O module settings -> Enter configuration settings (optional)
- System configuration
- Modbus interface setting
- Modbus permissions / limitations

Configuration customer menu („B" parameters)   *Section 7.11*
- Configuration setpoints
- Configuration hysteresis
- Configuration compound / zone control
- Configuration of temperature alarms 1 + 2

7.2 User menu („C" parameters)

The user menu is used to provide the end customer with a customised operating menu. Depending on which parameters are to be visible / editable for the end customer, the plant engineer can show these in the 'B' parameters! Furthermore, the input limits for the 'C' parameters (user menu) can also be defined in the 'B' parameters.

NOTICE

The settings shown here refer to setting values in the following parameter list. If setting values are changed here, the corresponding 'basic parameter' is changed simultaneously!

Example: Mirror parameter "C1" points to basic parameter „R5"

		Description	Range	Default
		Temperature settings		
R5	C1	Setpoint control block 1	-50,0..400,0°C	15,0
R25	C2	Setpoint control block 2	-50,0..400,0°C	15,0
R45	C3	Setpoint control block 3	-50,0..400,0°C	15,0
R65	C4	Setpoint control block 4	-50,0..400,0°C	15,0
R85	C6	Alternative setpoint (for control block 1..4) *Example: A second (alternative) setpoint C6 is defined for night-time reduction of a heating system. This is switched over, for example, by a digital input or a button.*	-50,0..400,0° C	15,0
R89	C7	Manual changeover of alternative setpoint *Type of switching see parameter [R86]* 0: deactivated 1: activated	0..1	0

		Hysteresis setting		
		Hysteresis setting		
R10	C21	Hysteresis control block 1	0,1..99,9K	1,0
R30	C22	Hysteresis control block 2	0,1..99,9K	1,0
R50	C23	Hysteresis control block 3	0,1..99,9K	1,0
R70	C24	Hysteresis control block 4	0,1..99,9K	1,0

		Settings for compound / zone control		
		Settings for compound / zone control *see also section 5.5.6*		
E25	C25	Temperature distance zone 1	0,1..99,9K	0,3
E26	C26	Temperature distance zone 2	0,1..99,9K	0,6

		Alarm settings *		
		Alarm settings *		
H17	C40	Alarm limit for temperature alarm 1 below	-50,0..400,0° C	-3,0
H18	C41	Alarm limit for temperature alarm 1 above	-50,0..400,0° C	3,0
H37	C42	Alarm limit for temperature alarm 2 below	-50,0..400,0° C	-5,0
H38	C43	Alarm limit for temperature alarm 2 above *In the case of relative limits, the values are to be viewed in Kelvin.*	-50,0..400,0° C	5,0

* Temperature alarm 3+4 cannot be displayed in the user menu.

		Software version		
		Software version		
	C98	Software version Displays the installed software version. Used for communication with the service technician.		

7.3 Control functions („R" parameters)

		Description	Range	Default
		Control block 1		
	R1	Activation / type of control 0: deactivated 1: two-point control 2: PID control clocked 3: PID analogue	0…3	1
	R2	Switching sense 0: heating function 1: cooling function	0…1	1
	R3	Actual value transmitter 1..4: Sensor 1.4 5: analog in 1 6: analog in 2	1…6	1
	R4	Setpoint adjuster 0: Fixed value 1..4: Sensor 1-4 5: analog In 1 6: analog In 2 7: corresponds to setting '0' = fixed value 8: setpoint of the control block 2 9: setpoint of the control block 3 10: setpoint of the control block 4	0…10	0
C1	**R5**	Setpoint control block 1	-50…400°C	15,0

		Description	Range	Default
	R7	Lower limit temperature Lower limiting of difference temperature control. (Switchover to absolute value control when reached).	-50…400°C	-50
	R8	Upper limit temperature Upper limiting of difference temperature control. (Switchover to absolute value control when reached).	-50…400°C	400

		Description	Range	Default
C21	**R10**	Hysteresis	0,1…99,9 K	1,0
	R11	Hysteresis mode 0: symmetrical 1: one-sided	0…1	1
	R12	Resetting the two-point control function or stopping the PID control integration in the event of a fault (assigned output is switched off) 0: deactivated 1: Two-point control is reset 2: Integration PID control is stopped 3: like 1 + 2	0...3	0

Setting parameters for a PID control system is very complex and requires a detailed knowledge of control engineering.

Incorrect parameter settings may cause undesirable malfunctions leading to damage to connected plant components.

	Description	Range	Default
R15	Xp (P part = proportional range)	0,1…99,9 K	10,0
R16	Tn (I part = reset time)	0…999 sec.	0
R17	Tv (D part = hold-back time)	0…999 sec.	0
R18	Ta (cycle time)	1,0…999 sec.	5,0
R19	Minimum on/off time in clocked PID operation	0,1…2,0 sec.	0,5

Parameter is displayed (if set in 'B' parameters) in user menu

to section 7.3: Control functions („R" parameters)

		Description	Range	Default
		Control block 2		
	R21	Activation / type of control 0: deactivated 1: two-point control 2: PID control clocked 3: PID analogue	0…3	0
	R22	Switching sense 0: heating function 1: cooling function	0…1	1
	R23	Actual value transmitter 1..4: Sensor 1.4 5: analog in 1 6: analog in 2	1…6	1
	R24	Setpoint adjuster 0: Fixed value 1..4: Sensor 1-4 5: analog In 1 6: analog In 2 7: corresponds to setting '0' = fixed value 8: setpoint of the control block 2 9: setpoint of the control block 3 10: setpoint of the control block 4	0…10	0
C2	R25	Setpoint control block 2	-50…400°C	15,0

	R27	Lower limit temperature Lower limiting of difference temperature control. (Switchover to absolute value control when reached).	-50…400°C	-50
	R28	Upper limit temperature Upper limiting of difference temperature control. (Switchover to absolute value control when reached).	-50…400°C	400

C22	R30	Hysteresis	0,1…99,9 K	1,0
	R31	Hysteresis mode 0: symmetrical 1: one-sided	0…1	1
	R32	Resetting the two-point control function or stopping the PID control integration in the event of a fault (assigned output is switched off) 0: deactivated 1: Two-point control is reset 2: Integration PID control is stopped 3: like 1 + 2	0...3	0

Setting parameters for a PID control system is very complex and requires a detailed knowledge of control engineering.

Incorrect parameter settings may cause undesirable malfunctions leading to damage to connected plant components.

	Description	Range	Default
R35	Xp (P part = proportional range)	0,1…99,9 K	10,0
R36	Tn (I part = reset time)	0…999 sec.	0
R37	Tv (D part = hold-back time)	0…999 sec.	0
R38	Ta (cycle time)	1,0…999 sec.	5,0
R39	Minimum on/off time in clocked PID operation	0,1…2,0 sec.	0,5

Parameter is displayed (if set in 'B' parameters) in user menu

to section 7.3: Control functions ("R" parameters)

		Description	Range	Default
		Control block 3		
	R41	Activation / type of control 0: deactivated 1: two-point control 2: PID control clocked 3: PID analogue	0…3	0
	R42	Switching sense 0: heating function 1: cooling function	0…1	1
	R43	Actual value transmitter 1..4: Sensor 1.4 5: analog in 1 6: analog in 2	1…6	1
	R44	Setpoint adjuster 0: Fixed value 1..4: Sensor 1-4 5: analog In 1 6: analog In 2 7: corresponds to setting '0' = fixed value 8: setpoint of the control block 2 9: setpoint of the control block 3 10: setpoint of the control block 4	0…10	0
C3	R45	Setpoint control block 3	-50…400°C	15,0

	Description	Range	Default
R47	Lower limit temperature Lower limiting of difference temperature control. (Switchover to absolute value control when reached).	-50…400°C	-50
R48	Upper limit temperature Upper limiting of difference temperature control. (Switchover to absolute value control when reached).	-50…400°C	400

		Description	Range	Default
C23	R50	Hysteresis	0,1…99,9 K	1,0
	R51	Hysteresis mode 0: symmetrical 1: one-sided	0…1	1
	R52	Resetting the two-point control function or stopping the PID control integration in the event of a fault (assigned output is switched off) 0: deactivated 1: Two-point control is reset 2: Integration PID control is stopped 3: like 1 + 2	0…3	0

Setting parameters for a PID control system is very complex and requires a detailed knowledge of control engineering.

Incorrect parameter settings may cause undesirable malfunctions leading to damage to connected plant components.

	Description	Range	Default
R55	Xp (P part = proportional range)	0,1…99,9 K	10,0
R56	Tn (I part = reset time)	0…999 sec.	0
R57	Tv (D part = hold-back time)	0…999 sec.	0
R58	Ta (cycle time)	1,0…999 sec.	5,0
R59	Minimum on/off time in clocked PID operation	0,1…2,0 sec.	0,5

Parameter is displayed (if set in 'B' parameters) in user menu

to section 7.3: Control functions   („R" parameters)

		Description	Range	Default
		Control block 4		
	R61	Activation / type of control 0: deactivated 1: two-point control 2: PID control clocked 3: PID analogue	0…3	0
	R62	Switching sense 0: heating function 1: cooling function	0…1	1
	R63	Actual value transmitter 1..4: Sensor 1.4 5: analog in 1 6: analog in 2	1…6	1
	R64	Setpoint adjuster 0: Fixed value 1..4: Sensor 1-4 5: analog In 1 6: analog In 2 7: corresponds to setting '0' = fixed value 8: setpoint of the control block 2 9: setpoint of the control block 3 10: setpoint of the control block 4	0…10	0
C4	**R65**	Setpoint control block 4	-50…400°C	15,0
	R67	Lower limit temperature Lower limiting of difference temperature control. (Switchover to absolute value control when reached).	-50…400°C	-50
	R68	Upper limit temperature Upper limiting of difference temperature control. (Switchover to absolute value control when reached).	-50…400°C	400
C24	**R70**	Hysteresis	0,1…99,9 K	1,0
	R71	Hysteresis mode 0: symmetrical 1: one-sided	0…1	1
	R72	Resetting the two-point control function or stopping the PID control integration in the event of a fault (assigned output is switched off) 0: deactivated 1: Two-point control is reset 2: Integration PID control is stopped 3: like 1 + 2	0...3	0
	R75	Xp (P part = proportional range)	0,1…99,9 K	10,0
	R76	Tn (I part = reset time)	0…999 sec.	0
	R77	Tv (D part = hold-back time)	0…999 sec.	0
	R78	Ta (cycle time)	1,0…999 sec.	5,0
	R79	Minimum on/off time in clocked PID operation	0,1…2,0 sec.	0,5

Setting parameters for a PID control system is very complex and requires a detailed knowledge of control engineering.

Incorrect parameter settings may cause undesirable malfunctions leading to damage to connected plant components.

Parameter is displayed (if set in 'B' parameters) in user menu

to section 7.3: Control functions   („R" parameters)

		Description	Range	Default
		Alternative setpoint		
	R81	Activation 0: deactivated 1..4: affects the control blocks 1..4	0…4	0
	R82	Operating mode 1: absolute value 2: Additive to the setpoint	1…2	1

		Description	Range	Default
	R84	Alternative setpoint adjuster 0: fixed value from R85 1..4: sensor 1..4 + offset from R85 5: analog in 1 + offset from R85 6: analog in 2 + offset from R85	0…6	0
C6	**R85**	Alternative setpoint (guide value / offset)	-50…400°C	15,0
	R86	Type of switching 0: via a digital input [R87] 1: via the "Arrow UP" button (toggle) 2: switching via parameter [C7 or R89]	0...2	0
	R87	Toggle assignment of digital input 1..6: switching via digital input 1..6	1…6	1
C7	**R89**	Manual switching via parameters 0: deactivated 1: activated	0...1	0

Parameter is displayed (if set in 'B' parameters) in user menu

7.4 Temperature alarms   („H" parameters)

		Description	Range	Def.
		Temperature alarm 1		
	H11	Alarm type 0: deactivated 1: limit alarm 2: over temperature alarm 3: low temperature alarm	0…3	0
	H13	Actual value transmitter 1..4: sensor 1-4 5: analog in 1 6: analog in 2	1…6	1
	H14	Limit value switch 0: fixed value 1: relative to setpoint control block 1 2: relative to setpoint control block 2 3: relative to setpoint control block 3 4: relative to setpoint control block 4	0…4	1

		Description	Range	Def.
C40	H17	Lower alarm limit	-50°C..400°C	-3,0
C41	H18	Upper alarm limit	-50°C..400°C	3,0
	H20	Alarm hysteresis	0,1..20,0 K	0,5

	Description	Range	Def.
H22	Start delay This delay time is restarted at: - turn on the controller - manual reset of a pending error - release from standby (depending on parameterization)	0..60 min	1
H23	Fault display delay Time that an fault event must be pending before it is displayed	0..999 sec.	0
H26	Behaviour in standby 0: Alarm is disabled 1: Alarm is disabled, when released, an auto-reset occurs with a start delay 2: Alarm is independent of standby 3: Alarm is independent of standby, when released, an auto-reset occurs with a start delay	0…3	0
H27	Output Shutdown (see section 9.2) 0: deactivated 1..1023: Shutdown of the selected outputs	0…1023 *	0
H28	Fault message activation and error memory 0: off 1: Alarm is passed on to the collective fault indicator, but not saved 2: Alarm is only saved, no collective fault message 3: Alarm is passed on to the collective fault indicator and saved	0…3	2
H29	Display and reset properties see section 9.2	0…7	1

* the configuration for the relevant outputs is entered here in coded form. See section 9.3

Parameter is displayed (if set in 'B' parameters) in user menu

to section 7.4: Temperature alarms („H" parameters)

	Description	Range	Def.
	Temperature alarm 2		
H31	Alarm type 0: deactivated 1: limit alarm 2: over temperature alarm 3: low temperature alarm	0…3	0
H33	Actual value transmitter 1..4: sensor 1-4 5: analog in 1 6: analog in 2	1…6	1
H34	Limit value switch 0: fixed value 1: relative to setpoint control block 1 2: relative to setpoint control block 2 3: relative to setpoint control block 3 4: relative to setpoint control block 4	0…4	1

		Description	Range	Def.
C42	H37	Lower alarm limit	-50°C…400°C	-5,0
C43	H38	Upper alarm limit	-50°C…400°C	5,0
	H40	Alarm hysteresis	0,1…20,0 K	0,5

	Description	Range	Def.
H42	Start delay This delay time is restarted at: - turn on the controller - manual reset of a pending error - release from standby (depending on parameterization)	0…60 min	1
H43	Fault display delay Time that an fault event must be pending before it is displayed	0…999 sec.	0
H46	Behaviour in standby 0: Alarm is disabled 1: Alarm is disabled, when released, an auto-reset occurs with a start delay 2: Alarm is independent of standby 3: Alarm is independent of standby, when released, an auto-reset occurs with a start delay	0…3	0
H47	Output Shutdown (see section 9.2) 0: deactivated 1..1023: Shutdown of the selected outputs	0…1023 *	0
H48	Fault message activation and error memory 0: off 1: Alarm is passed on to the collective fault indicator, but not saved 2: Alarm is only saved, no collective fault message 3: Alarm is passed on to the collective fault indicator and saved	0…3	2
H49	Display and reset properties see section 9.2	0…7	1

* the configuration for the relevant outputs is entered here in coded form. See section 9.3

Parameter is displayed (if set in 'B' parameters) in user menu

to section 7.4: Temperature alarms („H" parameters)

	Description	Range	Def.
	Temperature alarm 3		
H51	Alarm type 0: deactivated 1: limit alarm 2: over temperature alarm 3: low temperature alarm	0…3	0
H53	Actual value transmitter 1..4: sensor 1-4 5: analog in 1 6: analog in 2	1…6	1
H54	Limit value switch 0: fixed value 1: relative to setpoint control block 1 2: relative to setpoint control block 2 3: relative to setpoint control block 3 4: relative to setpoint control block 4	0…4	1

H57	Lower alarm limit	-50°C…400°C	-5,0
H58	Upper alarm limit	-50°C…400°C	5,0
H60	Alarm hysteresis	0,1…20,0 K	0,5

H62	Start delay This delay time is restarted at: - turn on the controller - manual reset of a pending error - release from standby (depending on parameterization)	0…60 min	1
H63	Fault display delay Time that an fault event must be pending before it is displayed	0…999 sec.	0

H66	Behaviour in standby
	0: Alarm is disabled
	1: Alarm is disabled, when released, an auto-reset occurs
	    with a start delay
	2: Alarm is independent of standby
	3: Alarm is independent of standby, when released, an
	    auto-reset occurs with a start delay
		0…3	0

H67	Output Shutdown (see section 9.2) 0: deactivated 1..1023: Shutdown of the selected outputs	0…1023 *	0

H68	Fault message activation and error memory
	0: off
	1: Alarm is passed on to the collective fault indicator, but
	    not saved
	2: Alarm is only saved, no collective fault message
	3: Alarm is passed on to the collective fault indicator
	    and saved
		0…3	2

H69	Display and reset properties see section 9.2	0…7	1

the configuration for the relevant outputs is entered here in coded form. See section 9.3

7. Parameter lists

to section 7.4: Temperature alarms ("H" parameters)

	Description	Range	Def.
	Temperature alarm 4		
H71	Alarm type 0: deactivated 1: limit alarm 2: over temperature alarm 3: low temperature alarm	0…3	0
H73	Actual value transmitter 1..4: sensor 1-4 5: analog in 1 6: analog in 2	1…6	1
H74	Limit value switch 0: fixed value 1: relative to setpoint control block 1 2: relative to setpoint control block 2 3: relative to setpoint control block 3 4: relative to setpoint control block 4	0…4	1

H77	Lower alarm limit	-50°C…400°C	-5,0
H78	Upper alarm limit	-50°C…400°C	5,0
H80	Alarm hysteresis	0,1…20,0 K	0,5

H82	Start delay This delay time is restarted at: - turn on the controller - manual reset of a pending error - release from standby (depending on parameterization)	0…60 min	1
H83	Fault display delay Time that an fault event must be pending before it is dis-played	0…999 sec.	0
H86	Behaviour in standby 0: Alarm is disabled 1: Alarm is disabled, when released, an auto-reset occurs with a start delay 2: Alarm is independent of standby 3: Alarm is independent of standby, when released, an auto-reset occurs with a start delay	0…3	0
H87	Output Shutdown (see section 9.2) 0: deactivated 1..1023: Shutdown of the selected outputs	0…1023 *	0
H88	Fault message activation and error memory 0: off 1: Alarm is passed on to the collective fault indicator, but not saved 2: Alarm is only saved, no collective fault message 3: Alarm is passed on to the collective fault indicator and saved	0…3	2
H89	Display and reset properties see section 9.2	0…7	1

* the configuration for the relevant outputs is entered here in coded form. See section 9.3

7.5 Digital inputs („D" parameters)

	Description	Range	Default
	ON/OFF button		
D1	Function 0: deactivated 1: The controller is switched on or off by using the OFF button 2: Assigned relay [P10, P20…P60 = setting 13:] is switched on or off via the OFF button	0…2	1

	Description	Range	Default
	Special functions		
D3	Standby release via digital input 0: deactivated 1..6: connected to digital input 1..6	0…6	0
D4	Function „RelayDirect" Assigned relay [P10, P20…P60 = setting 10:] is switched on or off via digital input 0: deactivated 1..6: connected to digital input 1..6	0…6	0

	Description	Range	Default
	Settings display properties		
D8	Hide display elements: 0: Disabled and inactive inputs are grayed out. 1: Deactivated inputs are hidden, inactive inputs are shown in gray. 2: Deactivated and inactive inputs are hidden.	0…2	1
D9	Display of the fault message symbol in the display (see section 6.2.1) 0: deactivated 1: activated 2: deactivated and blinking	0…2	1

7. Parameter lists

to section 7.5:   Digital inputs („D" parameters)

	Description	Range	Default
	Digital input 1		
D10	Activation 0: deactivated 1: high active 2: low active	0…2	1
D11	Reaction inertia (Filter) 1: fast 2: medium 3: sluggish	1…3	3
D12	Behaviour in standby 0: digital input is disabled 1: digital input is deactivated, when standby is enabled, an auto-reset occurs with a start delay 2: digital input is independent of standby 3: digital input is independent of standby, when standby is enabled, an auto-reset occurs with a start delay	0…3	0
D13	Start delay after power ON, standby or manual reset	0..250 sec.	0
D14	Time delay after digital input signal Time that an input signal must be present before it is evaluated or further processed.	0..250 sec.	0

	Description	Range	Default
D15	Event-triggered restart of the start delay If one or more relay outputs predefined here are switched on, the start delay is restarted. Any faults that occur at this digital input during this delay are suppressed. 0: function disabled 1..1023: selection of the relay outputs (see section 9.3)	0…1023*	0
D17	Event-triggered relay output shutdown If an input signal occurs at this digital input, one or more relay outputs predefined here are switched off. 0: function disabled 1..1023: shutdown of the selected relay outputs (see section 9.3)	0…1023*	0
D18	Alarm activation and fault memory 0: disabled 1: fault is passed on to the collective fault indicator, but not saved 2: fault is only saved, no collective fault message 3: Fault is transferred to the collective malfunction indicator and saved	0…3	2
D19	Display and reset properties see section 9.2	0…7	2

* the configuration for the relevant outputs is entered here in coded form. See section 9.3

to section 7.5: Digital inputs („D" parameters)

	Description	*Range*	*Default*
	Digital input 2		
D20	Activation 0: deactivated 1: high active 2: low active	0…2	1
D21	Reaction inertia (Filter) 1: fast 2: medium 3: sluggish	1…3	3
D22	Behaviour in standby 0: digital input is disabled 1: digital input is deactivated, when standby is enabled, an auto-reset occurs with a start delay 2: digital input is independent of standby 3: digital input is independent of standby, when standby is enabled, an auto-reset occurs with a start delay	0…3	0
D23	Start delay after power ON, standby or manual reset	0..250 sec.	0
D24	Time delay after digital input signal Time that an input signal must be present before it is evaluated or further processed.	0..250 sec.	0

D25	Event-triggered restart of the start delay If one or more relay outputs predefined here are switched on, the start delay is restarted. Any faults that occur at this digital input during this delay are suppressed. 0: function disabled 1..1023: selection of the relay outputs (see section 9.3)	0…1023*	0
D27	Event-triggered relay output shutdown If an input signal occurs at this digital input, one or more relay outputs predefined here are switched off. 0: function disabled 1..1023: shutdown of the selected relay outputs (see section 9.3)	0…1023*	0
D28	Alarm activation and fault memory 0: disabled 1: fault is passed on to the collective fault indicator, but not saved 2: fault is only saved, no collective fault message 3: Fault is transferred to the collective malfunction indicator and saved	0…3	2
D29	Display and reset properties see section 9.2	0…7	2

* the configuration for the relevant outputs is entered here in coded form. See section 9.3

to section 7.5:   Digital inputs („D" parameters)

	Description	Range	Default
	Digital input 3		
D30	Activation 0: deactivated 1: high active 2: low active	0…2	1
D31	Reaction inertia (Filter) 1: fast 2: medium 3: sluggish	1…3	3
D32	Behaviour in standby 0: digital input is disabled 1: digital input is deactivated, when standby is enabled, an auto-reset occurs with a start delay 2: digital input is independent of standby 3: digital input is independent of standby, when standby is enabled, an auto-reset occurs with a start delay	0…3	0
D33	Start delay after power ON, standby or manual reset	0..250 sec.	0
D34	Time delay after digital input signal Time that an input signal must be present before it is evaluated or further processed.	0..250 sec.	0

	Description	Range	Default
D35	Event-triggered restart of the start delay If one or more relay outputs predefined here are switched on, the start delay is restarted. Any faults that occur at this digital input during this delay are suppressed. 0: function disabled 1..1023: selection of the relay outputs (see section 9.3)	0…1023*	0
D37	Event-triggered relay output shutdown If an input signal occurs at this digital input, one or more relay out-puts predefined here are switched off. 0: function disabled 1..1023: shutdown of the selected relay outputs (see section 9.3)	0…1023*	0
D38	Alarm activation and fault memory 0: disabled 1: fault is passed on to the collective fault indicator, but not saved 2: fault is only saved, no collective fault message 3: Fault is transferred to the collective malfunction indicator and saved	0…3	2
D39	Display and reset properties see section 9.2	0…7	2

* the configuration for the relevant outputs is entered here in coded form. See section 9.3

to section 7.5: Digital inputs („D" parameters)

	Description	*Range*	*Default*
	Digital input 4		
D40	Activation 0: deactivated 1: high active 2: low active	0…2	1
D41	Reaction inertia (Filter) 1: fast 2: medium 3: sluggish	1…3	3
D42	Behaviour in standby 0: digital input is disabled 1: digital input is deactivated, when standby is enabled, an auto-reset occurs with a start delay 2: digital input is independent of standby 3: digital input is independent of standby, when standby is enabled, an auto-reset occurs with a start delay	0…3	0
D43	Start delay after power ON, standby or manual reset	0..250 sec.	0
D44	Time delay after digital input signal Time that an input signal must be present before it is evaluated or further processed.	0..250 sec.	0

	Description	*Range*	*Default*
D45	Event-triggered restart of the start delay If one or more relay outputs predefined here are switched on, the start delay is restarted. Any faults that occur at this digital input during this delay are suppressed. 0: function disabled 1..1023: selection of the relay outputs (see section 9.3)	0…1023*	0
D47	Event-triggered relay output shutdown If an input signal occurs at this digital input, one or more relay outputs predefined here are switched off. 0: function disabled 1..1023: shutdown of the selected relay outputs (see section 9.3)	0…1023*	0
D48	Alarm activation and fault memory 0: disabled 1: fault is passed on to the collective fault indicator, but not saved 2: fault is only saved, no collective fault message 3: Fault is transferred to the collective malfunction indicator and saved	0…3	2
D49	Display and reset properties see section 9.2	0…7	2

* *the configuration for the relevant outputs is entered here in coded form. See section 9.3*

to section 7.5:   Digital inputs („D" parameters)

	Description	Range	Default
	Digital input 5		
D50	Activation 0: deactivated 1: high active 2: low active	0…2	1
D51	Reaction inertia (Filter) 1: fast 2: medium 3: sluggish	1…3	3
D52	Behaviour in standby 0: digital input is disabled 1: digital input is deactivated, when standby is enabled, an auto-reset occurs with a start delay 2: digital input is independent of standby 3: digital input is independent of standby, when standby is enabled, an auto-reset occurs with a start delay	0…3	0
D53	Start delay after power ON, standby or manual reset	0..250 sec.	0
D54	Time delay after digital input signal Time that an input signal must be present before it is evaluated or further processed.	0..250 sec.	0

	Description	Range	Default
D55	Event-triggered restart of the start delay If one or more relay outputs predefined here are switched on, the start delay is restarted. Any faults that occur at this digital input during this delay are suppressed. 0: function disabled 1..1023: selection of the relay outputs (see section 9.3)	0…1023*	0
D57	Event-triggered relay output shutdown If an input signal occurs at this digital input, one or more relay out-puts predefined here are switched off. 0: function disabled 1..1023: shutdown of the selected relay outputs (see section 9.3)	0…1023*	0
D58	Alarm activation and fault memory 0: disabled 1: fault is passed on to the collective fault indicator, but not saved 2: fault is only saved, no collective fault message 3: Fault is transferred to the collective malfunction indicator and saved	0…3	2
D59	Display and reset properties see section 9.2	0…7	2

* *the configuration for the relevant outputs is entered here in coded form. See section 9.3*

to section 7.5:   Digital inputs („D" parameters)

	Description	Range	Default
	Digital input 6		
D60	Activation 0: deactivated 1: high active 2: low active	0…2	1
D61	Reaction inertia (Filter) 1: fast 2: medium 3: sluggish	1…3	3
D62	Behaviour in standby 0: digital input is disabled 1: digital input is deactivated, when standby is enabled, an auto-reset occurs with a start delay 2: digital input is independent of standby 3: digital input is independent of standby, when standby is enabled, an auto-reset occurs with a start delay	0…3	0
D63	Start delay after power ON, standby or manual reset	0..250 sec.	0
D64	Time delay after digital input signal Time that an input signal must be present before it is evaluated or further processed.	0..250 sec.	0

	Description	Range	Default
D65	Event-triggered restart of the start delay If one or more relay outputs predefined here are switched on, the start delay is restarted. Any faults that occur at this digital input during this delay are suppressed. 0: function disabled 1..1023: selection of the relay outputs (see section 9.3)	0…1023*	0
D67	Event-triggered relay output shutdown If an input signal occurs at this digital input, one or more relay outputs predefined here are switched off. 0: function disabled 1..1023: shutdown of the selected relay outputs (see section 9.3)	0…1023*	0
D68	Alarm activation and fault memory 0: disabled 1: fault is passed on to the collective fault indicator, but not saved 2: fault is only saved, no collective fault message 3: Fault is transferred to the collective malfunction indicator and saved	0…3	2
D69	Display and reset properties see section 9.2	0…7	2

the configuration for the relevant outputs is entered here in coded form. See section 9.3

to section 7.5:   Digital inputs („D" parameters)

	Description	Range	Default
	Digital input 7 **(optional – only with I/O extension module)**		
D70	Activation 0: deactivated 1: high active 2: low active	0…2	1
D71	Reaction inertia (Filter) 1: fast 2: medium 3: sluggish	1…3	3

D72	Behaviour in standby
	
	0: digital input is disabled
	1: digital input is deactivated, when standby is enabled, an
	       auto-reset occurs with a start delay
	2: digital input is independent of standby
	3: digital input is independent of standby, when standby is
	       enabled, an auto-reset occurs with a start delay
		0…3	0

D73	Start delay after power ON, standby or manual reset	0..250 sec.	0
D74	Time delay after digital input signal Time that an input signal must be present before it is evaluated or further processed.	0..250 sec.	0

D75	Event-triggered restart of the start delay If one or more relay outputs predefined here are switched on, the start delay is restarted. Any faults that occur at this digital input during this delay are suppressed. 0: function disabled 1..1023: selection of the relay outputs (see section 9.3)	0…1023*	0
D77	Event-triggered relay output shutdown If an input signal occurs at this digital input, one or more relay out- puts predefined here are switched off. 0: function disabled 1..1023: shutdown of the selected relay outputs (see section 9.3)	0…1023*	0

D78	Alarm activation and fault memory
	
	0: disabled
	1: fault is passed on to the collective fault indicator, but not
	       saved
	2: fault is only saved, no collective fault message
	3: Fault is transferred to the collective malfunction
	       indicator and saved
		0…3	2

D79	Display and reset properties see section 9.2	0…7	2

* the configuration for the relevant outputs is entered here in coded form. See section 9.3

to section 7.5: Digital inputs („D" parameters)

	Description	Range	Default
	Digital input 8 **(optional – only with I/O extension module)**		
D80	Activation 0: deactivated 1: high active 2: low active	0…2	1
D81	Reaction inertia (Filter) 1: fast 2: medium 3: sluggish	1…3	3
D82	Behaviour in standby 0: digital input is disabled 1: digital input is deactivated, when standby is enabled, an auto-reset occurs with a start delay 2: digital input is independent of standby 3: digital input is independent of standby, when standby is enabled, an auto-reset occurs with a start delay	0…3	0
D83	Start delay after power ON, standby or manual reset	0..250 sec.	0
D84	Time delay after digital input signal Time that an input signal must be present before it is evaluated or further processed.	0..250 sec.	0

	Description	Range	Default
D85	Event-triggered restart of the start delay If one or more relay outputs predefined here are switched on, the start delay is restarted. Any faults that occur at this digital input during this delay are suppressed. 0: function disabled 1..1023: selection of the relay outputs (see section 9.3)	0…1023*	0
D87	Event-triggered relay output shutdown If an input signal occurs at this digital input, one or more relay outputs predefined here are switched off. 0: function disabled 1..1023: shutdown of the selected relay outputs (see section 9.3)	0…1023*	0
D88	Alarm activation and fault memory 0: disabled 1: fault is passed on to the collective fault indicator, but not saved 2: fault is only saved, no collective fault message 3: Fault is transferred to the collective malfunction indicator and saved	0…3	2
D89	Display and reset properties see section 9.2	0…7	2

* the configuration for the relevant outputs is entered here in coded form. See section 9.3

to section 7.5:   Digital inputs („D" parameters)

	Description	Range	Default
	Digital input 9 **(optional – only with I/O extension module)**		
D90	Activation 0: deactivated 1: high active 2: low active	0…2	1
D91	Reaction inertia (Filter) 1: fast 2: medium 3: sluggish	1…3	3
D92	Behaviour in standby 0: digital input is disabled 1: digital input is deactivated, when standby is enabled, an auto-reset occurs with a start delay 2: digital input is independent of standby 3: digital input is independent of standby, when standby is enabled, an auto-reset occurs with a start delay	0…3	0
D93	Start delay after power ON, standby or manual reset	0..250 sec.	0
D94	Time delay after digital input signal Time that an input signal must be present before it is evaluated or further processed.	0..250 sec.	0

	Description	Range	Default
D95	Event-triggered restart of the start delay If one or more relay outputs predefined here are switched on, the start delay is restarted. Any faults that occur at this digital input during this delay are suppressed. 0: function disabled 1..1023: selection of the relay outputs (see section 9.3)	0…1023*	0
D97	Event-triggered relay output shutdown If an input signal occurs at this digital input, one or more relay outputs predefined here are switched off. 0: function disabled 1..1023: shutdown of the selected relay outputs (see section 9.3)	0…1023*	0
D98	Alarm activation and fault memory 0: disabled 1: fault is passed on to the collective fault indicator, but not saved 2: fault is only saved, no collective fault message 3: Fault is transferred to the collective malfunction indicator and saved	0…3	2
D99	Display and reset properties see section 9.2	0…7	2

* the configuration for the relevant outputs is entered here in coded form. See section 9.3

to section 7.5:   Digital inputs („D" parameters)

	Description	Range	Default
	Digital input 10 **(optional – only with I/O extension module)**		
D100	Activation 0: deactivated 1: high active 2: low active	0…2	1
D101	Reaction inertia (Filter) 1: fast 2: medium 3: sluggish	1…3	3
D102	Behaviour in standby 0: digital input is disabled 1: digital input is deactivated, when standby is enabled, an auto-reset occurs with a start delay 2: digital input is independent of standby 3: digital input is independent of standby, when standby is enabled, an auto-reset occurs with a start delay	0…3	0
D103	Start delay after power ON, standby or manual reset	0..250 sec.	0
D104	Time delay after digital input signal Time that an input signal must be present before it is evaluated or further processed.	0..250 sec.	0

	Description	Range	Default
D105	Event-triggered restart of the start delay If one or more relay outputs predefined here are switched on, the start delay is restarted. Any faults that occur at this digital input during this delay are suppressed. 0: function disabled 1..1023: selection of the relay outputs (see section 9.3)	0…1023*	0
D107	Event-triggered relay output shutdown If an input signal occurs at this digital input, one or more relay outputs predefined here are switched off. 0: function disabled 1..1023: shutdown of the selected relay outputs (see section 9.3)	0…1023*	0
D108	Alarm activation and fault memory 0: disabled 1: fault is passed on to the collective fault indicator, but not saved 2: fault is only saved, no collective fault message 3: Fault is transferred to the collective malfunction indicator and saved	0…3	2
D109	Display and reset properties see section 9.2	0…7	2

* the configuration for the relevant outputs is entered here in coded form. See section 9.3

to section 7.5:   Digital inputs („D" parameters)

	Description	Range	Default
	Digital input 11 **(optional – only with I/O extension module)**		
D110	Activation 0: deactivated 1: high active 2: low active	0…2	1
D111	Reaction inertia (Filter) 1: fast 2: medium 3: sluggish	1…3	3

D112	Behaviour in standby
	
	0: digital input is disabled
	1: digital input is deactivated, when standby is enabled, an
	      auto-reset occurs with a start delay
	2: digital input is independent of standby
	3: digital input is independent of standby, when standby is
	      enabled, an auto-reset occurs with a start delay
		0…3	0

D113	Start delay after power ON, standby or manual reset	0..250 sec.	0
D114	Time delay after digital input signal Time that an input signal must be present before it is evaluated or further processed.	0..250 sec.	0

	Description	Range	Default
D115	Event-triggered restart of the start delay If one or more relay outputs predefined here are switched on, the start delay is restarted. Any faults that occur at this digital input during this delay are suppressed. 0: function disabled 1..1023: selection of the relay outputs (see section 9.3)	0…1023*	0
D117	Event-triggered relay output shutdown If an input signal occurs at this digital input, one or more relay out- puts predefined here are switched off. 0: function disabled 1..1023: shutdown of the selected relay outputs (see section 9.3)	0…1023*	0

D118	Alarm activation and fault memory
	
	0: disabled
	1: fault is passed on to the collective fault indicator, but not
	      saved
	2: fault is only saved, no collective fault message
	3: Fault is transferred to the collective malfunction
	      indicator and saved
		0…3	2

D119	Display and reset properties see section 9.2	0…7	2

* the configuration for the relevant outputs is entered here in coded form. See section 9.3

7.6 Relay outputs („P" parameters)

	Description	Range	Default
	Mutual switch-on delay		
P1	Selection relay	0…1023*	0
P2	Delay Time	0…60 sec.	0

the configuration for the relevant outputs is entered here in coded form. See section 9.3

	Description	Range	Default
	Settings display properties for all relay outputs		
P8	Hide display items 0: Deactivated relay outputs are hidden, inactive relay outputs are shown in grey. 1: Deactivated relay outputs are hidden, inactive relay outputs are shown in grey. 2: Deactivated and inactive relay outputs are hidden.	0…2	0
P9	Icon representation in case of fault shutdown If the icons are not hidden by other setting 0: Icons are displayed in grey. 1: Outputs disabled by fault shutdown are shown in red.	0…1	0

to section 7.6:   Digital outputs („P" parameters)

		Description	Range	Default
		Relay contact 1		
P10		Function mapping	0…16	1
		0: disabled, always OFF 1: connected to control block 1 2: connected to control block 2 3: connected to control block 3 4: connected to control block 4 5: compound / zone control (see section 5.5.6) 6: compound / zone control prioritised 7: without function 8: connected to temperature alarm 1 9: connected to temperature alarm 2 10: connected to digital input [see D17 / D27 / D37 … D67] 11: connected to fault message display 12: without function 13: connected to OFF button [D1] 14: always on 15: Pump A (pump module see section 5.5.5) 16: Pump B (pump module see section 5.5.5)		
P11		Output inverted	0…2	0
		0: disabled 1: enabled 2: enabled, without direct shutdown		
P12		Behaviour in standby	0…4	0
		0: Relay is switched OFF 1: Relay is switched ON 2: Relay is independent of standby 3: Connected to frost protection funct. 1 (control block 3) 4: Connected to frost protection funct. 2 (control block 4)		
P13		Switch-on delay	0…999 sec.	0
		after power ON or standby		
P14		Blocking time after shutdown due to a fault	0…990 sec.	0
		If the relay contact is switched off due to a fault, it can only be switched on again after a time "X".		
P15		Timer function	0…6	0
		0: disabled 1: switch-on delay (timer A) 2: switch-off delay (timer B) 3: switch-on and -off delay (timer A and B) 4: switch-on impulse (timer A) 5: switch-off impulse (timer B) 6: Min. on time (timer A) and min. off time (timer B)		
P16 **P17**		Timer A (for parameter [P15]) Timer B (for parameter [P15])	0…999 sec. 0…999 sec.	0 0
P18		Fault behaviour in the event of a temperature sensor fault 0: off 1: on 2: no influence	0…2	0
P19		Display symbol	0…24	1
		0..24: see section 7.6.1		

On / off delay:

When activated, the relay output is switched on/off with a delay.

Switch-on / switch-off pulse

When activated, the relay output is switched on or off for time "X".

to section 7.6: Digital outputs („P" parameters)

		Description	Range	Default
		Relay contact 2		
	P20	Function mapping	0…16	1
		0: disabled, always OFF 1: connected to control block 1 2: connected to control block 2 3: connected to control block 3 4: connected to control block 4 5: compound / zone control (see section 5.5.6) 6: compound / zone control prioritised 7: without function 8: connected to temperature alarm 1 9: connected to temperature alarm 2 10: connected to digital input [see D17 / D27 / D37 … D67] 11: connected to fault message display 12: without function 13: connected to OFF button [D1] 14: always on 15: Pump A (pump module see section 5.5.5) 16: Pump B (pump module see section 5.5.5)		
	P21	Output inverted	0…2	0
		0: disabled 1: enabled 2: enabled, without direct shutdown		
	P22	Behaviour in standby	0…4	0
		0: Relay is switched OFF 1: Relay is switched ON 2: Relay is independent of standby 3: Connected to frost protection funct. 1 (control block 3) 4: Connected to frost protection funct. 2 (control block 4)		
	P23	Switch-on delay after power ON or standby	0…999 sec.	0
	P24	Blocking time after shutdown due to a fault If the relay contact is switched off due to a fault, it can only be switched on again after a time "X".	0…990 sec.	0
	P25	Timer function	0…6	0
		0: disabled 1: switch-on delay (timer A) 2: switch-off delay (timer B) 3: switch-on and -off delay (timer A and B) 4: switch-on impulse (timer A) 5: switch-off impulse (timer B) 6: Min. on time (timer A) and min. off time (timer B)		
	P26 P27	Timer A (for parameter [P15]) Timer B (for parameter [P15])	0…999 sec. 0…999 sec.	0 0
	P28	Fault behaviour in the event of a temperature sensor fault 0: off 1: on 2: no influence	0…2	0
	P29	Display symbol 0..24: see section 7.6.1	0…24	1

On / off delay:

When activated, the relay output is switched on/off with a delay.

Switch-on / switch-off pulse

When activated, the relay output is switched on or off for time "X".

to section 7.6:   Digital outputs („P" parameters)

	Description	Range	Default
	Relay contact 3		
P30	Function mapping	0…16	1
	0: disabled, always OFF 1: connected to control block 1 2: connected to control block 2 3: connected to control block 3 4: connected to control block 4 5: compound / zone control (see section 5.5.6) 6: compound / zone control prioritised 7: without function 8: connected to temperature alarm 1 9: connected to temperature alarm 2 10: connected to digital input [see D17 / D27 / D37 … D67] 11: connected to fault message display 12: without function 13: connected to OFF button [D1] 14: always on 15: Pump A (pump module see section 5.5.5) 16: Pump B (pump module see section 5.5.5)		
P31	Output inverted	0…2	0
	0: disabled 1: enabled 2: enabled, without direct shutdown		
P32	Behaviour in standby	0…4	0
	0: Relay is switched OFF 1: Relay is switched ON 2: Relay is independent of standby 3: Connected to frost protection funct. 1 (control block 3) 4: Connected to frost protection funct. 2 (control block 4)		
P33	Switch-on delay after power ON or standby	0…999 sec.	0
P34	Blocking time after shutdown due to a fault If the relay contact is switched off due to a fault, it can only be switched on again after a time "X".	0…990 sec.	0
P35	Timer function	0…6	0
	0: disabled 1: switch-on delay (timer A) 2: switch-off delay (timer B) 3: switch-on and -off delay (timer A and B) 4: switch-on impulse (timer A) 5: switch-off impulse (timer B) 6: Min. on time (timer A) and min. off time (timer B)		
P36 P37	Timer A (for parameter [P15]) Timer B (for parameter [P15])	0…999 sec. 0…999 sec.	0 0
P38	Fault behaviour in the event of a temperature sensor fault 0: off 1: on 2: no influence	0…2	0
P39	Display symbol 0..24: see section 7.6.1	0…24	1

On / off delay:

When activated, the relay output is switched on/off with a delay.

Switch-on / switch-off pulse

When activated, the relay output is switched on or off for time "X".

to section 7.6:   Digital outputs („P" parameters)

	Description	Range	Default
	Relay contact 4		
P40	Function mapping	0…16	1
	0: disabled, always OFF 1: connected to control block 1 2: connected to control block 2 3: connected to control block 3 4: connected to control block 4 5: compound / zone control (see section 5.5.6) 6: compound / zone control prioritised 7: without function 8: connected to temperature alarm 1 9: connected to temperature alarm 2 10: connected to digital input [see D17 / D27 / D37 … D67] 11: connected to fault message display 12: without function 13: connected to OFF button [D1] 14: always on 15: Pump A (pump module see section 5.5.5) 16: Pump B (pump module see section 5.5.5)		
P41	Output inverted	0…2	0
	0: disabled 1: enabled 2: enabled, without direct shutdown		
P42	Behaviour in standby	0…4	0
	0: Relay is switched OFF 1: Relay is switched ON 2: Relay is independent of standby 3: Connected to frost protection funct. 1 (control block 3) 4: Connected to frost protection funct. 2 (control block 4)		
P43	Switch-on delay after power ON or standby	0…999 sec.	0
P44	Blocking time after shutdown due to a fault If the relay contact is switched off due to a fault, it can only be switched on again after a time "X".	0…990 sec.	0
P45	Timer function	0…6	0
	0: disabled 1: switch-on delay (timer A) 2: switch-off delay (timer B) 3: switch-on and -off delay (timer A and B) 4: switch-on impulse (timer A) 5: switch-off impulse (timer B) 6: Min. on time (timer A) and min. off time (timer B)		
P46 P47	Timer A (for parameter [P15]) Timer B (for parameter [P15])	0…999 sec. 0…999 sec.	0 0
P48	Fault behaviour in the event of a temperature sensor fault 0: off 1: on 2: no influence	0…2	0
P49	Display symbol 0..24: see section 7.6.1	0…24	1

On / off delay:

When activated, the relay output is switched on/off with a delay.

Switch-on / switch-off pulse

When activated, the relay output is switched on or off for time "X".

to section 7.6:   Digital outputs („P" parameters)

		Description	Range	Default
		Relay contact 5 *(if available)* **(optional - only with I/O extension module)**		
P50		Function mapping	0…16	1
		0: disabled, always OFF 1: connected to control block 1 2: connected to control block 2 3: connected to control block 3 4: connected to control block 4 5: compound / zone control (see section 5.5.6) 6: compound / zone control prioritised 7: without function 8: connected to temperature alarm 1 9: connected to temperature alarm 2 10: connected to digital input [see D17 / D27 / D37 … D67] 11: connected to fault message display 12: without function 13: connected to OFF button [D1] 14: always on 15: Pump A (pump module see section 5.5.5) 16: Pump B (pump module see section 5.5.5)		
P51		Output inverted	0…2	0
		0: disabled 1: enabled 2: enabled, without direct shutdown		
P52		Behaviour in standby	0…4	0
		0: Relay is switched OFF 1: Relay is switched ON 2: Relay is independent of standby 3: Connected to frost protection funct. 1 (control block 3) 4: Connected to frost protection funct. 2 (control block 4)		
P53		Switch-on delay	0…999 sec.	0
		after power ON or standby		
P54		Blocking time after shutdown due to a fault	0…990 sec.	0
		If the relay contact is switched off due to a fault, it can only be switched on again after a time "X".		
P55		Timer function	0…6	0
		0: disabled 1: switch-on delay (timer A) 2: switch-off delay (timer B) 3: switch-on and -off delay (timer A and B) 4: switch-on impulse (timer A) 5: switch-off impulse (timer B) 6: Min. on time (timer A) and min. off time (timer B)		
P56 **P57**		Timer A (for parameter [P15]) Timer B (for parameter [P15])	0…999 sec. 0…999 sec.	0 0
P58		Fault behaviour in the event of a temperature sensor fault 0: off 1: on 2: no influence	0…2	0
P59		Display symbol	0…24	1
		0..24: see section 7.6.1		

On / off delay:

When activated, the relay output is switched on/off with a delay.

Switch-on / switch-off pulse

When activated, the relay output is switched on or off for time "X".

to section 7.6:   Digital outputs („P" parameters)

		Description	Range	Default
		Relay contact 6 *(if available)* **(optional - only with I/O extension module)**		
	P60	Function mapping 0: disabled, always OFF 1: connected to control block 1 2: connected to control block 2 3: connected to control block 3 4: connected to control block 4 5: compound / zone control (see section 5.5.6) 6: compound / zone control prioritised 7: without function 8: connected to temperature alarm 1 9: connected to temperature alarm 2 10: connected to digital input [see D17 / D27 / D37 … D67] 11: connected to fault message display 12: without function 13: connected to OFF button [D1] 14: always on 15: Pump A (pump module see section 5.5.5) 16: Pump B (pump module see section 5.5.5)	0…16	1
	P61	Output inverted 0: disabled 1: enabled 2: enabled, without direct shutdown	0…2	0
	P62	Behaviour in standby 0: Relay is switched OFF 1: Relay is switched ON 2: Relay is independent of standby 3: Connected to frost protection funct. 1 (control block 3) 4: Connected to frost protection funct. 2 (control block 4)	0…4	0
	P63	Switch-on delay after power ON or standby	0…999 sec.	0
	P64	Blocking time after shutdown due to a fault If the relay contact is switched off due to a fault, it can only be switched on again after a time "X".	0…990 sec.	0
	P65	Timer function 0: disabled 1: switch-on delay (timer A) 2: switch-off delay (timer B) 3: switch-on and -off delay (timer A and B) 4: switch-on impulse (timer A) 5: switch-off impulse (timer B) 6: Min. on time (timer A) and min. off time (timer B)	0…6	0
	P66 **P67**	Timer A (for parameter [P15]) Timer B (for parameter [P15])	0…999 sec. 0…999 sec.	0 0
	P68	Fault behaviour in the event of a temperature sensor fault 0: off 1: on 2: no influence	0…2	0
	P69	Display symbol 0..24: see section 7.6.1	0…24	1

On / off delay:

When activated, the relay output is switched on/off with a delay.

Switch-on / switch-off pulse

When activated, the relay output is switched on or off for time "X".

to section 7.6: Digital outputs („P" parameters)

	Description	Range	Default
	Relay contact 7 *(if available)* **(optional - only with I/O extension module)**		
P70	Function mapping 0: disabled, always OFF 1: connected to control block 1 2: connected to control block 2 3: connected to control block 3 4: connected to control block 4 5: compound / zone control (see section 5.5.6) 6: compound / zone control prioritised 7: without function 8: connected to temperature alarm 1 9: connected to temperature alarm 2 10: connected to digital input [see D17 / D27 / D37 … D67] 11: connected to fault message display 12: without function 13: connected to OFF button [D1] 14: always on 15: Pump A (pump module see section 5.5.5) 16: Pump B (pump module see section 5.5.5)	0…16	1
P71	Output inverted 0: disabled 1: enabled 2: enabled, without direct shutdown	0…2	0
P72	Behaviour in standby 0: Relay is switched OFF 1: Relay is switched ON 2: Relay is independent of standby 3: Connected to frost protection funct. 1 (control block 3) 4: Connected to frost protection funct. 2 (control block 4)	0…4	0
P73	Switch-on delay after power ON or standby	0…999 sec.	0
P74	Blocking time after shutdown due to a fault If the relay contact is switched off due to a fault, it can only be switched on again after a time "X".	0…990 sec.	0
P75	Timer function 0: disabled 1: switch-on delay (timer A) 2: switch-off delay (timer B) 3: switch-on and -off delay (timer A and B) 4: switch-on impulse (timer A) 5: switch-off impulse (timer B) 6: Min. on time (timer A) and min. off time (timer B)	0…6	0
P76 **P77**	Timer A (for parameter [P15]) Timer B (for parameter [P15])	0…999 sec. 0…999 sec.	0 0
P78	Fault behaviour in the event of a temperature sensor fault 0: off 1: on 2: no influence	0…2	0
P79	Display symbol 0..24: see section 7.6.1	0…24	1

On / off delay:

When activated, the relay output is switched on/off with a delay.

Switch-on / switch-off pulse

When activated, the relay output is switched on or off for time "X".

to section 7.6:   Digital outputs („P" parameters)

		Description	Range	Default
		Relay contact 8 *(if available)* **(optional - only with I/O extension module)**		
	P80	Function mapping	0…16	1
		0: disabled, always OFF 1: connected to control block 1 2: connected to control block 2 3: connected to control block 3 4: connected to control block 4 5: compound / zone control (see section 5.5.6) 6: compound / zone control prioritised 7: without function 8: connected to temperature alarm 1 9: connected to temperature alarm 2 10: connected to digital input [see D17 / D27 / D37 … D67] 11: connected to fault message display 12: without function 13: connected to OFF button [D1] 14: always on 15: Pump A (pump module see section 5.5.5) 16: Pump B (pump module see section 5.5.5)		
	P81	Output inverted	0…2	0
		0: disabled 1: enabled 2: enabled, without direct shutdown		
	P82	Behaviour in standby	0…4	0
		0: Relay is switched OFF 1: Relay is switched ON 2: Relay is independent of standby 3: Connected to frost protection funct. 1 (control block 3) 4: Connected to frost protection funct. 2 (control block 4)		
	P83	Switch-on delay after power ON or standby	0…999 sec.	0
	P84	Blocking time after shutdown due to a fault If the relay contact is switched off due to a fault, it can only be switched on again after a time "X".	0…990 sec.	0
	P85	Timer function	0…6	0
		0: disabled 1: switch-on delay (timer A) 2: switch-off delay (timer B) 3: switch-on and -off delay (timer A and B) 4: switch-on impulse (timer A) 5: switch-off impulse (timer B) 6: Min. on time (timer A) and min. off time (timer B)		
	P86 **P87**	Timer A (for parameter [P15]) Timer B (for parameter [P15])	0…999 sec. 0…999 sec.	0 0
	P88	Fault behaviour in the event of a temperature sensor fault 0: off 1: on 2: no influence	0…2	0
	P89	Display symbol 0..24: see section 7.6.1	0…24	1

On / off delay:

When activated, the relay output is switched on/off with a delay.

Switch-on / switch-off pulse

When activated, the relay output is switched on or off for time "X".

to section 7.6: Digital outputs („P" parameters)

		Description	Range	Default
		Relay contact 9 *(if available)* **(optional - only with I/O extension module)**		
P90		Function mapping	0…16	1
		0: disabled, always OFF 1: connected to control block 1 2: connected to control block 2 3: connected to control block 3 4: connected to control block 4 5: compound / zone control (see section 5.5.6) 6: compound / zone control prioritised 7: without function 8: connected to temperature alarm 1 9: connected to temperature alarm 2 10: connected to digital input [see D17 / D27 / D37 … D67] 11: connected to fault message display 12: without function 13: connected to OFF button [D1] 14: always on 15: Pump A (pump module see section 5.5.5) 16: Pump B (pump module see section 5.5.5)		
P91		Output inverted	0…2	0
		0: disabled 1: enabled 2: enabled, without direct shutdown		
P92		Behaviour in standby	0…4	0
		0: Relay is switched OFF 1: Relay is switched ON 2: Relay is independent of standby 3: Connected to frost protection funct. 1 (control block 3) 4: Connected to frost protection funct. 2 (control block 4)		
P93		Switch-on delay after power ON or standby	0…999 sec.	0
P94		Blocking time after shutdown due to a fault If the relay contact is switched off due to a fault, it can only be switched on again after a time "X".	0…990 sec.	0
P95		Timer function	0…6	0
		0: disabled 1: switch-on delay (timer A) 2: switch-off delay (timer B) 3: switch-on and -off delay (timer A and B) 4: switch-on impulse (timer A) 5: switch-off impulse (timer B) 6: Min. on time (timer A) and min. off time (timer B)		
P96 **P97**		Timer A (for parameter [P15]) Timer B (for parameter [P15])	0…999 sec. 0…999 sec.	0 0
P98		Fault behaviour in the event of a temperature sensor fault 0: off 1: on 2: no influence	0…2	0
P99		Display symbol 0..24: see section 7.6.1	0…24	1

On / off delay:

When activated, the relay output is switched on/off with a delay.

Switch-on / switch-off pulse

When activated, the relay output is switched on or off for time "X".

to section 7.6: Digital outputs („P" parameters)

		Description	Range	Default
		Relay contact 10 *(if available)* **(optional - only with I/O extension module)**		
P100		Function mapping	0…16	1
		0: disabled, always OFF 1: connected to control block 1 2: connected to control block 2 3: connected to control block 3 4: connected to control block 4 5: compound / zone control (see section 5.5.6) 6: compound / zone control prioritised 7: without function 8: connected to temperature alarm 1 9: connected to temperature alarm 2 10: connected to digital input [see D17 / D27 / D37 … D67] 11: connected to fault message display 12: without function 13: connected to OFF button [D1] 14: always on 15: Pump A (pump module see section 5.5.5) 16: Pump B (pump module see section 5.5.5)		
P101		Output inverted	0…2	0
		0: disabled 1: enabled 2: enabled, without direct shutdown		
P102		Behaviour in standby	0…4	0
		0: Relay is switched OFF 1: Relay is switched ON 2: Relay is independent of standby 3: Connected to frost protection funct. 1 (control block 3) 4: Connected to frost protection funct. 2 (control block 4)		
P103		Switch-on delay	0…999 sec.	0
		after power ON or standby		
P104		Blocking time after shutdown due to a fault	0…990 sec.	0
		If the relay contact is switched off due to a fault, it can only be switched on again after a time "X".		
P105		Timer function	0…6	0
		0: disabled 1: switch-on delay (timer A) 2: switch-off delay (timer B) 3: switch-on and -off delay (timer A and B) 4: switch-on impulse (timer A) 5: switch-off impulse (timer B) 6: Min. on time (timer A) and min. off time (timer B)		
P106 **P107**		Timer A (for parameter [P15]) Timer B (for parameter [P15])	0…999 sec. 0…999 sec.	0 0
P108		Fault behaviour in the event of a temperature sensor fault 0: off 1: on 2: no influence	0…2	0
P109		Display symbol	0…24	1
		0..24: see section 7.6.1		

On / off delay:

When activated, the relay output is switched on/off with a delay.

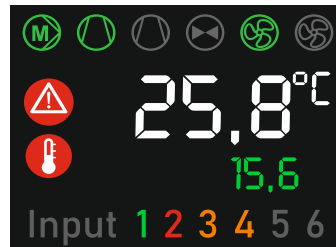**Switch-on / switch-off pulse**

When activated, the relay output is switched on or off for time "X".

7.6.1 Display symbols for relay outputs

A symbol can be set for the display for each relay output.

The setting is made via the parameters [P19 / P29 / P39 .. P69]

Relay outputs ➡

0:		Hidden		13:		Motor
1:		Relay output 1..6		14:		Pump 2
2:		Pump 1		15:		Alarm horn
3:		Compressor		16:		Faucet 1
4:		Fan 1		17:		Faucet 2
5:		Fan 2		18:		Disc valve
6:		2-way valve		19:		Drain tub
7:		3-way valve		20:		Fan flap
8:		4-way valve		21:		Agitator
9:		Heater		22:		Temperature
10:		Lamp		23:		Alarm
11:		Cooling icon		24:		Flow switch
12:		Timer				

7.7 Analog input / analog output („A" parameters)

	Description	Range	Default
	Analog input 1* (4..20 mA or 0..10 V)		
A10	Fault monitoring and cable break monitoring (only for 4..20 mA) 0: disabled 1: enabled	0…1	0
A13	Shown on the display 0: nothing 1: °C 2: l/m 3: bar	0…3	1
A14	Scaling „4 mA" or „0 V"	-100…400°	0
A15	Scaling „20 mA" or „10 V"	-100…400°	50,0
A19	Correction value	-10…10 K	0,0

	Description	Range	Default
	Analog input 2* (4..20 mA or 0..10 V)		
A20	Fault monitoring and cable break monitoring (only for 4..20 mA) 0: disabled 1: enabled	0…1	0
A23	Shown on the display 0: nothing 1: °C 2: l/m 3: bar	0…3	1
A24	Scaling „4 mA" or „0 V"	-100…400°	0
A25	Scaling „20 mA" or „10 V"	-100…400°	50,0
A29	Correction value	-10…10 K	0,0

* optional – je nach Reglerausführung

to section 7.7: Analog input / analog output („A" parameters)

	Description	Range	Default
	Analog output 1*		
A50	Operating mode (optional) 1: 0..10 V 2: 4..20 mA	1…2	1
A51	Function mapping 0: disabled 1: connected to control block 1 2: connected to control block 2 3: connected to control block 3 4: connected to control block 4 5: connected to sensor 1 as temperature output 6: connected to sensor 2 as temperature output 7: connected to sensor 3 as temperature output 8: connected to sensor 4 as temperature output	0…8	0
A52	Control variable inverted	0…1	0

	Description	Range	Default
A54	Behaviour in standby 0: Output is 0% 1: Output is 100% 2: Output is independent of standby. (retains its function)	0…2	0
A56	Behaviour in the event of a temperature sensor fault	0…100%	0
A58	Output limit minimum manipulated variable	0…100%	0
A59	Output limit maximum manipulated variable	0…100%	100

	Description	Range	Default
A60	Activation delay after power ON or standby	0…999 sec.	0
A62	Start variable after power ON or standby	0…100%	0
A63	Holding time of the start variable	0…999 sec.	0
A65	Manipulated variable limit or specification on event (as determined in parameter A66) 0: disabled 1: Actuating variable is limited 2: Actuating variable is specified as a fixed value	0…2	0
A66	Event assignment 1..6: via digital input 1..6 7: for temperature alarm 1 8: for temperature alarm 2 9: for temperature alarm 3 10: for temperature alarm 4	1…10	1
A67	Limit value / default value	0…100%	70

	Description	Range	Default
A75	Scaling for temperature output. Start of range	-50…400°C	0
A76	Scaling for temperature output. End of range	-50…400°C	50,0

optional – depending on controller version

to section 7.7:   Analog input / analog output („A" parameters)

	Description	Range	Default
	Analog output 2*		
A80	Operating mode (optional) 1: 0..10 V 2: 4..20 mA	1…2	1
A81	Function mapping 0: disabled 1: connected to control block 1 2: connected to control block 2 3: connected to control block 3 4: connected to control block 4 5: connected to sensor 1 as temperature output 6: connected to sensor 2 as temperature output 7: connected to sensor 3 as temperature output 8: connected to sensor 4 as temperature output	0…8	0
A82	Control variable inverted	0…1	0

	Description	Range	Default
A84	Behaviour in standby 0: Output is 0% 1: Output is 100% 2: Output is independent of standby. (retains its function)	0…2	0
A86	Behaviour in the event of a temperature sensor fault	0…100%	0
A88	Output limit minimum manipulated variable	0…100%	0
A89	Output limit maximum manipulated variable	0…100%	100

	Description	Range	Default
A90	Activation delay after power ON or standby	0…999 sec.	0
A92	Start variable after power ON or standby	0…100%	0
A93	Holding time of the start variable	0…999 sec.	0
A95	Manipulated variable limit or specification on event (as determined in parameter A66) 0: disabled 1: Actuating variable is limited 2: Actuating variable is specified as a fixed value	0…2	0
A96	Event assignment 1..6: via digital input 1..6 7: for temperature alarm 1 8: for temperature alarm 2 9: for temperature alarm 3 10: for temperature alarm 4	1…10	1
A97	Limit value / default value	0…100%	70

	Description	Range	Default
A105	Scaling for temperature output. Start of range	-50…400°C	0
A106	Scaling for temperature output. End of range	-50…400°C	50,0

* optional – depending on controller version

7.8 Configuration temperature sensor („T" parameters)

	Description	Range	Default
	General temperature sensor settings		
T1	Type of sensor (setting applies to all temp. sensors) 0: KTY81/210 1: PT100* 2: PT1000 3: KTY81/110 * not for sensor 4	0…3	0

	Description	Range	Default
	Setting temperature sensor 1		
T10	Activation 0: disabled 1: enabled	0…1	1
T11	Three-wire operation (it PT100 set) 0: disabled 1: enabled	0…1	0

	Description	Range	Default
	Setting temperature sensor 2		
T20	Activation 0: disabled 1: enabled	0…1	0
T21	Three-wire operation (it PT100 set) 0: disabled 1: enabled	0…1	0

	Description	Range	Default
	Setting temperature sensor 3		
T30	Activation (The third sensor does not support a PT100 3-wire) 0: disabled 1: enabled	0…1	0

	Description	Range	Default
	Setting temperature sensor 4 (optional)		
T40	Activation (The fourth sensor does not support PT100. In this setting it works as a PT1000) 0: disabled 1: enabled	0…1	0

	Description	Range	Default
	Sensor calibration (Offset correction)		
T90	Current actual value Sensor 1		
T91	Correction value Sensor 1	-10…10 K	0,0

		Range	Default
T92	Current actual value Sensor 2		
T93	Correction value Sensor 2	-10…10 K	0,0

		Range	Default
T94	Current actual value Sensor 3		
T95	Correction value Sensor 3	-10…10 K	0,0

		Range	Default
T96	Current actual value Sensor 4		
T97	Correction value Sensor 4	-10…10 K	0,0

7.9 Functional modules („E" parameters)

		Description	Range	Default
		Pump module (see also section 5.5.5) With automatic operating mode recognition: one-pump operation or redundant two-pump operation		
	E12	Behaviour in standby 0: Pumps are disabled 1: Pumps remain activated 2: Pumps are deactivated after the overrun time has elapsed	0…2	0
	E13	Pump run-on time in standby	0..60,0 min	0
	E14	Pump changeover time in redundant operation	0…48 h	24
	E17	Output Shutdown (in the event of a fault in both pumps in redundant operation) 0: disabled 1..1023: Shutdown of the selected relay outputs (see section 9.3)	0…1023*	0
	E18	Alarm activation and fault memory (in the event of a fault in both pumps in redundant operation) 0: off 1: Fault is passed on to the collective fault indicator	0…1	1

		Description	Range	Default
		Compound control / zone control (see section 5.5.6)		
	E21	Assignment to control block 1: Assignment to control block 1 2: Assignment to control block 2 3: Assignment to control block 3 4: Assignment to control block 4	1…4	1
	E23	Maximum runtime difference (between non-priority compressors)	0..300 min	60
C25	E25	Temperature distance zone 1 (distance to setpoint of zone 1)	0,1..10,0 K	0,3
C26	E26	Temperature distance zone 2 (distance to setpoint of zone 2)	0,1..10,0 K	0,6
	E27	Switch-on time zone 1 (time acc. to which a switching step is switched on in zone 1)	1..999 sec.	60
	E28	Switch-on time zone 2 (time acc. to which a switching step is switched on in zone 2)	1..999 sec.	30

* the configuration for the relevant outputs is entered here in coded form. See section 9.3

Parameter is displayed (if set in 'B' parameters) in user menu

7. Parameter lists

to section 7.9:   Functional modules

		Description	Range	Default
		Counter module (operating hours / event counter) *(Function see section 5.5.7)*		
E41		Visible 0: counter values cannot be viewed, (unless the service password is active) 1: Counter values can be viewed by the customer	0…1	1
E45		Counter 1 relay output mapping 0: Counter 1 switched off 1…x: State of relay x is counted	0…"X"	0
E46		Delete counter 1 with password	0…0xFFFF	0
E50		Counter 2 relay output mapping 0: Counter 2 switched off 1…x: State of relay x is counted	0…"X"	0
E51		Delete counter 2 with password	0…0xFFFF	0
E55		Counter 3 relay output mapping 0: Counter 3 switched off 1…x: State of relay x is counted	0…"X"	0
E56		Delete counter 3 with password	0…0xFFFF	0
E60		Counter 4 relay output mapping 0: Counter 4 switched off 1…x: State of relay x is counted	0…"X"	0
E61		Delete counter 4 with password	0…0xFFFF	0

„X"= Number of available relays depending on controller type

7.10 System settings ("U" parameters)

	Description		Range	Default
	Display setting			
U1	Actual value display 1..4: sensor 1..4 5: analog in 1 6: analog in 2	25,8℃ 15,6	1…6	1
U2	Target or actual value display 0: disabled 1..4: sensor 1..4 5: analog in 1 6: analog in 2 7: setpoint of the control block 1 8: setpoint of the control block 2 9: setpoint of the control block 3 10: setpoint of the control block 4	25,8℃ 15,6	0…10	7
U3	Display when „UP arrow" button is pressed 0: disabled 1..4: sensor 1..4 5: analog in 1 6: analog in 2	25,8℃ 15,6	0…6	0
U4	Display when „DOWN arrow" button is pressed 0: disabled 1..4: sensor 1..4 5: analog in 1 6: analog in 2	25,8℃ 15,6	0…6	0

	I/O module settings	Range	Default
	I/O module settings		
U11	Activate I/O module 0: disabled 1: enabled	0…1	0
U13	Output shutdown in case of module failure If the I/O module fails, one or more relay outputs pre-defined here are switched off. 0: function disabled 1..1023: switch off of the selected relay outputs	0…1023*	0
U14	Fault message activation and fault memory in the event of module failure 0: off 1: Fault at collective fault indicator => not saved 2: Fault is only saved, no collective fault message 3: Fault at collective fault indicator => is saved	0…3	0
U15	Reset properties in the event of a fault in the I/O module 0: autoReset 1: autoReset, with display memory 2: manReset	0…2	0
U16	Icon display 0: no display 1: "I/O" icon is displayed	0…1	1

7. Parameter lists

to section 7.10:   System settings („U" parameters)

		System settings		
U20	Language setting 1: german 2: english	1…2	1
U21	Expert mode 0: deactivated (display of help texts in the menus) 1: activated (no display of help texts in menus)	0…1	0
U23	Delete fault memory (see sectionn6.6)**Fehler! erweisquelle konnte nicht gefunden werden.**		
U25	Password service parameters (see 6.7.1)		0000

		Modbus interface setting *see also section 8.*		
U40	Baud setting 1: 9600 2: 19200 3: 38400 4: 57600 5: 76800	1…5	3
U41	Device address Required if several controllers are operated on one bus.	1…15	1
U42	Bus termination 0: off 1: on	0…1	0
U44	Transmission mode 0: 1 start-, 8 data-, 1 stop bit, no parity 1: 1 start-, 8 data-, 1 stop bit, even parity 2: 1 start-, 8 data-, 1 stop bit, odd parity 3: 1 start-, 8 data-, 2 stop bit, no parity	0…3	0

to section 7.10:   System settings („U" parameters)

	Description	Range	Default
	Modbus permissions / limitations		
U48	Activation "standby / release" via Modbus 0: deactivated, standby / enable cannot be influenced via Modbus. 1: activated, the controller expects a 0 on the corresponding "standby / release bit" to start operation, a 1 keeps the controller in standby. 2: activated, the controller expects a 1 on the corresponding "standby / release bit" to start operation, a 0 keeps the controller in standby.	0…2	0
U49	Activation of setpoint specification via Modbus 0: deactivated, no setpoint can be specified via Modbus 1..15: activated for control block 1..4. A setpoint specification within the defined limits U52…U59 is possible via Modbus. **Setting see table below.**	0…15	0
U50	Time-out 0: disabled 1..60: if after 'X' seconds no update of enable bits for - Standby / operation release or - activation of the target value, the activation bits are reset.	0..60 sec.	10

U52	Min. setpoint specificat. for RB1 via Modbus	-50..400°C	-50
U53	Max. setpoint specificat. for RB1 via Modbus	-50..400°C	400
U54	Min. setpoint specificat. for RB2 via Modbus	-50..400°C	-50
U55	Max. setpoint specificat. for RB2 via Modbus	-50..400°C	400
U56	Min. setpoint specificat. for RB3 via Modbus	-50..400°C	-50
U57	Max. setpoint specificat. for RB3 via Modbus	-50..400°C	400
U58	Min. setpoint specificat. for RB4 via Modbus	-50..400°C	-50
U59	Max. setpoint specificat. for RB4 via Modbus	-50..400°C	400

Setting for parameter U49:

Value					Value				
0:					8:				RB4
1:	RB1				9:	RB1			RB4
2:		RB2			10:		RB2		RB4
3:	RB1	RB2			11:	RB1	RB2		RB4
4:			RB3		12:			RB3	RB4
5:	RB1		RB3		13:	RB1		RB3	RB4
6:		RB2	RB3		14:		RB2	RB3	RB4
7:	RB1	RB2	RB3		15:	RB1	RB2	RB3	RB4

7.11 Configuration user menu   („B" parameters)

This is where you set which parameters are visible or editable in the user menu (section 6.5).

	Description	Range	Default
	Configuration setpoints		
B1	Properties setpoint 1 (Menu: Settings -> C1) 0: not visible 1: visible, not adjustable 2: visible and adjustable	0..2	2
B2 **B3**	Minimum adjustable setpoint 1 Maximum adjustable setpoint 1	-50..400 C° -50..400 C°	-50,0 400

B4	Properties setpoint 2 (Menu: Settings -> C2) 0: not visible 1: visible, not adjustable 2: visible and adjustable	0..2	0
B5 **B6**	Minimum adjustable setpoint 2 Maximum adjustable setpoint 2	-50..400 C° -50..400 C°	-50,0 400

B7	Properties setpoint 3 (Menu: Settings -> C3) 0: not visible 1: visible, not adjustable 2: visible and adjustable	0..2	0
B8 **B9**	Minimum adjustable setpoint 3 Maximum adjustable setpoint 3	-50..400 C° -50..400 C°	-50,0 400

B10	Properties setpoint 4 (Menu: Settings -> C4) 0: not visible 1: visible, not adjustable 2: visible and adjustable	0..2	0
B11 **B12**	Minimum adjustable setpoint 4 Maximum adjustable setpoint 4	-50..400 C° -50..400 C°	-50,0 400

B13	Properties of alternative setpoint (Menu: Settings -> C6) 0: not visible 1: visible, not adjustable 2: visible and adjustable	0..2	0
B14 **B15**	Min. adjustable alternative setpoint Max. adjustable alternative setpoint	-50..400 C° -50..400 C°	-50,0 400

B16	Manual changeover of alternative setpoint (Menu: Settings -> C7) 0: not visible 1: visible, not adjustable 2: visible and adjustable	0..2	0

to section 7.11: Configuration user menu   („B" parameters)

	Description	Range	Default
	Configuration hysteresises		
B21	Properties hysteresis 1 (Menu: Settings -> C21) 0: not visible 1: visible, not adjustable 2: visible and adjustable	0..2	0
B22 **B23**	Minimum adjustable hysteresis 1 Maximum adjustable hysteresis 1	0,1..99,9 K 0,1..99,9 K	0,1 99,9

B24	Properties hysteresis 2 (Menu: Settings -> C22) 0: not visible 1: visible, not adjustable 2: visible and adjustable	0..2	0
B25 **B26**	Minimum adjustable hysteresis 2 Maximum adjustable hysteresis 2	0,1..99,9 K 0,1..99,9 K	0,1 99,9

B27	Properties hysteresis 3 (Menu: Settings -> C23) 0: not visible 1: visible, not adjustable 2: visible and adjustable	0..2	0
B28 **B29**	Minimum adjustable hysteresis 3 Maximum adjustable hysteresis 3	0,1..99,9 K 0,1..99,9 K	0,1 99,9

B30	Properties hysteresis 4 (Menu: Settings -> C24) 0: not visible 1: visible, not adjustable 2: visible and adjustable	0..2	0
B31 **B32**	Minimum adjustable hysteresis 4 Maximum adjustable hysteresis 4	0,1..99,9 K 0,1..99,9 K	0,1 99,9

	Configuration zone settings compound control		
B36	Properties distance zone 1 (Menu: Settings -> C25) 0: not visible 1: visible, not adjustable 2: visible and adjustable	0..2	0
B37 **B38**	Minimum adjustable zone distance 1 Maximum adjustable zone distance 1	0,1..10,0 K 0,1..10,0 K	0,1 10,0

B39	Properties distance zone 2 (Menu: Settings -> C26) 0: not visible 1: visible, not adjustable 2: visible and adjustable	0..2	0
B40 **B41**	Minimum adjustable zone distance 2 Maximum adjustable zone distance 2	0,1..10,0 K 0,1..10,0 K	0,1 10,0

to section 7.11: Configuration user menu   („B" parameters)

	Description	Range	Default
	Configuration temperature alarms		
B51	Features lower temperature alarm 1 (Menu: Settings -> C40) 0: not visible 1: visible, not adjustable 2: visible and adjustable	0..2	0
B52 **B53**	Min. adjustable lower temperature alarm 1 Max. adjustable lower temperature alarm 1	-50..400 C° -50..400 C°	-50,0 400

B54	Features upper temperature alarm 1 (Menu: Settings -> C41) 0: not visible 1: visible, not adjustable 2: visible and adjustable	0..2	0
B55 **B56**	Min. adjustable upper temperature alarm 1 Max. adjustable upper temperature alarm 1	-50..400 C° -50..400 C°	-50,0 400

B57	Features lower temperature alarm 2 (Menu: Settings -> C42) 0: not visible 1: visible, not adjustable 2: visible and adjustable	0..2	0
B58 **B59**	Min. adjustable lower temperature alarm 2 Max. adjustable lower temperature alarm 2	-50..400 C° -50..400 C°	-50,0 400

B60	Features upper temperature alarm 2 (Menu: Settings -> C43) 0: not visible 1: visible, not adjustable 2: visible and adjustable	0..2	0
B61 **B62**	Min. adjustable upper temperature alarm 2 Max. adjustable upper temperature alarm 2	-50..400 C° -50..400 C°	-50,0 400

* Temperature alarms 3+4 cannot be displayed in the user menu.

8. Data access via MOD bus RTU

8.1.1 MOD bus „Reading register"

The controller supports the function code FC03 (read holding register) for reading out the operating data. A maximum of 16 registers can be queried in one access.

The basic settings for
- the interface device and
- permissions
- limitations
- see "System settings („U" parameters)" – section 7.10

The following data is provided:

Byte / Bit	Description	Data type	Unit / condition
Address 0	**Actual value temperature sensor 1**	SI16	*°C (*10)*
Address 1	**Actual value temperature sensor 2**	SI16	*°C (*10)*
Address 2	**Actual value temperature sensor 3**	SI16	*°C (*10)*
Address 3	**Actual value temperature sensor 4** (optional)	SI16	*°C (*10)*

Byte / Bit	Description	Data type	Unit / condition
Address 5	**Temperature representation analog input 1**	SI16	*°C (*10)*
Address 6	**Temperature representation analog input 2 (optional)**	SI16	*°C (*10)*

Byte / Bit	Description	Data type	Unit / condition
Address 8	**Current setpoint RB 1**	SI16	*°C (*10)*
Address 9	**Current setpoint RB 2**	SI16	*°C (*10)*
Address 10	**Current setpoint RB 3**	SI16	*°C (*10)*
Address 11	**Current setpoint RB 4**	SI16	*°C (*10)*

Byte / Bit	Description	Data type	Unit / condition
Address 12	**Physical state of digital inputs**	UI16	
Bit 0	Digital input 1		*disabled/enabled*
Bit 1	Digital input 2		*disabled/enabled*
Bit 2	Digital input 3		*disabled/enabled*
Bit 3	Digital input 4		*disabled/enabled*
Bit 4	Digital input 5		*disabled/enabled*
Bit 5	Digital input 6		*disabled/enabled*
Bit 6 - 15	*(only with connected IO expansion module)*		*disabled/enabled*

Byte / Bit	Description	Data type	Unit / condition
Address 13	**Logical state of digital inputs**	UI16	
	(Does not represent physical condition. The logical state depends on the parameterization of the controller, whether low-active or high-active, saving...)		
Bit 0	Digital input 1		*disabled/enabled*
Bit 1	Digital input 2		*disabled/enabled*
Bit 2	Digital input 3		*disabled/enabled*
Bit 3	Digital input 4		*disabled/enabled*
Bit 4	Digital input 5		*disabled/enabled*
Bit 5	Digital input 6		*disabled/enabled*
Bit 6 - 15	*(only with connected IO expansion module)*		*disabled/enabled*

8. Data access via MOD bus RTU

Byte / Bit	Description	Data type	Unit / condition
Address 14	**Fault messages**	UI16	
Bit 0	Sensor fault 1		*OK / alarm*
Bit 1	Sensor fault 2		*OK / alarm*
Bit 2	Sensor fault 3		*OK / alarm*
Bit 3	Sensor fault 4 (optional)		*OK / alarm*
Bit 4	- - -		
Bit 5	Cable break 4-20 mA input 1		*OK / alarm*
Bit 6	Cable break 4-20 mA input 2 (optional)		*OK / alarm*
Bit 7	- - -		
Bit 8	Collective fault message		*OK / alarm*
Bit 9	Lower temperature alarm 1		*OK / alarm*
Bit 10	Upper temperature alarm 1		*OK / alarm*
Bit 11	Lower temperature alarm 2		*OK / alarm*
Bit 12	Upper temperature alarm 2		*OK / alarm*
Bit 13	Temperature alarm 3		*OK / alarm*
Bit 14	Temperature alarm 4		*OK / alarm*
Bit 15	- - -		

Byte / Bit	Description	Data type	Unit / condition
Address 15	Physical state of output relay	UI16	
Bit 0	Digital input 1		*disabled/enabled*
Bit 1	Digital input 2		*disabled/enabled*
Bit 2	Digital input 3		*disabled/enabled*
Bit 3	Digital input 4		*disabled/enabled*
Bit 4	Digital input 5		*disabled/enabled*
Bit 5	Digital input 6		*disabled/enabled*
Bit 6 - 15	*(only with connected IO expansion module)*		*disabled/enabled*

Byte / Bit	Description	Data type	Unit / condition
Address 16	**Manipulated variable analog output 1**	UI16	*% (*10)*
Address 17	**Manipulated variable analog output 2** (optional)	UI16	*% (*10)*

Byte / Bit	Description	Data type	Unit / condition
Address 20	**Status information / releases for operation release**	UI16	
Bit 0	„Operation release/standby" Modbus activation 0: disabled, no influence can be exerted on an operating release via Modbus 1: enables, the controller requires an operating release via Modbus. Required signal see bit 1.		*disabled/enabled*
Bit 1	„Operational enable/standby" signal meaning 0: The controller needs a 0 to be switched ready for operation. 1: The controller needs a 1 to be switched ready for operation.		
Bit 2/3	„Operational release/standby" current status 0: the controller is ready for operation 1: the controller is in standby. 2: the controller is OFF (via button)		
Bit 4	Communication status 0: the controller cannot be reached via the bus (all read data are not valid) 1: the controller can be reached via the bus		*ON / OFF*
Bit 5 - 7	- - -		*OK / alarm*
Bit 8 - 15	Bus timeout in seconds 0: no timeout 1...: If the controller determines that no more data is sent after the set time, this is evaluated as a bus failure..	UI8	

Byte / Bit	Description	Data type	Unit / condition
Address 21	**Status information / releases for setpoint specification**	UI16	
Bit 0	Setpoint release RB 1		disabled/enabled
Bit 1	Setpoint release RB 2		disabled/enabled
Bit 2	Setpoint release RB 3		disabled/enabled
Bit 3	Setpoint release RB 4		disabled/enabled
	0: deactivated, a setpoint specification via Modbus is not possible.. 1: active, setpoint specification via Modbus is possible		

Byte / Bit	Description	Data type	Unit / condition
Bit 4	Setpoint setting "active" RB 1		disabled/enabled
Bit 5	Setpoint setting "active" RB 2		disabled/enabled
Bit 6	Setpoint setting "active" RB 3		disabled/enabled
Bit 7	Setpoint setting "active" RB 4		disabled/enabled
	1: active. If the control module 'X' has been switched to external setpoint specification via Modbus, this bit is set.		
Bit 8	Range check setpoint specification RB 1		OK / fault
Bit 9	Range check setpoint specification RB 2		OK / fault
Bit 10	Range check setpoint specification RB 3		OK / fault
Bit 11	Range check setpoint specification RB 4		OK / fault
	1: Fault, setpoint specification was not accepted because it is outside the permitted range.		
Bit 12 - 15	- - -		

Byte / Bit	Description	Data type	Unit / condition
Address 22	**Minimum permissible setpoint specification RB 1**	SI16	
Address 23	**Maximum permissible setpoint specification RB 1**	SI16	
Address 24	**Minimum permissible setpoint specification RB 2**	SI16	
Address 25	**Maximum permissible setpoint specification RB 2**	SI16	
Address 26	**Minimum permissible setpoint specification RB 3**	SI16	
Address 27	**Maximum permissible setpoint specification RB 3**	SI16	
Address 28	**Minimum permissible setpoint specification RB 4**	SI16	
Address 29	**Maximum permissible setpoint specification RB 4**	SI16	

Byte / Bit	Description	Data type	Unit / condition
Address 31	**Controller type / software version**		
Bit 0 - 7	Controller type 1: MR(x)C-3-001-A 2: MR(x)C-3-002-F 3: MR(x)C-3-003-F 5: MR(x)C-3-005-F	UI8	
Bit 8 - 15	Software version	UI8	

8.1.2 MOD-Bus „Write register"

Via the function code FC06 (write holding register), it is possible to
- preset a setpoint to the controller for each of the four control functions, or
- the controller can be switched to standby.

These functions can be released or blocked individually in the parameterisation of the controller.

For the validity of the specifications, they have to be repeated at least every 'X' seconds (depending on the setting [FC3, address 20, bit 8-15]). If the controller detects that no data were sent for more than 'X' seconds, this is interpreted as a bus-failure.

The following register accesses are provided:

Byte / Bit	Description	Data type	Unit / condition
Address 64 **Address 65** **Address 66** **Address 67**	**Setpoint specification RB 1** - (Bit „X" = Bit „0") **Setpoint specification RB 2** - (Bit „X" = Bit „1") **Setpoint specification RB 3** - (Bit „X" = Bit „2") **Setpoint specification RB 4** - (Bit „X" = Bit „3")	SI16 SI16 SI16 SI16	°C (*10) °C (*10) °C (*10) °C (*10)
	Must be enabled in the controller parameterization. Is displayed in FC3 [address 21 / bit "X"]. In addition, bit "X" must be set at address 68 to activate the setpoint. It is then possible to switch between setting the setpoint via the bus or programming the controller.		

Byte / Bit	Description	Data type	Unit / condition
Address 68 *Bit 0* *Bit 1* *Bit 2* *Bit 3*	 Setpoint specification RB 1 activation - address „Y" = 64 Setpoint specification RB 2 activation - address „Y" = 65 Setpoint specification RB 3 activation - address „Y" = 66 Setpoint specification RB 4 activation - address „Y" = 67	UI16	 *disabled/enabled* *disabled/enabled* *disabled/enabled* *disabled/enabled*
	0: deactivated, the control block "X" works with its own setpoint specification as programmed. 1: active, the control module "X" works with the setpoint specification that is specified via Modbus FC6 [address "Y"]..		
Bit 4 - 7	- - -		
Bit 8	Operation enable / standby activation Modbus With this bit, the controller can be given the operating release or the controller can be switched to standby. In general, this function must be enabled in the parameterization of the controller. Is displayed in FC3 [address 20 / bit 0]. Which signal the controller expects depends on its programming. **This information can be found in FC3 [address 20 / bit 1].** Bit not set: Controller requires a 0 for the operation enable Bit set: Controller requires a 1 for the operation enable		
Bit 9-15	- - -		

9. Other information

9.1 Setting the actual value correction

A correction can be made to the value as measured by the sensor, which applies cumulatively over the entire measuring range.

This is necessary when:
- at the first installation,
- the length of the sensor cable is changed, or,
- faulty sensor is replaced, giving rise to an incorrect reading.

In order to adjust the actual value correction, a reference thermometer is needed.

Proceed as follows:
- Switch off power supply.
- Install / change sensor
- Switch on power supply.
- Change parameter setting, if required.
- Measure the medium temperature using the reference thermometer.
- Enter the temperatures registered in the parameters [T90 / T92 / T94 / T96].
  (The offset value calculated by the controller is now displayed in the parameters [T91 / T93 / T95 / T97] and can be corrected as desired.)

9.2 Display and RESET configuration

9.2.1 … for temperature alarms

Here you can parameterize for each temperature alarm [H29 / H49 / H69 / H89]:
- the display behaviour on the display
- the RESET behaviour (automatic or manual)
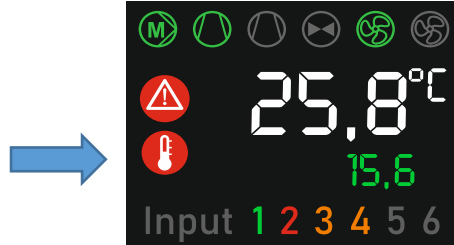
autoReset = Alarm is automatic. reset as soon as the temperature alarm stops.

manReset = Alarm must be reset using the RESET button.

	Alarm	Icon		Type of reset	Start delay
0:	**Alarm comes**		Alarm is set automatically		
	Alarm disapp.		Alarm is automatically reset	*autoReset*	
1:	**Alarm comes**		Alarm is set automatically		
	Alarm disapp.		Alarm is automatically reset	*autoReset*	
2:	**Alarm comes**		Alarm is set automatically		
	Alarm disapp.		Alarm is automatically reset	*autoReset*	
3:	**Alarm comes**		Alarm is set automatically – manually resettable	*manReset*	START
	Alarm disapp.		Alarm is automatically reset	*autoReset*	
4:	**Alarm comes**		Alarm is set automatically		
	Alarm disapp.		Alarm is reset automatically, display must be confirmed manually.	*autoReset*	
5:	**Alarm comes**		Alarm is set automatically – manually resettable	*manReset*	START
	Alarm disapp.		Alarm is reset automatically, display must be confirmed manually.	*autoReset*	
6:	**Alarm comes**		Alarm is set automatically		
	Alarm disapp.		Alarm must be reset manually	*manReset*	
7:	**Alarm comes**		Alarm is set automatically – manually resettable	*manReset*	START
	Alarm disapp.		Alarm must be reset manually	*manReset*	

START = Start delay is restarted

Generally:

- In OFF mode, all faults and displays are reset.

- If a start delay is parameterised for the temperature alarm, this is always triggered again when starting again from OFF mode. Other functions will be reset in this case. If no start delay is configured, a pending alarm is displayed directly.

- If a temperature alarm is configured "independent of standby", its function is also retained in standby.

- If the "on release, an auto reset with start delay" option is activated for a temperature alarm in parameter [H26 / H46 / H66 / H86], the temperature alarm is reset when released from standby and the start delay is restarted.

9.2.2 … for digital inputs

Here you can parameterize for each digital input [D19 / D29 / … / D69]:
- the display behaviour on the display
- the RESET behaviour (automatic or manual)

autoReset =   Alarm is automatic. reset as soon as the temperature alarm stops.

manReset =   Alarm must be reset using the RESET button.
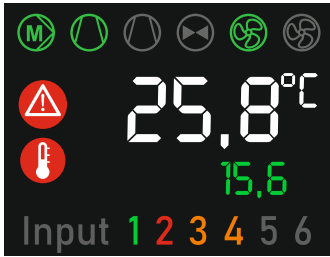
	Event	Icon		Type of reset	Start delay
0:	Ereignis comes		Message is set automatically		
	Ereignis disapp.		Message is automatically reset	autoReset	
1:	Ereignis comes	3	Message is set automatically		
	Ereignis disapp.		Message is automatically reset	autoReset	
2:	Ereignis comes	3	Message is set automatically		
	Ereignis disapp.		Message is automatically reset	autoReset	
3:	Ereignis comes	3	Message is set automatically – manually resettable	manReset	START
	Ereignis disapp.		Message is automatically reset	autoReset	
4:	Ereignis comes	3	Message is set automatically		
	Ereignis disapp.	3	Message is automatically reset, display must be confirmed manually	autoReset	
5:	Ereignis comes	3	Message is set automatically – manually resettable	manReset	START
	Ereignis disapp.	3	Message is automatically reset, display must be confirmed manually	autoReset	
6:	Ereignis comes	3	Message is set automatically		
	Ereignis disapp.	3	Message must be reset manually	manReset	
7:	Ereignis comes	3	Message is set automatically – manually resettable	manReset	START
	Ereignis disapp.	3	Message must be reset manually	manReset	
8:	Ereignis comes	3	Message is set automatically		
	Ereignis disapp.		Message is automatically reset	autoReset	
9:	Ereignis comes	3	Message is set automatically – manually resettable	manReset	START
	Ereignis disapp.		Message is automatically reset	autoReset	

START = Start delay is restarted

Generally:

- In OFF mode, all faults and displays are reset.

- If a start delay is parameterised for the digital input, this is always triggered again when starting again from OFF mode. Other functions will be reset in this case. If no start delay is configured, a pending alarm is displayed directly.

- If a digital input is parameterized "independent of standby", its function is also retained in standby.

- If the "on release, an auto reset with start delay" option is activated for a digital input in parameter [D12 / D22 / D32 / D42 / D52 / D62], the digital input is reset when released from standby and the start delay is restarted.

Case studies display and RESET behaviour for digital inputs

Selection 0:
autoReset, no display

For background applications that should not be visible on the display.
(e.g. a relay is switched on via a digital input).

Selection 1:
autoReset, green display

For functions that are switched via a digital input
(e.g. operating release of the controller via digital input).

Selection 2:
autoReset, red display

For faults that should be reset automatically (e.g. low pressure fault). After a fault, the machine automatically continues to operate. Fault event is no longer visible after the fault.

Selection 3:
autoReset, red display,
Possibility of manual reset if the fault is still pending.

For faults that cannot be reset automatically due to the system.
(e.g. flow monitor).

Since a fault usually switches off the pump, the flow cannot come back on its own. The fault can be reset with the RESET button in order to start the pump again. (set start delay)

9. Other information

Selection 4:
autoReset, red display, display memory

For errors that are to be reset automatically, but the event remains visible after the fault (e.g. low pressure fault).

After a fault, the machine automatically continues to operate. Fault event is visible (orange) after the disturbance. The display is reset with the RESET button.

Selection 5:
autoReset, red display, display memory,
Possibility of manual reset if the fault is still pending.

For faults that are to be reset automatically and, if necessary, manually in the event of a fault, but the event remains visible after the fault (e.g. low-pressure fault).

After a fault, the machine automatically continues to operate. Fault event is visible (orange) after the disturbance. The display is reset with the RESET button.

In this setting, the machine could also be put into operation in the event of a fault by pressing the RESET button.

Selection 6:
manReset, red display.

In the event of faults that cannot be reset independently (e.g. high pressure fault).

The machine remains blocked even after the fault and can only be put into operation with a manual RESET (after the fault has been eliminated). Whether a fault is currently present (red) or no longer is present (orange) indicated by the colour of the symbol.

Selection 7:
manReset, red display,
Possibility of manual reset if the fault is still pending.

For faults that must not be reset independently (e.g. float switch).

The machine remains blocked even after the fault and can only be put into operation with a manual RESET (even if the fault is still present). Whether a fault is currently pending (red) or no longer present (orange) is indicated by the colour of the symbol.

Selection 8:
autoReset, orange display.

Like 2: - only input is shown in YELLOW.

Selection 9:
autoReset, orange display,
Possibility of manual reset if the fault is still pending.

Like 3: - only input is shown in YELLOW.

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9.3 Switch position of the relays in the event of an fault

The output switch-off determines which relay is to be switched off in the event of a fault event.

In principle, the relays to be switched can be selected in two different ways:
- directly via the controller display
- about the Konsoft

Additional setting for the digital inputs [D15]:

If an assigned relay output switches on and there is no fault at this moment, the set start delay is restarted.

9.3.1 Entry via the controller display

Proceed as follows:
- Call up the service menu.
- Select the desired sub-item:
  - Temperature alarms
  - Digital inputs
  - Function modules -> pump module
- Select menu item "Output switch-off".
  The following display appears:

```
Entry 1
 D17 Output switch-off   0
  □ K1 □ K2 □ K3 □ K4
  □ K5 □ K6 □ K7 □ K8
  □ K9 □ K10
 save
```
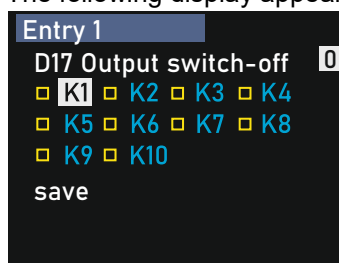
- *Example: digital input 1*

- Use the arrow keys to select the desired relay.
- Activate / deactivate the relay with the SET button.

```
Entry 1
 D17 Output switch-off 293
  ■ K1 □ K2 ■ K3 □ K4
  □ K5 ■ K6 □ K7 □ K8
  ■ K9 □ K10
 save
```
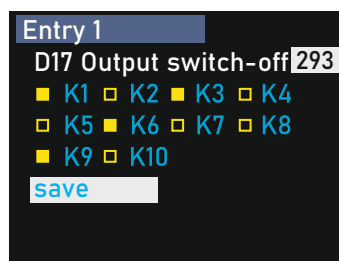
The number "293" is calculated automatically from the marked relays and is saved in the corresponding parameter.

- If all relays are selected => save.

You can exit the menu without saving by pressing the "Back arrow" key.

9.3.2 Input via the Konsoft

In the Konsoft, the desired relays CANNOT be determined separately. A 'code' must be entered in the parameter list for the corresponding parameter <u>under the item "Output switch-off"</u>, which must be determined according to the following table.

Relay	Relay encoding value	Selected relay

Relay	Relay encoding value	Selected relay
K1	1	**1**
K2	2	
K3	4	**4**
K4	8	
K5	16	
K6	32	**32**
K7	64	
K8	128	
K9	256	**256**
K10	512	

Explanation:

A coding value is stored for each relay. The sum of the values of the selected relays corresponds to the 'code'.

	Total (code):	**293**

9.4 "I/O extension module" connection (optional)

Function and connection

With an I/O expansion module, your controller can be expanded to include additional digital and analog inputs and outputs.

- The 6 output relays can either all be operated with 24VDC or all with 230VAC.
- The 5 digital inputs (24V DC) can be configured as either NPN or PNP inputs using a jumper.
- The 2 current inputs 4..20 mA with supply voltage connection can be used to connect corresponding sensors.

Observe the documentation supplied with the expansion module.

Configuration

The I/O extension module is configured in parameters [U11 – U16].

9.5 General measures when using electronic control systems

So that even complicated regulatory tasks can be presented to the user in a manner which is clear and simple and ensures high measurement accuracy, today's electronic control systems make increasing use of microprocessors. However, the benefits of these systems are countered by the disadvantage that increased measurement accuracy is accompanied by sensitivity to interference. In order to minimise the effect which interference may have on the regulator the user also must take account of a number of points when installing a new regulator.

Assistance here is provided by standard DIN VDE 0843 on the electromagnetic compatibility (EMC) of measurement, control and regulatory devices in industrial process technology. The following table shows, for example, the maximum interference levels to which (according to the standard), an appliance may be exposed.

Degree of severity	Environment class	Test voltage Power supply	Test voltage Signal/control line
1	well-protected environment	0.5 kV	0.25 kV
2	protected environment	1.0 kV	0.5 kV
3	typical industrial environment	2.0 kV	1.0 kV
4	industrial environment with very high interference level	4.0 kV	2.0 kV

As the values given in the table are maximum values, operational values should remain well below them. However, in practice this is possible only with difficulty, as even a normal contactor without interference suppression produces interference pulses of up to 3.0 kV. For this reason we recommend that the following principles be taken into account during installation:

a. Try to eliminate all sources of interference by carrying out interference suppression and minimising the interference level. Radio interference suppression is required under VDE 0875 and confirmed by VDE 0874. In principle the interference must be eliminated at source. The nearer the interference suppresser is to the source of interference the greater its effect.

Interference spreads through wires or by electromagnetic radiation. It is usually the former which interferes most seriously with regulation systems..

Possible interference sources (to name a few) include:
- bouncing contacts when switching loads
- switching off inductive loads (contactors, motors, solenoid valves, etc.)
- unsatisfactory routing of wires, too small cross-sections
- loose contacts
- rhythmically changing power stages (power converters)
- power breakers
- high-frequency generators

b. If specific interference sources cannot be avoided they should at least be kept at a distance from the regulator system.

c. Capacitive and inductive couplings can cause crosstalk between high-voltage lines and parallel low-voltage and sensor lines. This distorts measured values and signals and can disrupt the entire regulatory process. It is therefore recommended that all sensors and signal lines be placed separately from the control and mains voltage lines.

d. If possible a separate main line should be provided to feed the regulator system. This helps reduce any interference penetrating the regulator via the mains supply line. Voltage surges resulting from switching substantial loads will also then be less of a problem.

e. In the case of contactors, solenoid valves and other inductive consumers the induction voltage occurring during switching has to be reduced by appropriate protection methods. The choice of methods depends on whether the consumer runs on DC or AC voltage

Right !
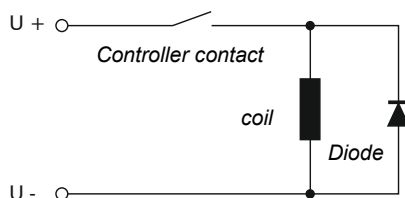
DC voltage

In the case of d/c voltage systems the induction voltage occurring can, for example, be limited by using self-induction diodes, varistors or suppresser diodes. The diagram on the left shows one possibility using a self-induction diode.
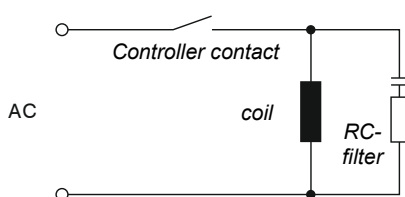
AC voltage

In the case of a/c voltage interference suppression as described above is not possible. Instead an RC combination must be used. An RC filter must be connected as directly as possible to the inductance in order to ensure a short line. In addition the component ratings of the RC combination must be geared to the inductance. Too low ratings lead to excessive voltage and too high ratings cause significant losses in the interference suppresser component. Another point to note here is that only capacitors which meet VDE 0656 may be used. They must be suited to the mains voltage and designed for very high switching voltages. The diagram on the left shows inductance interference suppression using an RC filter.

Wrong !
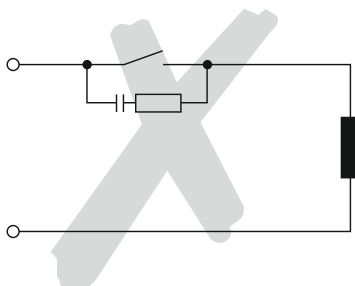
An RC filter should not be fitted directly to the regulator's switching contact (as shown on the left), as an idle current will flow through the RC combination even when the switching contact is open. This current may be enough to mean that a downstream contactor is not de-energised and a closed protective contact does not reopen.

f. Semiconductor switches such as thyristors or triacs also produce interference voltages. They occur as a result of non-linear characteristics and finite ignition voltages. These components must be protected against excessive voltages, for which mainly varistors, RC combinations or choke coils are used. The use of zero-voltage switches is also recommended.

The suggestions made represent only a few of the possible ways of protecting a microprocessor-controlled regulator system from interference. The suggested measures have the advantage that they will increase the lifetime of the devices as lower induction voltages (reduced spark formation) will also reduce contact burn.

10. Glossary

Setpoint and hysteresis

The setpoint (SW) is the temperature to which the medium is to be regulated. This can be both a heating and a cooling process.

If the temperature of the medium (actual value) exceeds the desired setpoint by a specified number of degrees (hysteresis), the control contact switches on the heating or cooling unit. When the setpoint is reached again, the control contact switches off again. This process is repeated cyclically.
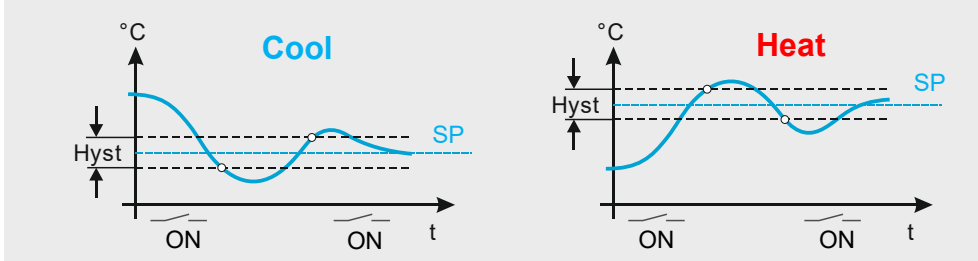
It should be noted:

- for cooling: hysteresis applied above the setpoint
- for heating: hysteresis set below the setpoint

The hysteresis can be one-sided or symmetrical to the setpoint.

Hysteresis one-sided
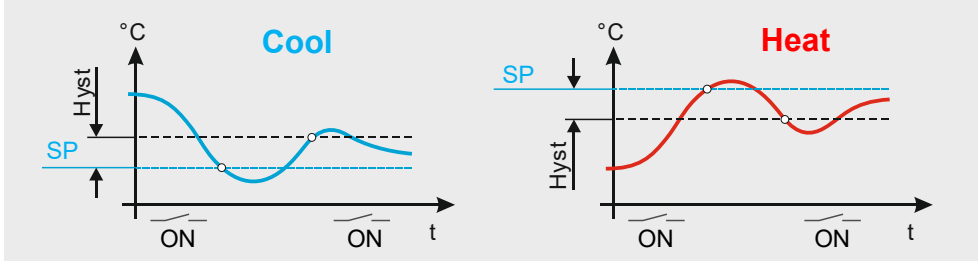
Hysteresis symmetrical

Absolute and relative setpoints

The 'main setpoint' is generally determined via parameter C1. This setpoint is the only one that can be displayed or changed directly in the working level using the SET button.

Absolute setpoints:

The setpoints are 'absolute' values to which the medium temperature is to be regulated.

Relative setpoints:

The setpoints are 'relative values' (ΔW) to setpoint C1.

Advantage: If several setpoints should always have the same distance to the previous setpoint, the operator only has to change the main setpoint C1, all other setpoints are carried over.

Relative setpoints with differential temperature control:

With differential temperature control, two media temperatures should be brought to a certain distance from each other.
- Reference variable: default temperature
- Consecutive variable: is controlled by the controller.

The following size can be set larger, smaller or equal.
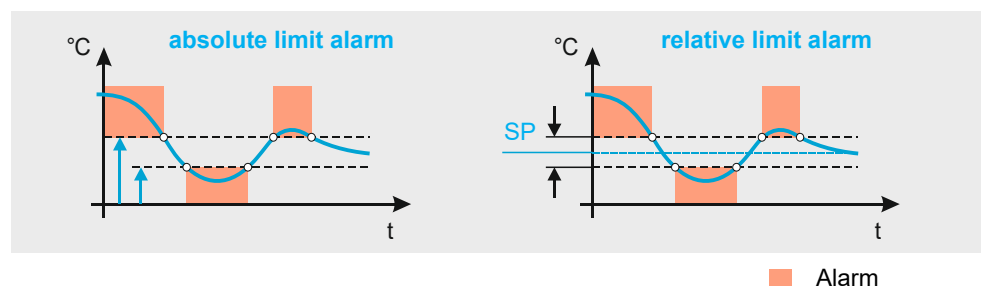
Differential temperature control with limit value:

As previously read, however, limits [parameters C30 - 31] can be entered from which the following variable no longer follows the reference variable. The temperature of the following variable is then kept at a fixed value.

Limit alarms

A limit alarm occurs when the temperature is outside the limits.

The alarm can work with fixed limits or be set as a relative alarm based on the respective setpoint.

[Setting parameters C40 - 43]

Difference temperature control

With a differential temperature control, the temperature is not controlled to a fixed value, but to a variable reference variable.

A second sensor or a specification via the analog input can be configured as a reference variable. In this case, the controller will always readjust the difference between the actual value (temperature of the medium) and the reference variable.