Measuring - Controlling - Regulating
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welba.de

Programmable PID multichannel temperature controller

MRF-2 ...
MRH-2 ...

Installation and operating instructions for plant engineering companies

Software version V2.4

Programmable via configuration software WELBA „KONSOFT"

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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 MRF-2 | MRH-2 PID multichannel temperature controller. This manual contains all necessary suggestions, informations, 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 errors 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 controller.

⚠ WARNING

When delivered, the parameterization of the MRF-2 | MRH-2 does not necessarily correspond to the intended use. This must be adjusted accordingly during the installation.

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

Operation instruction for the operator

The plant engineers, the installer or the service technician must prepare operating instructions for the operator of the controller. 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 prepared with the utmost care. However, the information contained herein is not an assurance of product characteristics.

The manufacturer accepts no liability for errors and reserves the right to make technical changes at any time. 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

WARNING

The proper function of the WTS-300 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 Appliance 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 MRF-2 | MRH-2 has up to three analogue universal temperature sensor inputs, one configurable analogue input and up to five digital inputs. Temperature sensor types KTY, PT-100 (2 or 3 leads) or PT1000 can be connected to it. The analogue input 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 five relay outputs or a freely configurable analogue output.

The operation and prior setting of the parameters of the MRF-2 | MRH-2 is divided into four operating levels. Access rights for each level must be determined by the plant engineering company. The programming level includes, for example, the parameters which the end user must be able to adjust during subsequent operation. As interference with the basic configuration by the end user can result in dangerous changes to functions, access to the other parameter levels is made more difficult by the use of codes.

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 three sensors, the analogue input and the analogue output control signal can be transmitted to a PC.

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

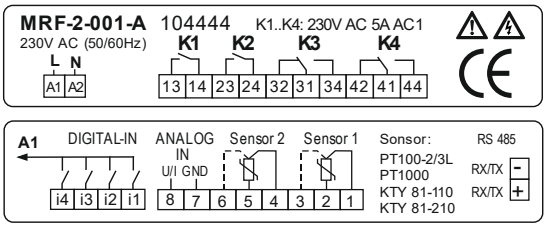
The manufacture cannot be held liable for errors and may at any time make changes serving technical progress. All rights reserved.

1.4 Model / type plate

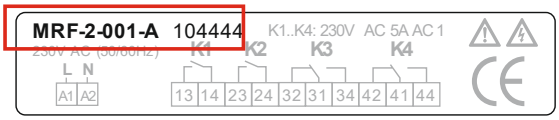
These instructions apply to all controllers in the series MRF-2 | MRH-2. They contain detailed descriptions for operation and parameter setting for all variants.

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

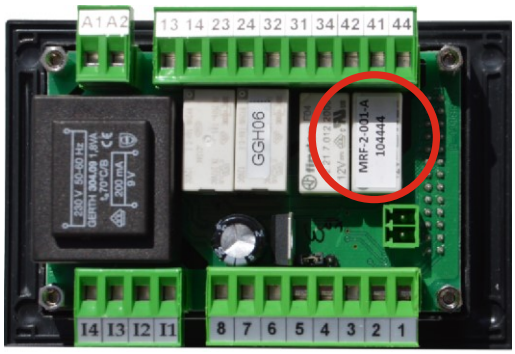
Example:



Controller type designation:

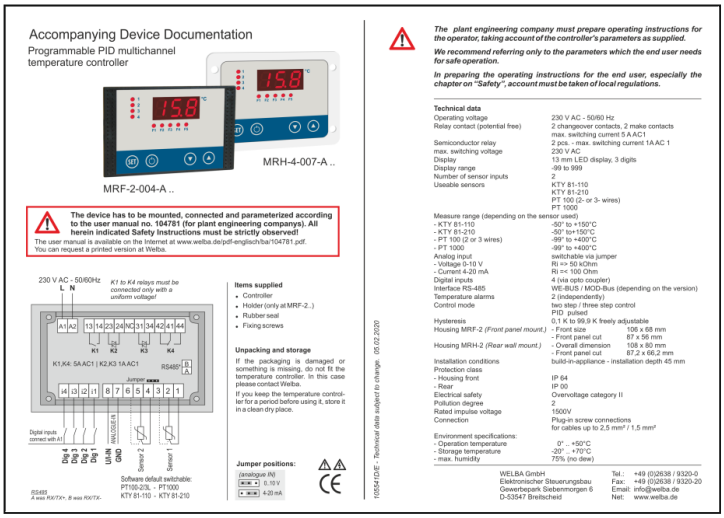


and



You can find a more detailed connection diagram for your controller on the accompanying device documentation.

Example:



1.5 Items supplied

- Controller MRF-2 | MRH-2
- Holder
- Rubber seal
- Fixing screws
- Accompanying documentation
- Software “WELBA-KONSOFT” (optional)

1.6 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.

1.7 Cleaning instructions

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

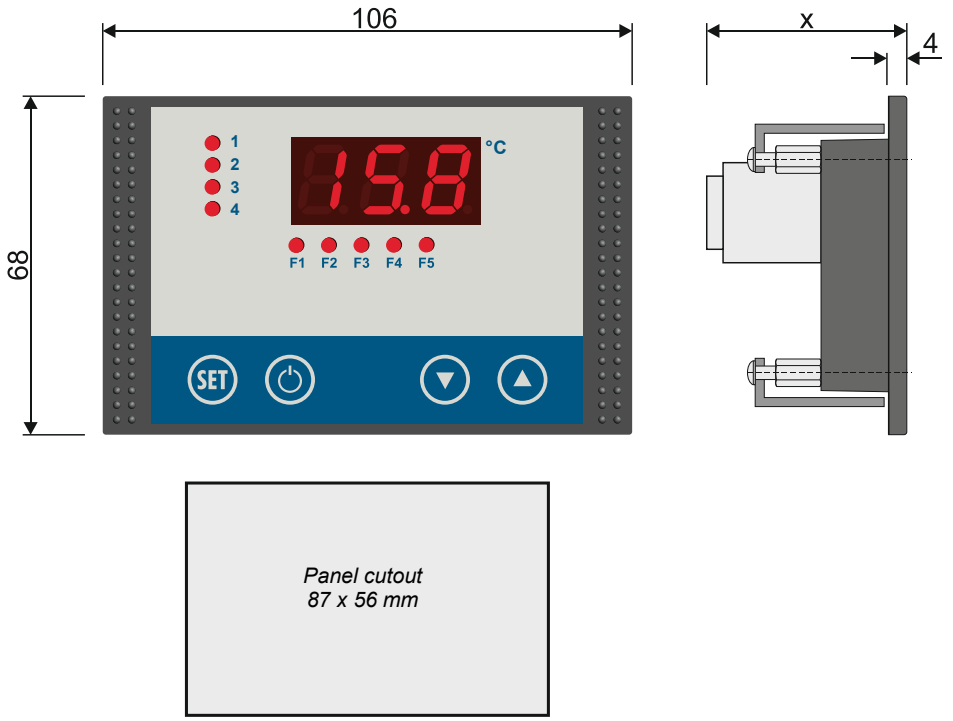
NOTICE

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

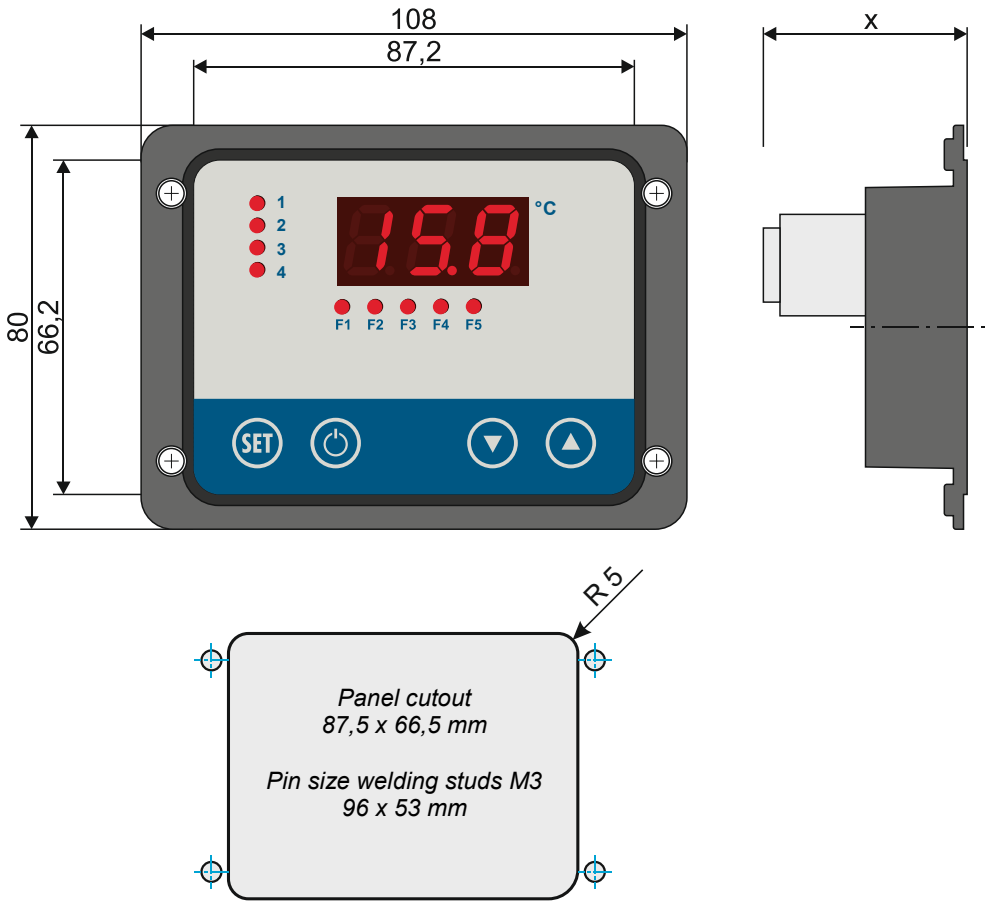
The use of these cleaners and cleaning methods may lead to damages!

1.8 Dimensions

MRF-2



MRH-2



1.9 Technical data

Operating voltage	see circuit diagram sticker
Relay contact	depending on device - see circuit diagram sticker
max. switching current	depending on device - see circuit diagram sticker
max. switching voltage	depending on device - see circuit diagram sticker
Display	13 mm LED-Display, 3 digits
Display range	-99 .. 999
Number of inputs	2 or 3
Usable sensors	KTY 81-110 KTY 81-210 PT 100 (2- oder 3-Leiter) PT 1000
Measurement range - KTY 81-110 - KTY 81-210 - PT 100 - 2 Leiter - PT 100 - 3 Leiter - PT 1000	 -50° .. +150°C -50° .. +150°C -99° .. +400°C -99° .. +400°C -99° .. +400°C
Digital inputs	up to 5 (via opto coupler)
Temperature alarms	2 (independently)
Control mode	two-step / three-step control PID (continuous or pulsed)
Hysteresis	0,1 K .. 99,9 K freely adjustable
Housing MRF-2 (Front panel mount.) Housing MRH-2 (Rear wall mount.)	- Front size 106 x 68 mm - Front panel cut 87 x 56 mm - Overall dimension 108 x 80 mm - Front panel cut 87,2 x 66,2 mm
Installation conditions	Regulator is designed as ‚built-in appliance‘
Degree of protection - Housing front - Rear	 IP 64 IP 00
Electrical safety	Overvoltage category III, pollution degree I
Connection	Plug-in screw connections for cables up to 2,5 mm²
Environment specifications: - Operation temperature - Storage temperature - max. humidity	 0° .. +50°C -20° .. +70°C 75% (no dew)
Pollution degree	Electrically conductive pollution must not enter the housing interior
Overvoltage category	CAT II

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.

NOTICE

IMPORTANT

The parameter settings of the MRF-2 | MRH-2 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.

⚠ 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 documentationor 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 not 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 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.

CE

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.

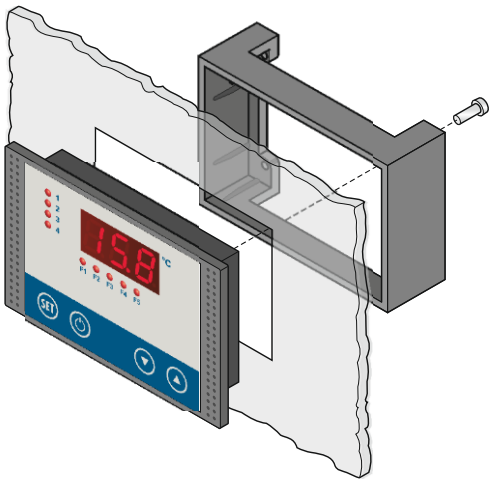
If you keep the temperature controller for a period before using it, store it in a clean dry place at a temperature of between -20°C and +70°C.

3.3 Installation of housing

MRF-2

For fixing the 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.

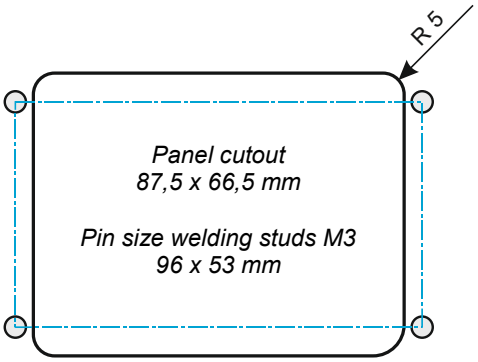


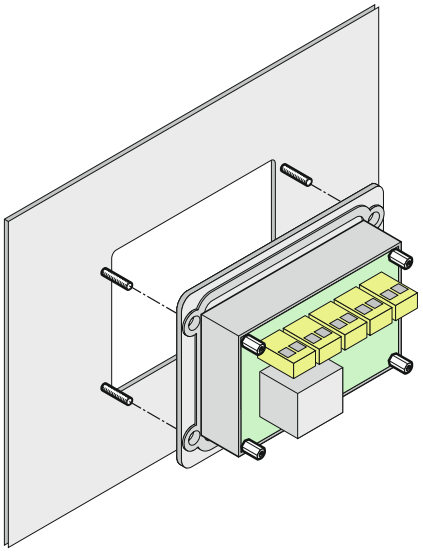
Panel cutout
87 x 56 mm

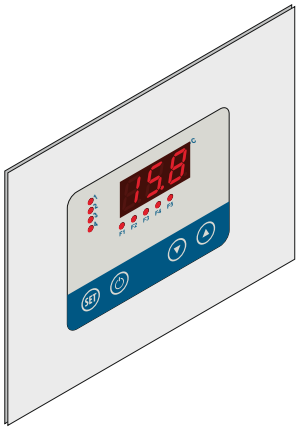
MRH-2

For fixing the 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..







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 MRF-2 | MRH-2 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 C91] 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 **Fehler! Verweisquelle konnte nicht gefunden werden.** "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 *Fehler! Verweisquelle konnte nicht gefunden werden.****)***

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.

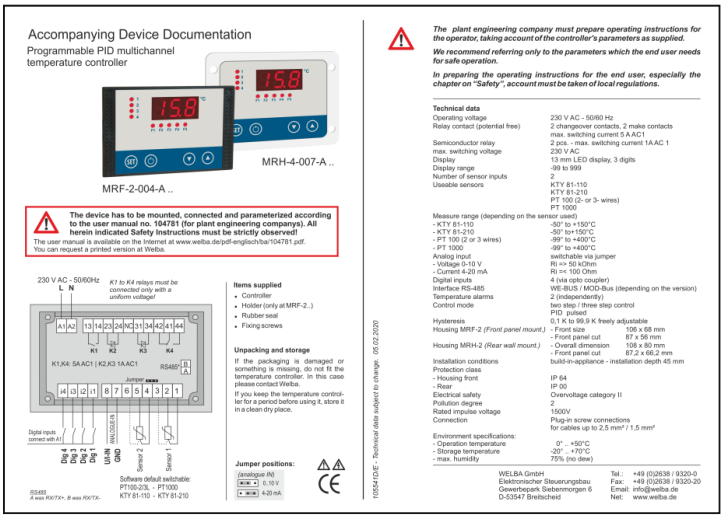
Use copper wire (except for the sensor connection) and ensure that all supply leads and connection terminals are dimensioned to suit the relevant current rating.

When connecting the controller and selecting the wiring materialsto 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.


Accompanying Device Documentation

Programmable PID multichannel temperature controller

MRH-4-007-A ..

MRF-2-004-A ..

The device has to be mounted, connected and parameterized according to the user manual no. 104781 (for plant engineering companys). All herein indicated Safety Instructions must be strictly observed!

The user manual is available on the Internet at www.welba.de/pdf-englisch/ba/104781.pdf. You can request a printed version at Welba.

230 V AC - 50/60Hz L N

K1 to K4 relays must be connected only with a uniform voltage!

K1,K4: 5A AC1 | K2,K3 1A AC1

Items supplied
- Controller
- Holder (only at MRF-2..)
- Rubber seal
- Fixing screws

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.

Jumper positions:

Software default switchable:
PT100-2/3L - PT1000
KTY 81-110 - KTY 81-210

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.

Technical data

Operating voltage	230 V AC - 50/60 Hz
Relay contact (potential free)	2 changeover contacts, 2 make contacts max. switching current 5 A AC1
Semiconductor relay	2 pcs. - max. switching current 1A AC 1
max. switching voltage	230 V AC
Display	13 mm LED display, 3 digits
Display range	-99 to 999
Number of sensor inputs	2
Useable sensors	KTY 81-110 KTY 81-210 PT 100 (2- or 3- wires) PT 1000
Measure range (depending on the sensor used)	
- KTY 81-110	-50° to +150°C
- KTY 81-210	-50° to+150°C
- PT 100 (2 or 3 wires)	-99° to +400°C
- PT 1000	-99° to +400°C
Analog input	switchable via jumper
- Voltage 0-10 V	Ri => 50 kOhm
- Current 4-20 mA	Ri =< 100 Ohm
Digital inputs	4 (via opto coupler)
Interface RS-485	WE-BUS / MOD-Bus (depending on the version)
Temperature alarms	2 (independently)
Control mode	two step / three step control PID pulsed
Hysteresis	0,1 K to 99,9 K freely adjustable
Housing MRF-2 *(Front panel mount.)*	- Front size 106 x 68 mm - Front panel cut 87 x 56 mm
Housing MRH-2 *(Rear wall mount.)*	- Overall dimension 108 x 80 mm - Front panel cut 87,2 x 66,2 mm
Installation conditions	build-in-appliance - installation depth 45 mm
Protecton class	
- Housing front	IP 64
- Rear	IP 00
Electrical safety	Overvoltage category II
Pollution degree	2
Rated impulse voltage	1500V
Connection	Plug-in screw connections for cables up to 2,5 mm² / 1,5 mm²
Environment specifications:	
- Operation temperature	0° .. +50°C
- Storage temperature	-20° .. +70°C
- max. humidity	75% (no dew)

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- 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. Operation

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.

TIP:

In the standard setting, only the setpoint temperature C1 can be directly changed in the operating level. When programming the different set temperatures, it is therefore necessary to consider which setpoint temperature must be corrected most frequently by the end user.

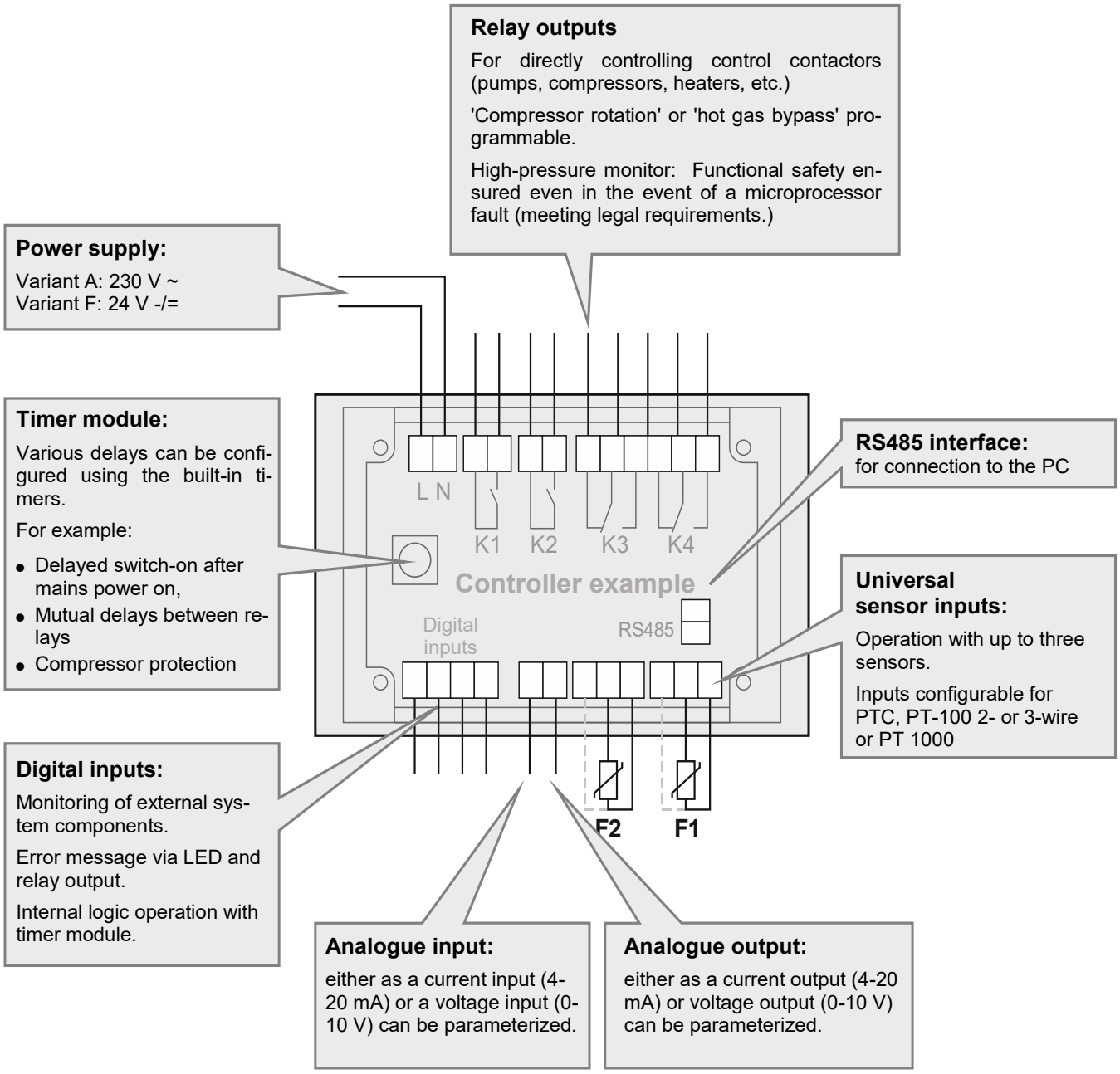
In the extended working level setting, the plant engineer can release further parameters of the setting level for the end user to view or modify.

TIP:

WELBA „KONSOFT"

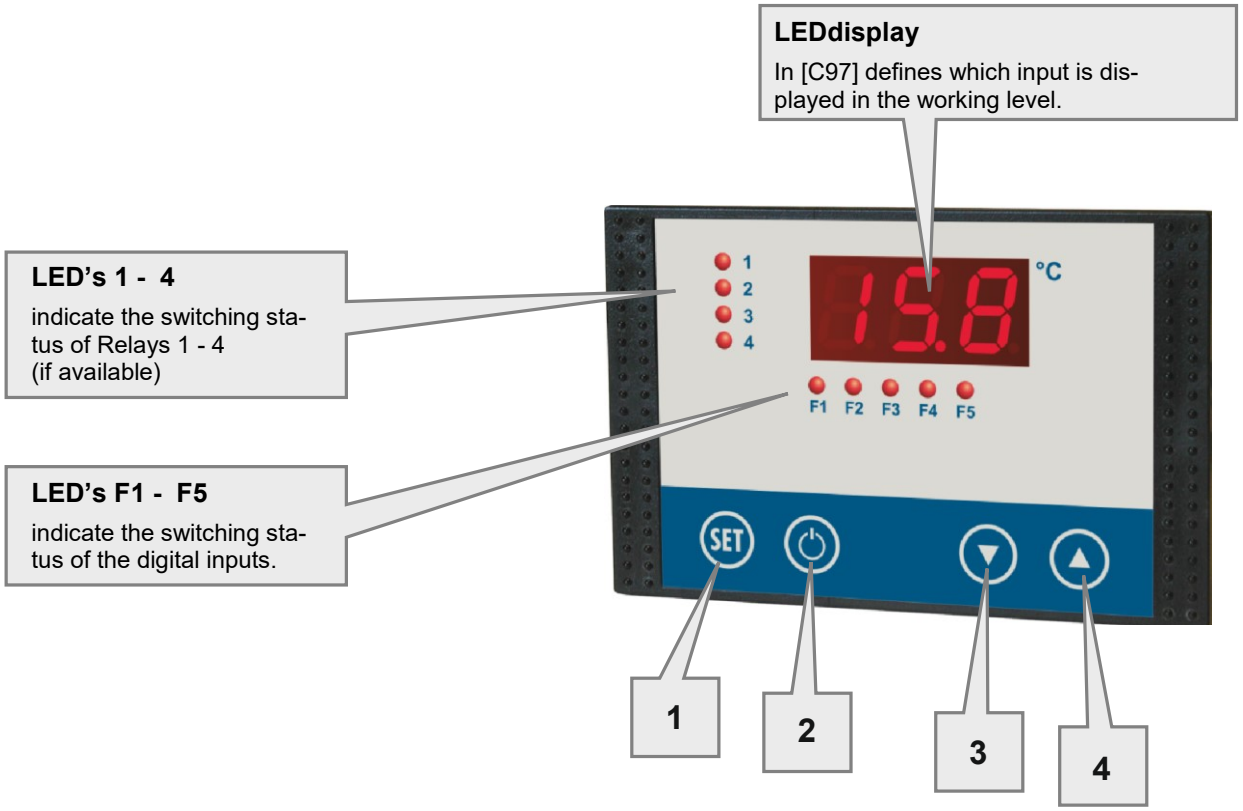
The configuration software available as an option can be used to set and update the temperature controller's parameters. The values measured by the three sensors, the analogue input and the analogue output control signal can also be transmitted to a PC.

5.2 Controller overview



5.3 Controls / Displays

5.3.1 Meaning of LED's



5.3.2 Button functions (Working level)

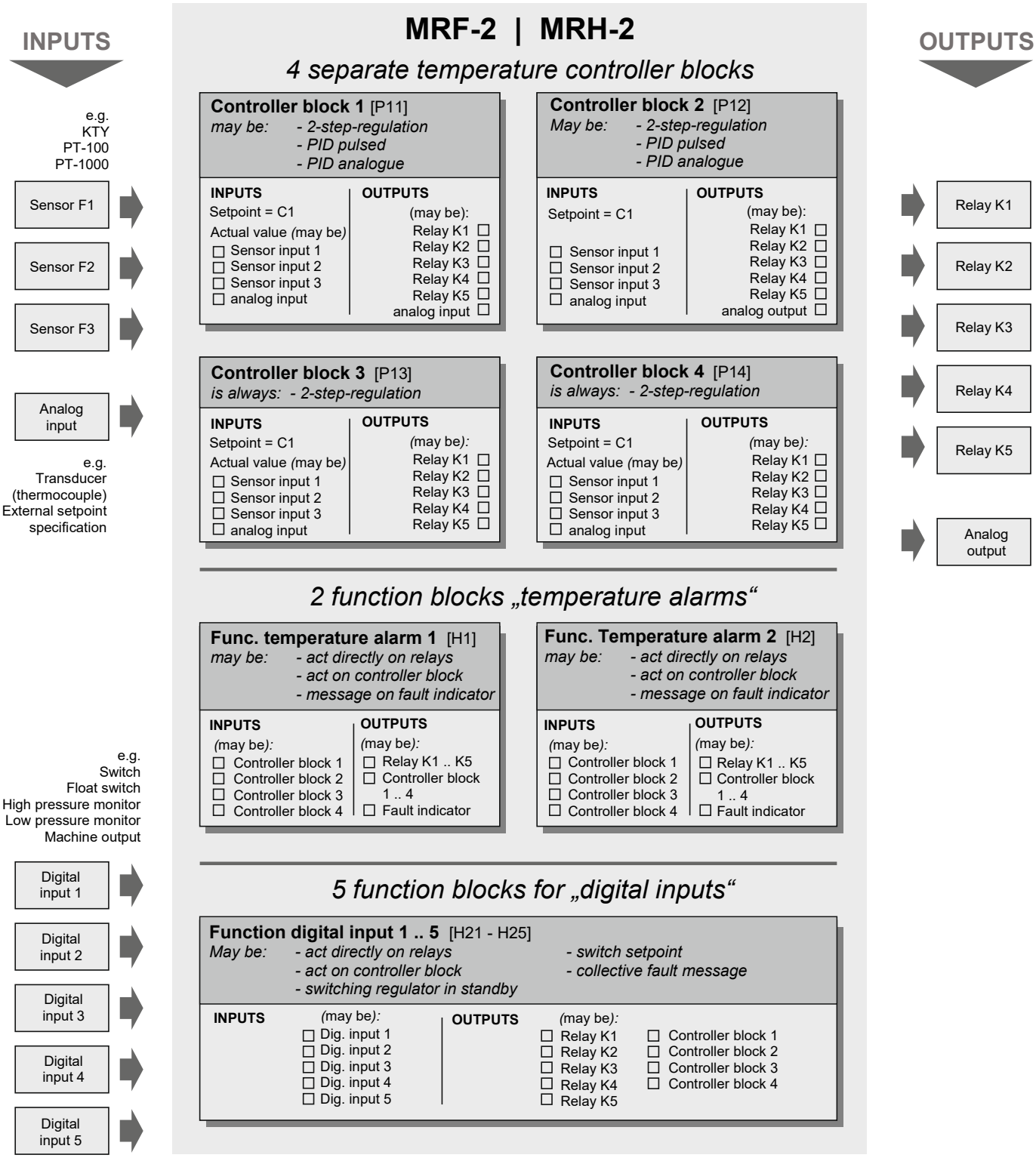
1	**SET button** =	
	STANDARD	To display or change the target temperature settings using the up and down arrow buttons.
	EXTENDED WORKING LEVEL	Adjustment of function see d-parameters. Depending on the setting of the plant engineering further parameters of the programming level can be displayed or changed here.
	Function	- Push SET button for 3 seconds until [C1] appears on the display. - Release SET button and select desired parameters with arrow buttons. - Press SET button - the set value is displayed and can be changed by using the arrow keys. - If no key is pressed for more than 1 minute, the controller switches back - to the working level. Modified values will be saved.
2	**I/O**	Controller on/off
3	**Down arrow** button on its own	Display measured sensor temperature 1 - 3 or analogue input value (determined in [H97]
	Together with SET button	reduce current target temperature C1
4	**Up arrow** button on its own	as above - determined in [H98]
	Together with SET button	increase current target temperature C1

5.4 Controller architecture

The MRF-2 | MRH-2 includes:

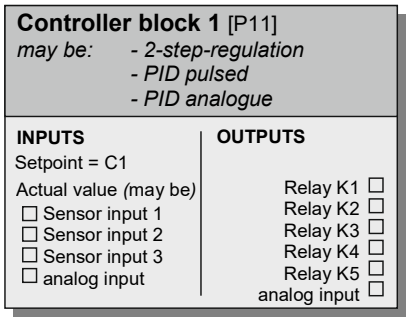
- 4 separate and independent thermostat - hereafter called "controller blocks“.
- 2 function blocks "Temperature alarms"
- 5 function blocks for digital inputs.

All blocks and functions can be set via the parameterization and are linkable.



5.4.1 Explanation of controller and function blocks

Explanation controller block 1 + 2



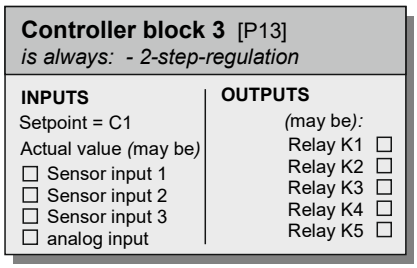
Parameter [P11 + P12] you determine:

which type of control	- 2-step-regulation - PID pulsed - PID analogue
which input	- Sensor 1 to 3 (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 relay or the analogue output [parameters P21-P27].

Explanation controller block 3 + 4

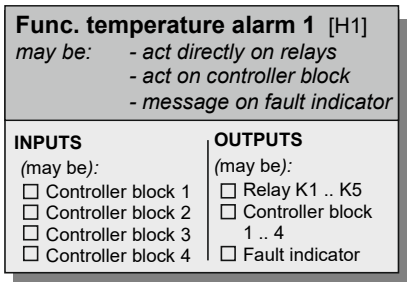


Parameter [P13 + P14] you determine:

which type of control	- only 2-step-regulation possible

Everything else same as controller block 1.

Explanation function block temperature alarm 1 + 2



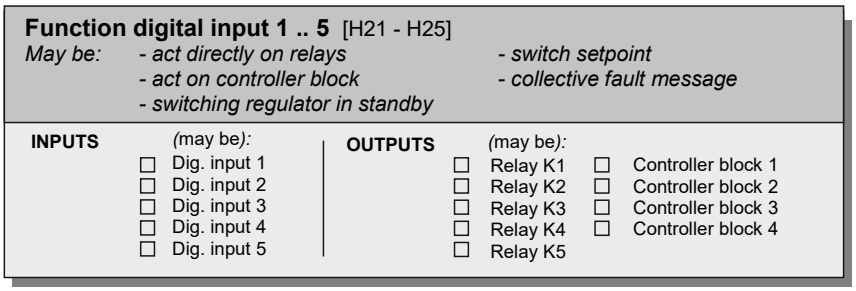
Parameter [H1 + H2] you determine:

which alarm type	- band alarm - limit alarm - High or low temperature alarm - each with relative or absolute
which input	- controller block 1 to 4
link	- act directly on relays - act on controller block - message on fault indicator

Adjustment see parameter list.

The setting for which OUTPUTS are to be controlled is defined firstly in parameters [H5 + H6] and secondly on the relevant relay [parameters P21-P25].

Explanation function block digital input 1 + 5



Parameter [H21 or H25] you determine:

which function	- switches relays on and off - triggers fault reports - switches to alternative setpoint - activates stand-by
which input	- digital input 1 to 5
link	- act directly on relays - act on controller block - Message on fault indicator

Adjustment see parameter list.

The setting for which OUTPUTS are to be controlled is defined firstly in parameters [H25 + H26] and secondly on the relevant relay [parameters P21-P25].

5.5 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**

Activate the required sensors and analogue inputs / outputs in the d-level 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 parameters [P11 to P14] 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 parameters [P21 to P27].

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

The digital inputs are connected with the temperature alarms 1 or 2 or with the output relays via parameters [H21 to H25] and [P21 to P25] A collective fault reporting contact can also be defined.

Step 5: **Configuration of temperature alarms**

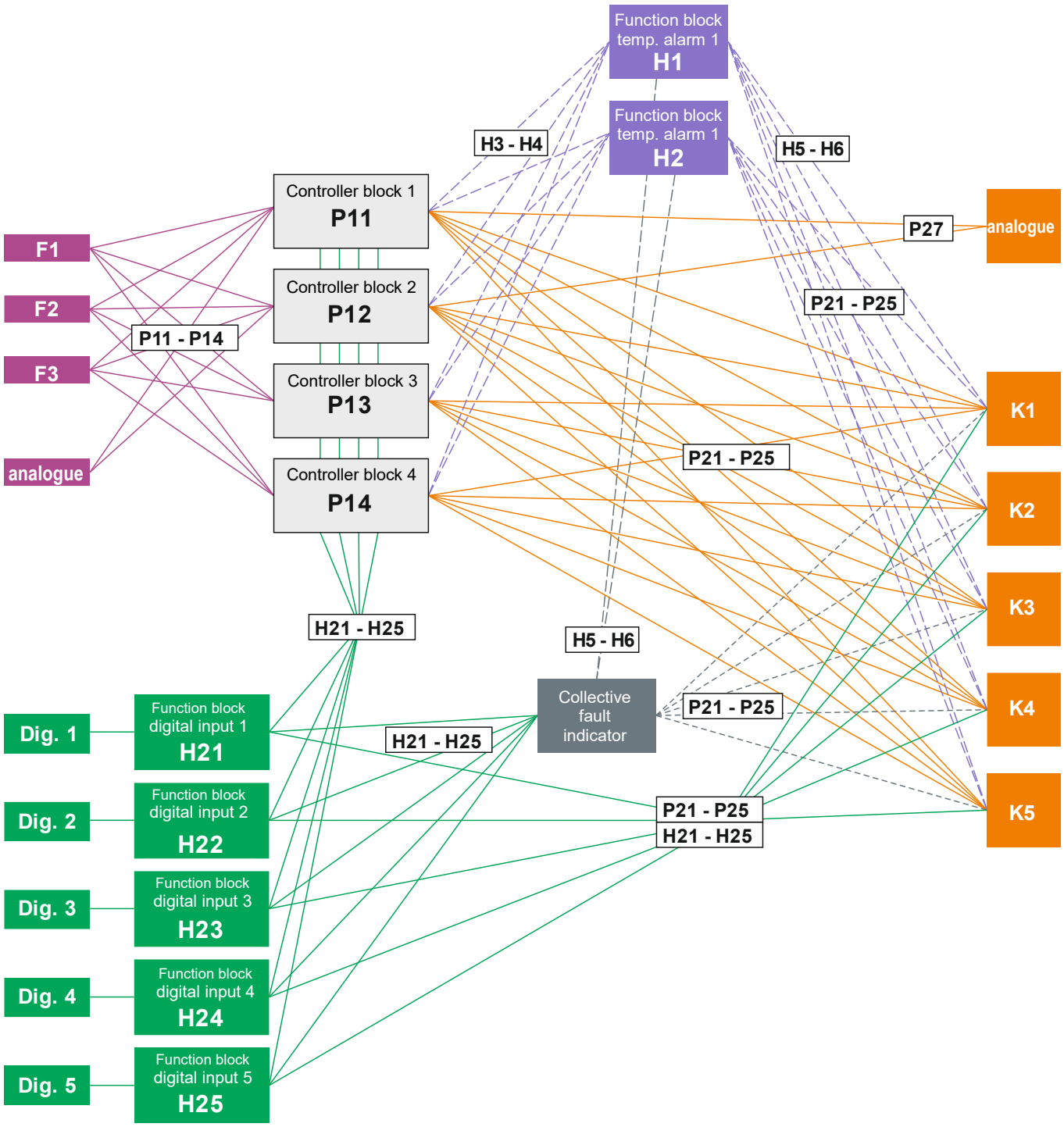
Parameter s[H1 to H6] and [P21 to P25] are used to determine:

- the nature of the temperature alarms,
- assignment to the control components,
- optional additional functions,
- connection with the output relays.

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

A collective fault report can be triggered by a temperature alarm [H5 or H6] or a digital input [parameters H21 to H25]. Parameters P21 to P25] are used to determine which relay is to be switched.

5.6 Parameter Quick-Guide



5.7 Parameter levels

The operation of the controller is carried out in different operating levels:

Working level
... is for everyday operation by the end user.

Auf The display permanently shows the temperature as currently measured.

STANDARD

The “SET“ button can be used to display and, in conjunction with the arrow buttons, to change target temperatures that have been set. See parameter [d6] for how to adjust the function of the SET button.

NB: Target temperatures can be changed here only if the button lock [C99] is set to '0' in the programming level.

EXTENDED WORKING LEVEL

The plant engineering company has the ability to share the customer additional parameter setting level to view or to change. The setting for this can be found in the parameters [d6, d7, d8].

Programming level
... for setting the regulatory parameters (C-parameter).

The programming level contains the parameters which the end user must be able to adjust during subsequent operation.

Configuration level + Option level
... for setting the basic functions
and programming of additional settings (P- / H- parameter).

Configuration level [P parameters]

The configuration level is used for programming the basic functions of the controller. 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).

Option level [H parameters]

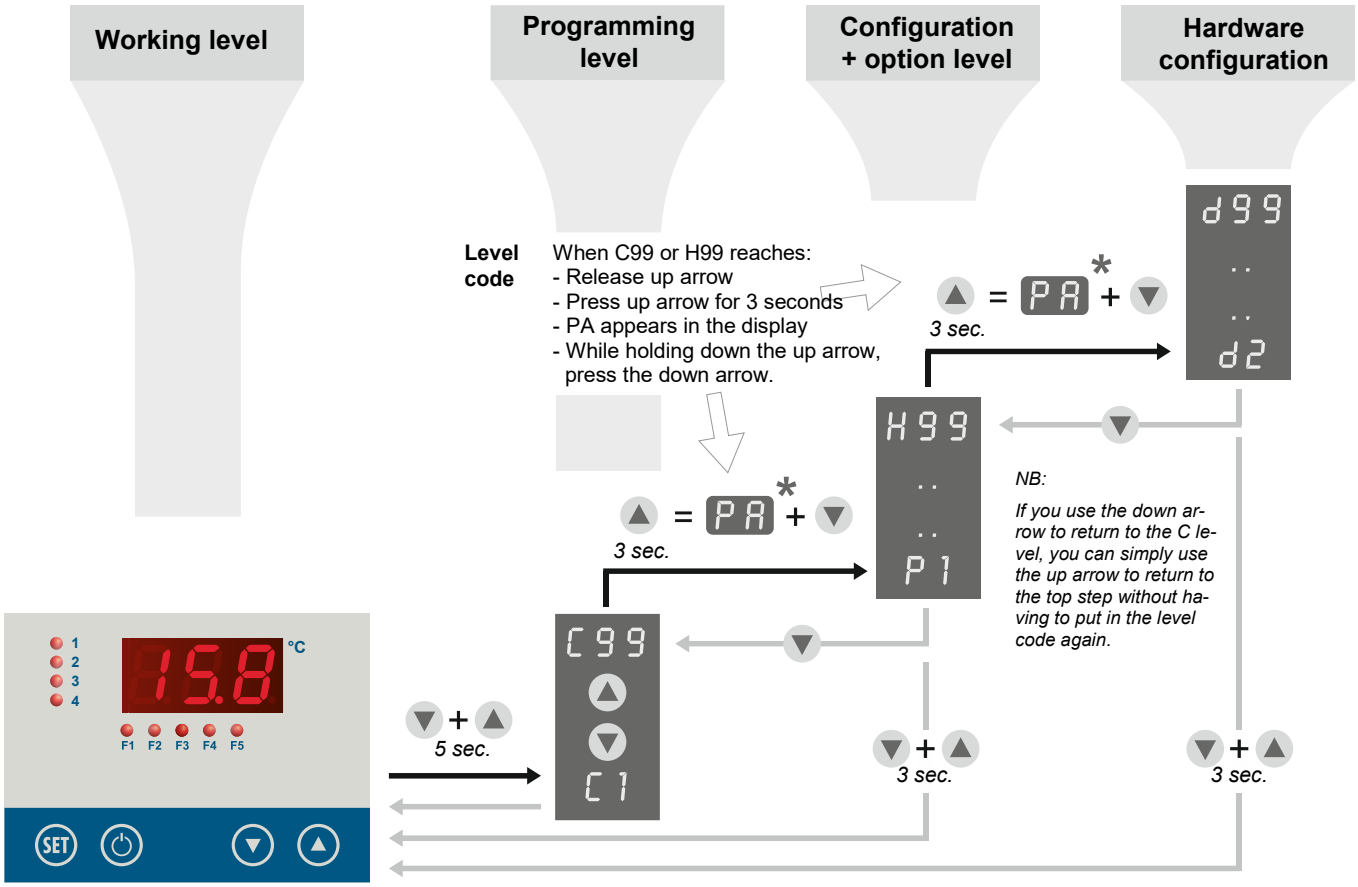
The option level is used to programme additional controller functions such as determination of alarms, functions of digital inputs, button functions, etc..

Hardware configuration
... for configuration of controller hardware (D- parameter).

This is where the controller hardware is configured.

(Number and type of sensor inputs, determination of analogue input and output, interface monitoring speed, etc.)

5.7.1 Operation of parameter levels



Password protection:

* If instead of P1 only three zeros (000) appear in the display, it means that the plant engineering company has protected against access to the next parameter level by means of a password.

To enter password: (the first zero blinks)
- Use the arrow buttons to enter the first character of the password.
- Press SET - the second zero blinks
- Use the arrow buttons to enter the second character of the password.
- Press SET - the third zero blinks.
- Enter the third character.
- Confirm with SET. The first parameter of the next level appears.

5.7.2 Changing and storing parameters

Change parameters:	***Store parameters:***	***Discard parameters:***
. Select parameter (on pressing the SET button the value currently set is displayed). . Hold the SET button down throughout the operation to change the parameter. . Use the UP or DOWN arrow button to set the required value. (NB: if you hold down the UP or DOWN button longer, the value changes more quickly). . Release the SET button. In order to store the value in the memory, first release the arrow button and then the "SET" button.	. Press and hold down the UP and DOWN buttons simultaneously for 5 seconds. All parameters are thus stored and the controller switches back to the working level. . At every change of level the parameters that have been changed are also stored.	. Time-out: if one minute passes without any buttons being pressed, the controller automatically switches back to the working level and all changes are discarded

5.8 Parameter lists

5.8.1 C- parameters (Programming level)

NB:

Full list of parameters.

Depending on controller type and parameter configuration, certain parameters may be hidden.

	Description	Range	Default
C1	Setpoint 1 for controller block 1 - [P11]	-99°C .. +400°C	15,0
C2	Setpoint 2 for controller block 2 - [P12]	-99°C .. +400°C	15,0
C3	Setpoint 3 for controller block 3 - [P13]	-99°C .. +400°C	15,0
C4	Setpoint 4 for controller block 4 - [P14]	-99°C .. +400°C	15,0
	[C2 .. C4] werden ausgeblendet, wenn der entsprechende Regelbaustein [P12 .. P14] deaktiviert ist.		
C6	Alternative setpoint to C1 [C6] is visible only if set in [P18]. Example: if a heating system temperature is reduced at night, a second alternative setpoint C6 is set. One of the digital inputs [H21 .. H25] is used for switching.	-99°C .. +400°C	15,0
C7	Gap between “guide temperature and successive temperature“ In the case of difference temperature control (customer-specific version - not always present) [C7] is visible only if automatic sensor recognition in [D60] is enabled. If there is no second sensor connected, the setpoint C1 is used for fixed-value setting. IMPORTANT: If automatic sensor 2 recognition is enabled in [D60] it is essential that difference temperature control is configured in [P11] (setting 5..10, 17..22, 29..34).	-50 K .. +150 K	0,0

PID settings for control component 1 - [P11]

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.

If you have any questions concerning parameter settings, please contact Welba's technical department.

C10	PID: Xp (P-part = proportional range)	0,1 K .. 99,9 K	10,0
C11	PID: Tn (I-part = reset time)	0 s .. 999 s	0,0
C12	PID: Tv (D-part = hold-back time)	0 s .. 999 s	0,0
C13	PID: Tz (cycle time)	1 s .. 999 s	5,0
	[C10 .. C13] are visible only if control component 1 - [P11] is set to PID control. [C13] is hidden in the case of analogue control..		

PID settings for control component 2 - [P12]

C15	PID: Xp (P- part = proportional range)	0,1 K .. 99,9 K	10,0
C16	PID: Tn (I- part = reset time)	0 s .. 999 s	0,0
C17	PID: Tv (D-part = hold-back time)	0 s .. 999 s	0,0
C18	PID: Tz (cycle time)	1 s .. 999 s	5,0
	[C15 .. C18] are visible only if control component [P12] is set to PID control. [C18] is hidden in the case of analogue control.		

C20	Value of hysteresis 1	0,1 K .. 99,9 K	0,05
C21	Value of hysteresis 2	0,1 K .. 99,9 K	0,05
C22	Value of hysteresis 3	0,1 K .. 99,9 K	0,05
C23	Value of hysteresis 4	0,1 K .. 99,9 K	0,5
	[C20 .. C23] are hidden if the relevant control component (P11 .. P14) is not set to 2-point control or disabled.		

** = further details see glossary*

	Description	Range	Default
C30*	Lower limit temperature Lower limiting of difference temperature control. (Switchover to absolute value control when reached).	-99°C .. 400°C	15,0
C31*	Upper limit temperature Upper limiting of difference temperature control. (Switchover to absolute value control when reached). [C30 .. C31] are visible only if at least one control component is set to difference temperature with limit values.	-99°C .. 400°C	32,0

C40*	Alarm limit for temperature alarm 1 below	-99°C .. +400°C	-10,0
C41*	Alarm limit for temperature alarm 1 up	-99°C .. +400°C	50,0
C42*	Alarm limit for temperature alarm 2 below	-99°C .. +400°C	-10,0
C43*	Alarm limit for temperature alarm 2 up	-99°C .. +400°C	50,0
	In the case of relative limits, the values should be regarded as degrees Kelvin. [C40 .. C43] are hidden, in accordance with the alarm settings [H3 und H4].		

C90**	Actual value sensor 1 Sensor correction [C91] is entered automatically.	-99°C .. +400°C	
C91	Sensor correction sensor 1 (offset value) Only display value. Is entered automatically.	-30 K .. +30 K	
C92**	Actual value sensor 2 Sensor correction [C93] is entered automatically..	-99°C .. +400°C	
C93	Sensor correction sensor 2 (offset value) Only display value. Is entered automatically.	-30 K .. +30 K	
C94**	Actual value sensor 3 Sensor correction [C95] is entered automatically.	-99°C .. +400°C	
C95	Sensor correction sensor 3 (offset value) Only display value. Is entered automatically. [C92 .. C95] are only displayed if activated in [D2, D3].	-30 K .. +30 K	

C96	Actual value analog input Display value. Can not be changed. [C96] is hidden when analog input is disabled.	-99°C .. +400°C	
C97	Displayed value, working level This is used to determine which actual value should be displayed in the working level as the default setting. [C97] is in use only if more than one sensor is enabled. 1 = sensor 1 2 = sensor 2 3 = sensor 3 4 = analog input 1	1.. 4	1
C98	Software version Display value. Can not be changed.		
C99	Button lock in working level When locked, the setpoints can NOT be changed in the working level.. 0 = lock on 1 = lock off	0 .. 1	0

* = further details see glossary
** = For sensor correction procedure see section **Fehler! Verweisquelle konnte nicht gefunden werden.**

5.8.2 P- parameters (configuration level)

NB:

Full list of parameters.

Depending on controller type and parameter configuration, certain parameters may be hidden.

	Description	Range	Default
P1	Switch mode controller block 1	0 .. 1	1
P2	Switch mode controller block 2	0 .. 1	1
P3	Switch mode controller block 3	0 .. 1	1
P4	Switch mode controller block 4	0 .. 1	1
	0 = heating 1 = cooling		

P7	Switch mode relay for temperature alarm 1	0 .. 1	1
P8	Switch mode relay for temperature alarm 2	0 .. 1	1
	0 = off when event occurs | 1 = on when event occurs		

P9	Switch mode relay for digital input	0 .. 1 0 .. 1	1 1
	0 = off when event occurs | 1 = on when event occurs		

The control types defined here take effect only when they are assigned to the desired outputs [P21 .. P27].

P11	Control type controller block 1	1 .. 36	1
P12	Regelart Regelbaustein 2	0 .. 36	0

0: Controller block is disabled

2-step-control

1: Absolute value control based on sensor 1
2: Absolute value control based on sensor 2
3: Absolute value control based on sensor 3 (optional)
4: Absolute value control based on analog input
5: (controller block 1) - Difference temperature control sensor 1 and sensor 2
5: (controller block 2) - Difference temperature control sensor 3 and sensor 2
6: (controller block 1) - Difference temperature control sensor 1 and analog input
6: (controller block 2) - Difference temperature control sensor 2 and analog input
7: Difference temperature control analog input and sensor 2
8: Difference temperature control like 5 with limits
9: Difference temperature control like 6 with limits
10: Difference temperature control like 7 with limits
11: Special control arrangement (optional)
12: Dependent setpoint ΔW with reference to setpoint of control component 1 (without function in the case of P11)

PID-control pulsed

13: Absolute value control based on sensor 1
14: Absolute value control based on sensor 2
15: Absolute value control based on sensor 3 (optional)
16: Absolute value control based on analog input
17: (controller block 1) - Difference temperature control sensor 1 and sensor 2
17: (controller block 2) - Difference temperature control sensor 3 and sensor 2
18: (controller block 1) - Difference temperature control sensor 1 and analog input
18: (controller block 2) - Difference temperature control sensor 2 and analog input
19: Difference temperature control analog input and sensor 2
20: Difference temperature control like 17 with limits
21: Difference temperature control like 18 with limits
22: Difference temperature control like 19 with limits
23: Special control arrangement (optional)
24: Dependent setpoint ΔW with reference to setpoint of control component 1 (without function in the case of P11)

PID-control analog (optional)

25: Absolute value control based on sensor 1
26: Absolute value control based on sensor 2
27: Absolute value control based on sensor 3 (optional)
28: Absolute value control based on analog input
29: (controller block 1) - Difference temperature control sensor 1 and sensor 2
29: (controller block 2) - Difference temperature control sensor 3 and sensor 2
30: (controller block 1) - Difference temperature control sensor 1 and analog input
30: (controller block 2) - Difference temperature control sensor 2 and analog input
31: Difference temperature control analog input and sensor 2
32: Difference temperature control like 29 with limits
33: Difference temperature control like 30 with limits
34: Difference temperature control like 31 with limits
35: Special control arrangement (optional)
36: Dependent setpoint ΔW with reference to setpoint of control component 1 (without function in the case of P11)

The control types defined here take effect only when they are assigned to the desired outputs [P21 .. P27].

	Description	Range	Default
P13	Controller block 3 for Setpoint C3 (2-step-control)	0 .. 12	0
P14	Controller block 4 for Setpoint C4 (2-step-control))	0 .. 12	0
	0 : Controller block is disabled 1: Absolute value control based on sensor 1 2: Absolute value control based on sensor 2 3: Absolute value control based on sensor 3 (optional) 4: Absolute value control based on analog input 5: (controller block 3) - Difference temperature control sensor 1 and sensor 2 5: (controller block 4) - Difference temperature control sensor 3 and sensor 2 6: (controller block 3) - Difference temperature control sensor 1 and analog input 6: (controller block 4) - Difference temperature control sensor 2 and analog input 7: Difference temperature control analog input and sensor 2 8: Difference temperature control like 5 with limits 9: Difference temperature control like 6 with limits 10: Difference temperature control like 7 with limits 11: Special control arrangement (optional) 12: Dependent setpoint ΔW with reference to setpoint of control component 1 (without function in the case of P11)		

P18	Function C6, alternative setpoint to C1	0 .. 4	0
	Alternative setpoint for control component 1 0: no function 1: C6 is an absolute value 2: C6 additional to C1 3: C6 is the analogue input and is an absolute value 4: C6 is the analogue input additional to C1		

P21	Function relay contact K1	0 .. 14	1
P22	Function relay contact K2	0 .. 14	0
	0: always OFF 1: connected to controller block 1 - parameter [P11] 2: connected to controller block 2 - parameter [P12] 3: connected to controller block 3 - parameter [P13] 4: connected to controller block 4 - parameter [P14] 5: connected to controller block 1 - parameter [P11] inverted function 6: connected to controller block 1 - par. [P11] and 2 [P12] in rotating operation* 7: connec. to contr. block 1 - par. [P11] AND contr. block 3 [P13] (only 2-step-control) 8: connected to temperature alarm 1 - parameter [H1] 9: connected to temperature alarm 2 - parameter [H2] 10: connected to digital inputs directly - parameters [H21 .. H25] 11: connected to collective fault reporting, high-active - [H21 .. H25] (energised in the event of fault report) 12: connected to collective fault reporting, low-active - [H21 .. H25] (de-energised in the event of fault report) 13: connected to ON/OFF button - [H50] 14: On/Off function (relay is energised, except in standby mode) See also parameter [H50].		

P23	Function relay contact K3	0 .. 14	0
P24	Function relay contact K4	0 .. 14	0
P25	Function relay contact K5	0 .. 14	0
	0 : always OFF 1: connected to controller block 1 2: connected to controller block 2 3: connected to controller block 3 4: connected to controller block 4 5: connected to controller block 1 inverted function 6: connected to controller block 2 inverted function 7: connected to controller block 1 AND controller block 3 (only 2-step-control) 8: connected to temperature alarm 1 9: connected to temperature alarm 2 10: connected to digital inputs directly 11: connec. to collec. fault reporting, high-active (energised in the event of fault report) 12: connec. to collec. fault reporting, low-active (de-energised in the event of fault rep.) 13: connected to ON/OFF button 14: On/Off function (relay is energised, except in standby mode)		

	Description	Range	Default
P27	Function analog output (optional)	0 .. 6	1
	1: connected to controller block 1 2: connected to controller block 2 3: connected to controller block 1 inverted function 4: connected to controller block 2 inverted function 5: connected to controller block 1 and 2. The second control component acts as a selected-variable limiter, derived in linear fashion from the selected variable of the first control component. Integration of the first control function is disabled during limitation. 6: connected to controller block 1 and 2. The second control component acts as a selected-variable limiter, and reduces the selected variable for the first control component by a percentage. Integration of the first control function is disabled during limitation.		

P28*	Lower limit of variable, analogue output (optional)	0 .. 50%	0
P29*	Upper limit of variable, analogue output (optional)	50 .. 100%	100
	In the case of PID control with analogue output, the limits can be determined here as a percentage of the overall spectrum.		

P30	Behaviour relay K1 at sensor fault	0 .. 2	0
P31	Behaviour relay K2 at sensor fault	0 .. 2	0
P32	Behaviour relay K3 at sensor fault	0 .. 2	0
P33	Behaviour relay K4 at sensor fault	0 .. 2	0
P34	Behaviour relay K5 at sensor fault	0 .. 2	0
	0: off in the event of a fault 1: on in the event of a fault 2: no influence		

P36	Behaviour analog output at sensor fault	0 .. 100%	0

P40*	Hysteresis mode controller block 1	0 .. 1	1
P41*	Hysteresis mode controller block 2	0 .. 1	1
P42*	Hysteresis mode controller block 3	0 .. 1	1
P43*	Hysteresis mode controller block 4	0 .. 1	1
	0 = symmetrical 1 = unilaterl		

P50	Minimum adjustable value for setpoint 1	-99°C ..+400°C	-50
P51	Maximum adjustable value for setpoint 1	-99°C ..+400°C	150
P52	Minimum adjustable value for setpoint 2	-99°C .. +400°C	-50
P53	Maximum adjustable value for setpoint 2	-99°C .. +400°C	150
P54	Minimum adjustable value for setpoint 3	-99°C .. +400°C	-50
P55	Maximum adjustable value for setpoint 3	-99°C .. +400°C	150
P56	Minimum adjustable value for setpoint 4	-99°C .. +400°C	-50
P57	Maximum adjustable value for setpoint 4	-99°C .. +400°C	150
	Limiting the setting of parameters C1 .. C4		

P60	Minimum adjustable value altern. setpoint C6	-99°C ..+400°C	-50
P61	Maximum adjustable value altern. setpoint C6	-99°C ..+400°C	150
	Limiting the setting of parameter C6		

P62	Minimum adjustable value for setpoint 7	-99°C ..+400°C	-10
P63	Maximum adjustable value for setpoint 7	-99°C ..+400°C	10
	Limiting the setting of parameter C7		

** = weitere Erläuterungen siehe Glossar*

	Description	Range	Default
P65	Min. adjustable value für hysteresis 1 below	0,1K .. 99,9 K	0,1
P66	Max. adjustable value für hysteresis 1 up	0,1K .. 99,9 K	10
P67	Min. adjustable value für hysteresis 2 below	0,1K .. 99,9 K	0,1
P68	Max. adjustable value für hysteresis 2 up	0,1K .. 99,9 K	10
P69	Min. adjustable value für hysteresis 3 below	0,1K .. 99,9 K	0,1
P70	Max. adjustable value für hysteresis 3 up	0,1K .. 99,9 K	10
P71	Min. adjustable value für hysteresis 4 below	0,1K .. 99,9 K	0,1
P72	Max. adjustable value für hysteresis 4 up	0,1K .. 99,9 K	10
	Limiting the setting of parameters C20 .. C23		

P75	Switch-on delay relay X	0 .. 5	0
	Used to determine whether a relay (and if so which) should be switched on with a delay. For delay time see [P76]. 0 = disabled 1 .. 5 = applies to relay 1..5		

P76	Time setting for switch-on delay	0 .. 999 sec.	0

P77	Switch-off delay relay X	0 .. 5	0
	Used to determine whether a relay (and if so which) should be switched off with a delay. For delay time see [P78]. 0 = disabled 1 .. 5 = applies to relay 1..5		

P78	Time setting for switch-on delay	0 .. 999 sec.	0

P80	Minimum duty relay K1	0 .. 999 sec.	0
P81	Minimum off time relay K1	0 .. 999 sec.	0
P82	Minimum duty relay K2	0 .. 999 sec.	0
P83	Minimum off time relay K2	0 .. 999 sec.	0
P84	Minimum duty relay K3	0 .. 999 sec.	0
P85	Minimum off time relay K3	0 .. 999 sec.	0
P86	Minimum duty relay K4	0 .. 999 sec.	0
P87	Minimum off time relay K4	0 .. 999 sec.	0
P88	Minimum duty relay K5	0 .. 999 sec.	0
P89	Minimum off time relay K5	0 .. 999 sec.	0

P91	2-lead / 3-lead setting for sensor 1	2 .. 3	2
P92	2-lead / 3-lead setting for sensor 2	2 .. 3	2
	2: 2 lead 3: 3 lead		

P95	Mutual switch-on delay for control components	0 .. 999 sec.	0

P96	Switch-on delay for control components after mains power on	0 .. 999 sec.	0

P98	Button lock C parameters	0 .. 1	0
	0: not locked 1: locked		

5.8.3 H- parameter (option level)

NB:

Full list of parameters.

Depending on controller type and parameter configuration, certain parameters may be hidden.

	Description	Range	Default
H1	Kind of temperature alarm 1	0 .. 5	0
H2	Kind of temperature alarm 2	0 .. 5	0
	When an alarm with relative limits is selected, the parameter values set for the upper and lower alarm limits always relate to the assigned setpoint. 0: Limit value alarm with relative limits in relation to setpoint 1: Limit value alarm with absolute limits 2: High temperature alarm with relative limits in relation to setpoint 3: High temperature alarm with absolute limits 4: Low temperature alarm with relative limits in relation to setpoint 5: Low temperature alarm with absolute limits Optional: In the event of an alarm, the analog output is limited to the maximum value set in D17. 6: as 0, but with analog output limitation in case of alarm 7: as 1, but with analog output limitation in case of alarm 8: as 2, but with analog output limitation in case of alarm 9: as 3, but with analog output limitation in case of alarm 10: as 4, but with analog output limitation in case of alarm 11: as 5, but with analog output limitation in case of alarm		

H3	Assignment temperature alarm 1	0 .. 4	0
H4	Assignment temperature alarm 2	0 .. 4	0
	0: disabled 1 ..4: Connected to controller block 1 .. 4		

H5	Special function temperature alarm 1	0 .. 63	0
H6	Special function temperature alarm 2	0 .. 63	0

A temperature alarm directly switches off the relays stipulated according to the following table. The setting 32' means that only the fault report component is enabled.

Val.	STM	K5	K4	K3	K2	K1	Val.	STM	K5	K4	K3	K2	K1
0:	0	0	0	0	0	0	32:	1	0	0	0	0	0
1:	0	0	0	0	0	1	33:	1	0	0	0	0	1
2:	0	0	0	0	1	0	34:	1	0	0	0	1	0
3:	0	0	0	0	1	1	35:	1	0	0	0	1	1
4:	0	0	0	1	0	0	36:	1	0	0	1	0	0
5:	0	0	0	1	0	1	37:	1	0	0	1	0	1
6:	0	0	0	1	1	0	38:	1	0	0	1	1	0
7:	0	0	0	1	1	1	39:	1	0	0	1	1	1
8:	0	0	1	0	0	0	40:	1	0	1	0	0	0
9:	0	0	1	0	0	1	41:	1	0	1	0	0	1
10:	0	0	1	0	1	0	42:	1	0	1	0	1	0
11:	0	0	1	0	1	1	43:	1	0	1	0	1	1
12:	0	0	1	1	0	0	44:	1	0	1	1	0	0
13:	0	0	1	1	0	1	45:	1	0	1	1	0	1
14:	0	0	1	1	1	0	46:	1	0	1	1	1	0
15:	0	0	1	1	1	1	47:	1	0	1	1	1	1
16:	0	1	0	0	0	0	48:	1	1	0	0	0	0
17:	0	1	0	0	0	1	49:	1	1	0	0	0	1
18:	0	1	0	0	1	0	50:	1	1	0	0	1	0
19:	0	1	0	0	1	1	51:	1	1	0	0	1	1
20:	0	1	0	1	0	0	52:	1	1	0	1	0	0
21:	0	1	0	1	0	1	53:	1	1	0	1	0	1
22:	0	1	0	1	1	0	54:	1	1	0	1	1	0
23:	0	1	0	1	1	1	55:	1	1	0	1	1	1
24:	0	1	1	0	0	0	56:	1	1	1	0	0	0
25:	0	1	1	0	0	1	57:	1	1	1	0	0	1
26:	0	1	1	0	1	0	58:	1	1	1	0	1	0
27:	0	1	1	0	1	1	59:	1	1	1	0	1	1
28:	0	1	1	1	0	0	60:	1	1	1	1	0	0
29:	0	1	1	1	0	1	61:	1	1	1	1	0	1
30:	0	1	1	1	1	0	62:	1	1	1	1	1	0
31:	0	1	1	1	1	1	63:	1	1	1	1	1	1

0: no influence
1: Switch off the relay in a force-guided manner or send a message to the fault message block

	Description	Range	Default
H7	Hysteresis temperature alarm 1	0,1 .. 5K	0,1
H8	Hysteresis temperature alarm 2	0,1 .. 5K	0,1

H9	Switch-on delay temperature alarm 1	0 .. 999 sec.	0
H10	Switch-on delay temperature alarm 2	0 .. 999 sec.	0
	Period for which alarm event must exist for alarm to be triggered.		

H11	Activation delay for temperature alarm 1*	0 .. 300 min.	0
H12	Activation delay for temperature alarm 2*	0 .. 300 min.	0

** after mains power on*

H13	Temperature alarm 1 display	0 .. 1	0
	0 = no text 1 = display alternates between “AL1" and the alarm temperature assigned in [H3]. If alarm temperature 2 is also reached, ONLY “AL2" appears in the display!		

H14	Temperature alarm 2 display (dominant)	0 .. 1	0
	0 = no text 1 = display alternates between “AL2" and the alarm temperature assigned in [H4].		

H21	Function digital input 1	0 .. 67	0
H22	Function digital input 2	0 .. 67	0
H23	Function digital input 3	0 .. 67	0
H24	Function digital input 4	0 .. 67	0
H25	Function digital input 5	0 .. 67	0

Val.	STM	K5	K4	K3	K2	K1		Val.	STM	K5	K4	K3	K2	K1
0:	0	0	0	0	0	0		32:	1	0	0	0	0	0
1:	0	0	0	0	0	1		33:	1	0	0	0	0	1
2:	0	0	0	0	1	0		34:	1	0	0	0	1	0
3:	0	0	0	0	1	1		35:	1	0	0	0	1	1
4:	0	0	0	1	0	0		36:	1	0	0	1	0	0
5:	0	0	0	1	0	1		37:	1	0	0	1	0	1
6:	0	0	0	1	1	0		38:	1	0	0	1	1	0
7:	0	0	0	1	1	1		39:	1	0	0	1	1	1
8:	0	0	1	0	0	0		40:	1	0	1	0	0	0
9:	0	0	1	0	0	1		41:	1	0	1	0	0	1
10:	0	0	1	0	1	0		42:	1	0	1	0	1	0
11:	0	0	1	0	1	1		43:	1	0	1	0	1	1
12:	0	0	1	1	0	0		44:	1	0	1	1	0	0
13:	0	0	1	1	0	1		45:	1	0	1	1	0	1
14:	0	0	1	1	1	0		46:	1	0	1	1	1	0
15:	0	0	1	1	1	1		47:	1	0	1	1	1	1
16:	0	1	0	0	0	0		48:	1	1	0	0	0	0
17:	0	1	0	0	0	1		49:	1	1	0	0	0	1
18:	0	1	0	0	1	0		50:	1	1	0	0	1	0
19:	0	1	0	0	1	1		51:	1	1	0	0	1	1
20:	0	1	0	1	0	0		52:	1	1	0	1	0	0
21:	0	1	0	1	0	1		53:	1	1	0	1	0	1
22:	0	1	0	1	1	0		54:	1	1	0	1	1	0
23:	0	1	0	1	1	1		55:	1	1	0	1	1	1
24:	0	1	1	0	0	0		56:	1	1	1	0	0	0
25:	0	1	1	0	0	1		57:	1	1	1	0	0	1
26:	0	1	1	0	1	0		58:	1	1	1	0	1	0
27:	0	1	1	0	1	1		59:	1	1	1	0	1	1
28:	0	1	1	1	0	0		60:	1	1	1	1	0	0
29:	0	1	1	1	0	1		61:	1	1	1	1	0	1
30:	0	1	1	1	1	0		62:	1	1	1	1	1	0
31:	0	1	1	1	1	1		63:	1	1	1	1	1	1

„0“ means: input disabled
„1“ means: Switch off relay forcibly or alarm on fault report component
64: Switchover to alternative setpoint C6
65: Standby as long as input active
66: Relay direct, off during standby
67: Relay direct, regardless of standby
68: Limitation analog output. (Output is limited to D17)

	Description	Range	Default
H27	Compressor protection (time relay function)	0 .. 3	0
	Assignment of blocking time in case of switch-off by digital input or temperature alarm. Blocking time see [H28]] 0: disabled 1: applies to relay 1 2: applies to relay 2 3: applies to relay 1 and relay 2		

H28	Compressor blocking time	0 .. 990 sec.	240

H31	Activation delay digital input 1	0 .. 250 sec.	0
H32	Activation delay digital input 2	0 .. 250 sec.	0
H33	Activation delay digital input 3	0 .. 250 sec.	0
H34	Activation delay digital input 4	0 .. 250 sec.	0
H35	Activation delay digital input 5	0 .. 250 sec.	0
	Time which must pass before message from a digital input is accepted.		

H36	Circuitry digital input 1	0 .. 1	0
H37	Circuitry digital input 2	0 .. 1	0
H38	Circuitry digital input 3	0 .. 1	0
H39	Circuitry digital input 4	0 .. 1	0
H40	Circuitry digital input 5	0 .. 1	0
	0: low aktiv 1: high aktiv		

H41	Delay time after mains ON for digital input 1	0 .. 250 sec.	0
H42	Delay time after mains ON for digital input 2	0 .. 250 sec.	0
H43	Delay time after mains ON for digital input 3	0 .. 250 sec.	0
H44	Delay time after mains ON for digital input 4	0 .. 250 sec.	0
H45	Delay time after mains ON for digital input 5	0 .. 250 sec.	0
	Time after mains ON or start after ‚stand-by' during which messages from all digital inputs are ignored.		

H50	Function ON / OFF - button	0 .. 2	1
	0: no function 1: Controller is switched on or off by pressing button. 2: The selected relay contact is switched on or off by pressing button (toggle function)		

H53	Scaling analogue input at 0 V / 4 mA	-99° .. 100°	0,0°
H54	Scaling analogue input at 10 V / 20 mA	-99° .. 100°	10,0°

H55	Line monitoring at 4 .. 20 mA input	0 .. 1	0
	0: disabled 1: enabled		

H60	Min. adjustable value for temperature alarm 1 [C40 / C41]	-50°..400°	-50°
H61	Max.adjustable value for temperature alarm 1 [C40 / C41]	-50°..400°	150°
H62	Min. adjustable value for temperature alarm 2 [C42 / C43]	-50°..400°	-50°
H63	Max.adjustable value for temperature alarm 2 [C42 / C43]	-50°..400°	150°

	Description	Range	Default
H97	Display when DOWN button pressed	0 .. 4	0
H98	Display when UP button pressed	0 .. 4	2
	in working level 0: disabled 1: sensor 1 2: sensor 2 3: sensor 3 4: analogue input		

H99	Display text in standby (OFF) mode	0 .. 2	2
	0 = no text 1 = AUS 2 = OFF		

5.8.4 d- parameter (hardware configuration)

NB:

Full list of parameters.

Depending on controller type and parameter configuration, certain parameters may be hidden.

	Description	Range	Default
d2	Activation sensor 2	0 .. 1	0
d3	Activation sensor 3 (optionally)	0 .. 1	0
	0: disabled 1: enabled		

d4	Analogue input	0 .. 2	0
	0: disabled, (all relevant parameters are hidden) 1: functions as voltage input 0-10 V NB: Jumper must be in position “V“. 2: functions as current input 4-20 mA NB: Jumper must be in position “A“.		

d5	Activation of fault message memory	0 .. 31	0
	LED flashes if error is no longer present until it has been confirmed via SET		

Value	in5	in4	in 3	in 2	in 1		Value	in 5	in 4	in 3	in 2	in 1
0:	0	0	0	0	0		16:	1	0	0	0	0
1:	0	0	0	0	1		17:	1	0	0	0	1
2:	0	0	0	1	0		18:	1	0	0	1	0
3:	0	0	0	1	1		19:	1	0	0	1	1
4:	0	0	1	0	0		20:	1	0	1	0	0
5:	0	0	1	0	1		21:	1	0	1	0	1
6:	0	0	1	1	0		22:	1	0	1	1	0
7:	0	0	1	1	1		23:	1	0	1	1	1
8:	0	1	0	0	0		24:	1	1	0	0	0
9:	0	1	0	0	1		25:	1	1	0	0	1
10:	0	1	0	1	0		26:	1	1	0	1	0
11:	0	1	0	1	1		27:	1	1	0	1	1
12:	0	1	1	0	0		28:	1	1	1	0	0
13:	0	1	1	0	1		29:	1	1	1	0	1
14:	0	1	1	1	0		30:	1	1	1	1	0
15:	0	1	1	1	1		31:	1	1	1	1	1

d6	Function SET button in working level	0 .. 8	0
	Release of the setpoints C1 to C6 (C7 is automatically displayed when needed) 0: only adjusted target temperature of C1 can be displayed and changed 1: display of C1 2: display of C1, C2 3: display of C1, C2, C3 4: display of C1, C2, C3, C4 5..8 as 1..4 with additional C6		

d7	Enable hysteresis change in the working level	0 .. 4	0
	without function, if [d6 = 0] 0: Hysteresis are not displayed. 1: Hysteresis 1 can be viewed / changed 2: Hysteresis 1 to 2 can be viewed / changed 3: Hysteresis 1 to 3 can be viewed / changed 4: Hysteresis 1 to 4 can be viewed / changed		

d8	Enable alarm limits in the working level	0 .. 2	0
	without function, if [d6 = 0] 0: Alarm limits are not displayed. 1: Alarm limits for temperature alarm 1 can be viewed / changed 2: Alarm limits for temperature alarm 1 and 2 can be viewed / changed		

d9	Kind of sensor	0 .. 3	0
	Setting applies to all connected sensors! 0: KTY81/210 1: PT100 2: PT1000 3: KTY81/110		

d11	Minimum switch-on time/ Minimum switch-off time in pulsed PID operation	1 .. 20	5
	Serves to reduce the frequency of switching during the cycle time, so as not to operate any slower control elements (e.g. microvalves) too often. 10 = 100 ms 20: 200 ms 30: 300 ms … 200: 2000 ms		

d14	Mode analogue output 1 (optionally)	0 .. 2	0
	0: disabled (all relevant parameters are hidden) 1: functions as voltage output 0-10 V NB: Jumper must be in position “V“. 2: functions as current output 4-20 mA NB: Jumper must be in position “A“.		

d15 **d16**	Start variable analogue output (optional) Stop time for start variable (optional)	0 .. 100% 0 .. 300 sec.	0 0
	after mains on.		

d17	Limitation analog output	0 .. 100%	0
	When activated via digital input or temperature alarm the analog output is limited to the value set here.		

d20	RS-485 Baud rate	1 .. 3	3
	1: 9600 Bit/sec. 2: 19200 Bit/sec. 3: 38400 Bit/sec.		

d21	Appliance address	0 .. 15	3
	On the RS-485 bus up to 16 appliances can be operated in parallel at the same time. Each appliance must be assigned its own address.		

d24	Sensor attenuator	1 .. 5.0	0
	refers both to the display and to the controller component 0: disabled 0.1 to 5.0: temperature rise in degrees per second		

d25	Dämpfung Analogausgang	0 .. 100%	0
	refers to the controller component only 0: disabled 1 to 100: max. setpoint change in percent per second		

d30	Independence fault report relay	1 .. 3	3
	If activated, the fault message function and its LED display remain OFF and / or standby. 0: disabled. The relay switches off at OFF or standby. 1: Independent of OFF (via button). The relay only switches off during standby (via digital input). 2: Independent of standby (via digital input). The relay only switches off when OFF (via key) 3: Independent of OFF and Standby.		

d60	Automatic switchover Fixed-value control / Difference temp. control	0 .. 1	0
	(customer-specific version - not always present) If enabled:: - <u>If only one sensor is connected:</u> The first control component [P11] is switched to fixed-value control. The setpoint is [C1]. If the UP button is pressed "- - -" appears in the display.. - <u>If a second sensor is connected:</u> The parameter setting for the first control component [P11] is retained (must be set to 5..10, 17..22, 29..34). The setpoint is [C7]. When the controller is switched on,"dif" appears in the display. If the UP button is pressed the temperature of the second sensor is displayed.. In the working level, it is always the currently active setpoint [C1] or [C7] which is displayed or changed using the SET button. 0: disabled (no automatic switchover) 1: enabled (automatic switchover) NB: The controller recognises the change "Add" or " Remove" for the second sensor only after a mains disconnection!		

d90	Enable sensor calibration in the working level	0 .. 1	0
	Without function, if [d6 = 0] 0: adjustment parameters are not displayed. 1: adjustment parameter can be displayed and changed		

d98	Password 1	000 .. FFF	000
	A password can be defined here to block access to - the configuration level - the option level - hardware configuration The password must be repeated in [d99]. The block will be enabled only if both passwords match. Entering '000' = no password.		

d99	Password 2	001 .. FFF	FFF
	The password from [d98] must be repeated here. The block will be enabled only if both passwords match.		

6. Other information

6.1 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 [C90 / C92 / C94]. [C92 .. C95] are visible only if enabled in [D2, D3].

6.2 Fault indication

Faults in the regulator are indicated by a flashing display as follows:

LED - Display	Fault
F1L* **F2L*** **F3L*** **F4L****	**Sensor short circuit:** The sensor or sensor cable is faulty and must be replaced or repaired. Parameter [C91] "Actual value correction" must then be adjusted at programming level.
F1H* **F2H*** **F3H*** **F4H****	**Broken sensor:** The sensor or sensor cable is faulty and must be replaced or repaired. Parameter [C91] "Actual value correction" must then be adjusted at programming level.
FFF	**Measurement range exceeded:** The maximum measurement range of the sensor has been exceeded.
F99	**Memory fault:** Faulty regulator! Remove the regulator and send it for repair.

** Number corresponds to the sensor concerned*

*** Number corresponds to the analogue input 0..4 mA*

6.3 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. Versuchen 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

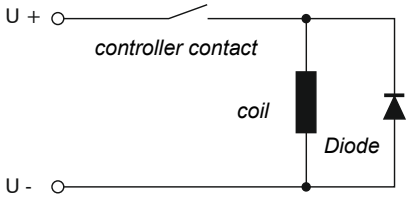
b. If specific interference sources cannot be avoided they should at least be kept at a distance from the regulator system.

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.

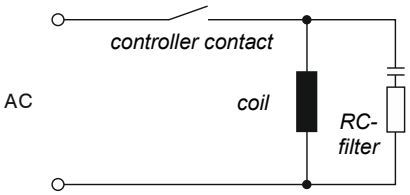
e. In the case of contactors, solenoid valves and other inductive consumers the induction voltage occurring during switching has to be reduced by appropriate protection methods. The choice of methods depends on whether the consumer runs on DC or AC voltage

Right !



DC voltage

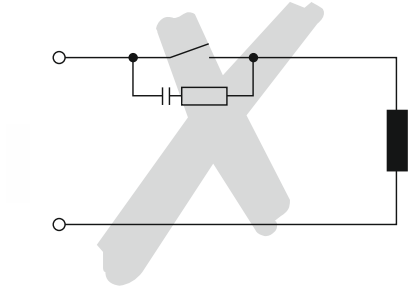
In the case of d/c voltage systems the induction voltage occurring can, for example, be limited by using self-induction diodes, varistors or suppresser diodes. The diagram on the left shows one possibility using a self-induction diode.



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.