ROEMHELD
HILMA ▪ STARK

ROEMHELD-Receiver

for wireless pressure transmission
of the measured values

Operating Manual

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1.1 Safety information

General information

This manual contains information that must be observed in the interest of your own safety and to avoid damage to assets. This information is supported by symbols which are used in this manual as follows.

Please read this manual before commissioning the device. Keep the manual in a place accessible to all users at all times.

If difficulties occur during commissioning, please refrain from carrying out any manipulations that could jeopardize your warranty rights.

Warning signs

DANGER!
This symbol indicates that **Injury or death caused by electrical shock** can/may occur, if the respective protective measures are not carried out.

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

Note signs

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

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

1 Introduction

1.2 Description

The ROEMHELD-receiver T01 in combination with suitable probes is used for mobile or stationary temperature measurements. The application of future oriented radio technology in the ISM band (industrial, scientific and medical band) 868.4MHz or 915MHz results in a notable reduction of installation work and costs. Cable connections are not required, the radio-based sensor technology also functions in a rough industrial environment. The supplied Lambda/4 antenna with an impedance of 50 Ohm can be screwed on directly or fitted externally. When using the antenna wall holder with the 3 meter long antenna cable, the maximum open air range is 300m. The received measured values are converted in the receiver, displayed and are available as linear current or voltage signals (0(4) to 20mA, 0 to 10V) via the digital RS485 interface. For the basic type ...
two relay outputs are provided to signal different alarms. All receiver outputs are electrically isolated. Linkage to higher-ranking systems, e.g. system visualization software or Modbus master compatible paperless recorder, is possible via the digital interface with Modbus protocol.

Operation and configuration is possible via the keyboard in connection with a 2-line LCD or, more comfortable, using a setup program. Thus, parameters, such as filter constants, offset, alarms and fly back (minimum and maximum value memory) can be separately set for each channel. For this purpose, a plug is provided on the front for a PC interface with TTL/RS232 or USB/TTL converter for the connection between receiver and PC.

The receiver in the mounting rail housing is intended for fitting on a top hat rail 35 mm x 7.5 mm according to DIN EN 60715.

The screw-type terminals for the electric connection are arranged at different levels. Ensure that the cable cross section does not exceed 2.5mm^2.

1.3 Block diagram

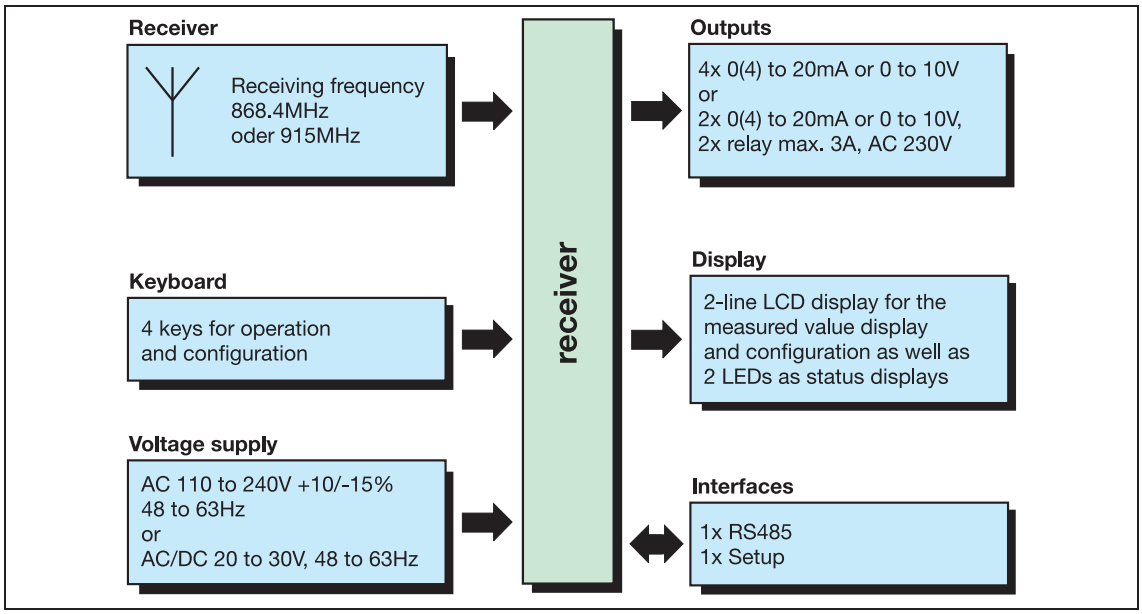


Figure 1: Receiver block diagram

3.1 Radio technology

The characteristic framework conditions for each transmission system include the available band width in the electro-magnetic spectrum and the maximum permissible transmission capacity. These parameters define the channel capacity.

The main selection criteria for the frequency range to be used include the requirement of a long range, interference resistance as well as the possibility to be able to apply a customized transmission protocol in public spectrum band. The focus when selecting the possible communication technologies is placed on miniaturizing the transmitting and receiving circuit as well as the power consumption, on enhancing the transmission safety and the transmission stability as well as on saving costs of the technology involved. The use of a wireless connection generates above all lower costs, higher flexibility and mobility as well as simpler handling.

Taking the currently valid legislation into account and by complying with the available norms and industrial standards, we have opted in favor of a wireless solution for the application of the Wtrans system without a generally specified protocol in the ISM band on the following frequencies: 868.4 MHz (Europe) or 915 MHz (America, Canada, Australia and New Zealand).

Regarding the ISM band, in certain areas there are stringent regulations in place concerning duty cycle, channel distribution as well as transmission capacity. The various subdivisions within this frequency band are shown on the following figure 2.

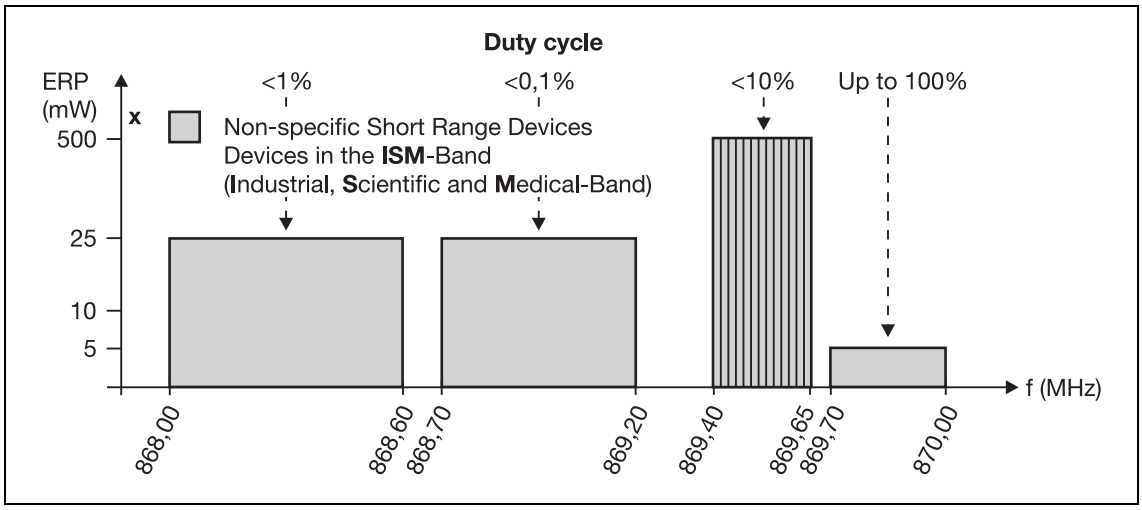


Figure 1: Subdivision of the 868 MHz frequency band

The ERP power value (ERP: equivalent radiated power) value represents the permitted transmission capacity related to a Lambda/2 dipole gain. When utilizing the duty cycle, during the transmission pulse at a very small pulse width, the transmission capacity is only generated for a very short period.

Duty cycle in percent identifies the duration of the transmission of a probe related to 1 hour. The entire transmission time can be distributed to several transmission intervals. As such, duty cycle given in percent represents the ratio between transmission time and overall time.

The duty cycle is also termed pulse-to-pause ratio.

If, for instance, the transmission duration of a signal is 5 ms followed by a 995 ms transmission pause, the duty cycle results from the following computation:

$$\frac{t_S}{t_G} = \frac{5\ ms}{1000\ ms} = 0{,}005 = 0{,}5\ \%$$

3.2 General information about radio transmission

Radio signals are electro-magnetic waves becoming weaker on their way from the probe to the receiver (this is referred to as path attenuation). The field strength decreases inversely in proportion to the square distance between probe and receiver.

In addition to this natural limitation of the operating distance, a reduced operating distance can also have further causes:

- Reinforced concrete walls, metal objects and surfaces, heat insulation or heat protection glass with a vapor deposited metal layer reflect and absorb electro-magnetic waves and, for this reason, a so-called radio shadow is generated.
- Antenna is installed in too low a position - install the antenna as high above floor as possible and ensure intervisibility between probe and receiver.

The following are some reference values concerning the transmittance of radio signals:

Material	**Transmittance**
Wood, cement, uncoated glass	90 to 100 %
Walls/brickwork, chipboards/fiber boards	65 to 95 %
Reinforced concrete	10 to 90 %
Metal, aluminum lamination	0 to 10 %

The maximum range between probe and receiver is 300 m in the open air when using the antenna wall holder for the receiver. Ensure intervisibility between probe and receiver to achieve optimum reception.

When installing the receiver into a switch cabinet, behind concrete walls or ceilings, always use the wall holder and antenna cable for the receiver.

3.3 Reception characteristic of the lambda/4 antenna

Alignment of the lambda/4 antenna

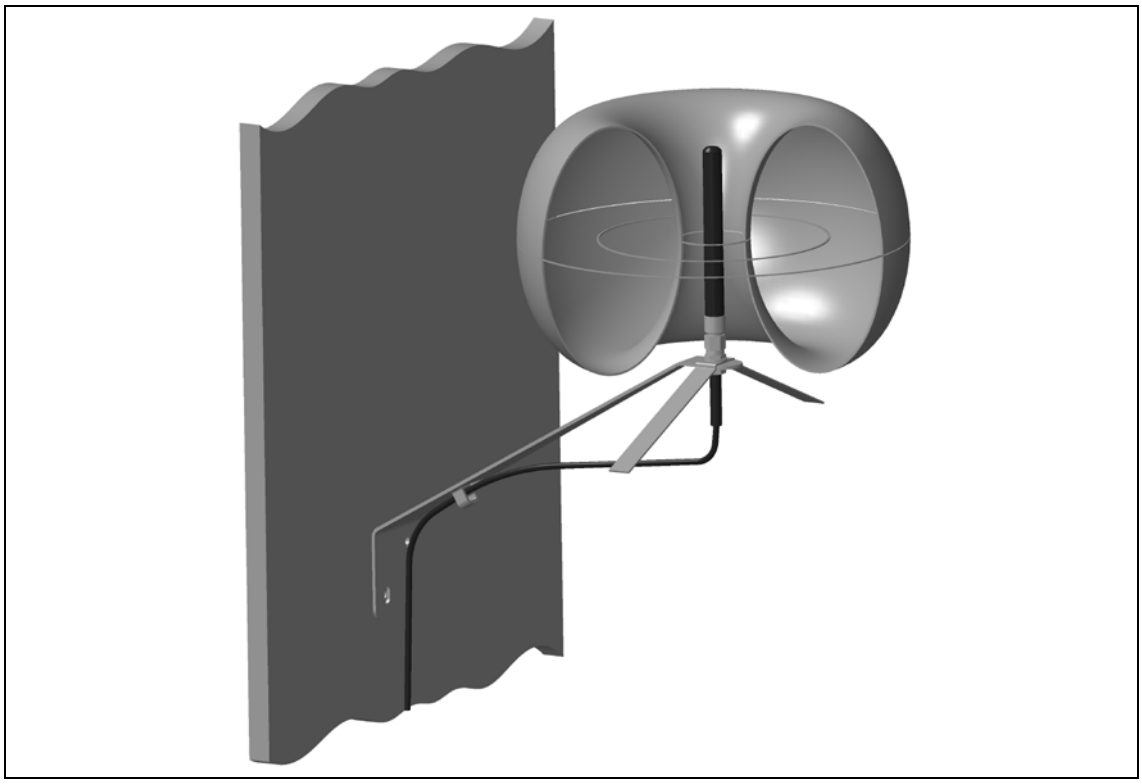


Figure 2: Spatial directional response pattern of the lambda/4 antenna

From the spatial directional response pattern of the lambda/4 antenna you can derive that optimum reception can only be achieved when the antenna is vertically aligned.
From the vertical rod, the reception is nearly identical in all directions. The range to the top and bottom, however, is strongly limited.
Fitting the antenna wall holder including the antenna in the vertical direction upwards or downwards is possible, horizontal installation is not recommended.

TIP!
To ensure that the reception antennas do not influence each other, adhere to a minimum distance of 500 mm for an optimum reception.

3.4 Interferences

Collisions when using an excessive number of transmitters

When using a large number of probes, do not select a transmission interval which is too low, otherwise the transmission frequency will be unnecessarily obstructed. A too low transmission interval means a very high data volume on the selected frequency which can lead to collisions with other probes. Telegrams can be destroyed during radio transmission caused by collisions.

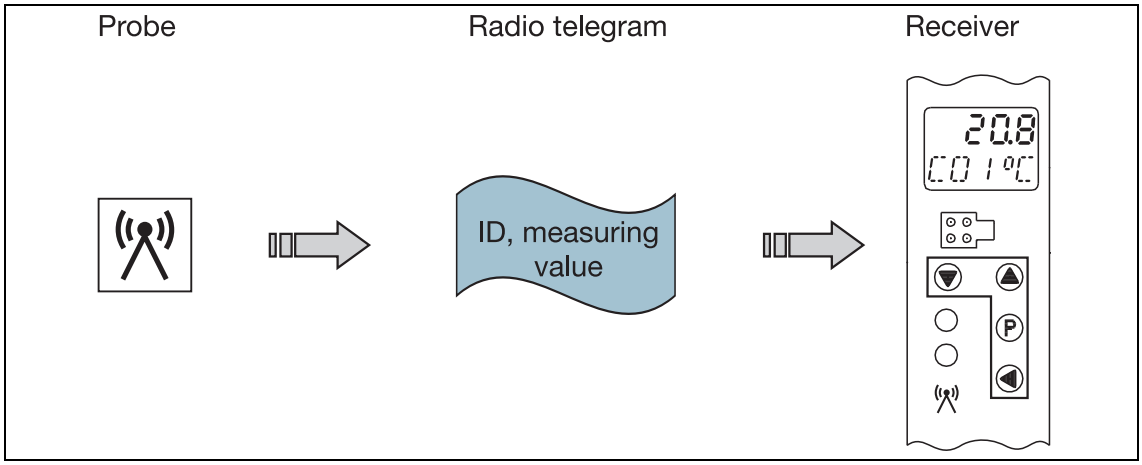


Figure 3: The telegrams of a probe reach the receiver without collisions.

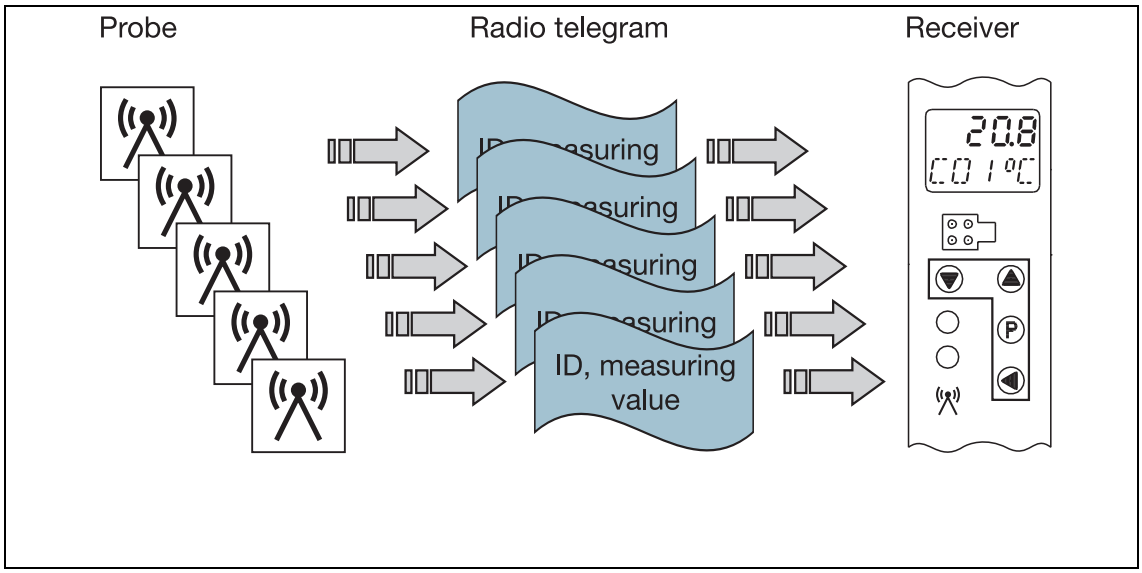


Figure 4: Telegrams of several probes can collide.

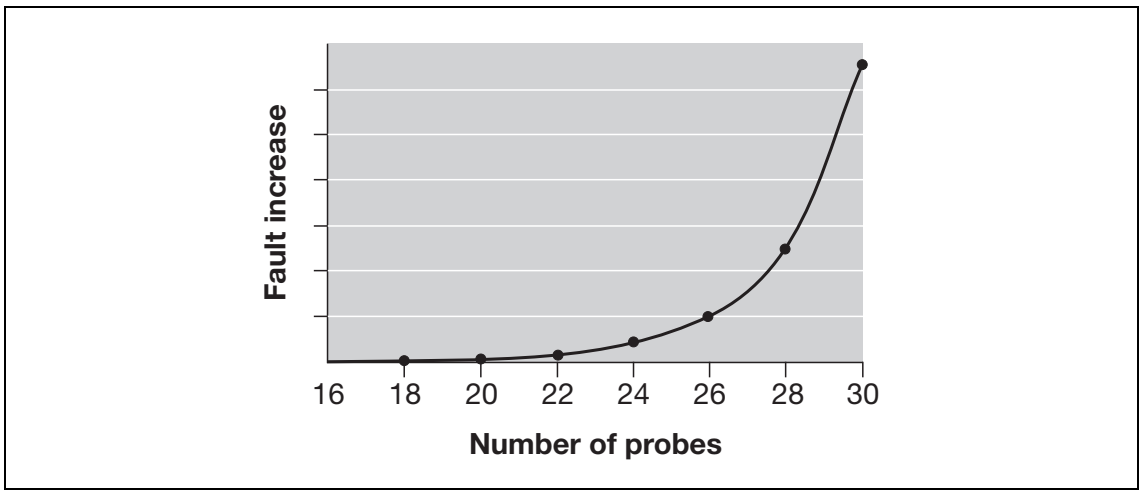


Figure 5: Collisions depending on the number of probes at a transmission interval of 1 s

As you can see in the figure, 5 the error curve jumps up at the number of 24 probes.
For this reason, we recommend to use a maximum of 16 probes for the smallest transmission interval of 1 s.
For the factory setting 10 s, a considerably larger number of probes is possible.

Estimation of the maximum number of transmitters

If more than the recommended 16 probes are to be used at a transmission interval of 1 s, select a higher transmission interval to prevent an increased error quota.
Example:

16 probes at a transmission interval of 1 s = 32 probes at a transmission interval of 2 s

When the number of probes is to be increased additionally, the following calculation results in the next example:

Example:

16 probes at a transmission interval of 1 s = 48 probes at a transmission interval of 3 s(theoretical)

At a transmission interval of ≥ 3 s, however, the telegram is transmitted twice. For this reason, the number of probes to be used is halved.

16 probes at a transmission interval of 1 s = 24 probes at a transmission interval of 3 s(effective)

The identical behavior occurs from a transmission interval of ≥ 60 s. From this transmission interval, the telegram is transmitted three times.

External transmitters

External probes can transmit on the same frequency. If, for example, the probe and an external probe transmit their radio telegrams at the same time, the telegrams are destroyed. Due to the fact, that the probes are not able to check their own active transmission, no error is detected.

Electrical devices

In rough industrial environment, radio telegrams can be destroyed, for example, by frequency converters, electrical welding equipment or poorly shielded PCs, audio/video devices, electronic transformers, electronic ballasts, etc.

Error map-out

The radio transmission timeout parameter on the receiver can be used to map out lost telegrams (either by external influence or collisions caused by a large number of probes) and no error message appears. The value received last is retained over 2 to 20 transmission intervals and the alarm radio transmission timeout is only then activated (display "----").

TIP!
In the event of collisions caused by an excessive number of probes, observe and, if necessary, correct the factors "Number of probes", "transmission interval" and on the receiver the "Radio transmission timeout" factor.

3.5 Function overview

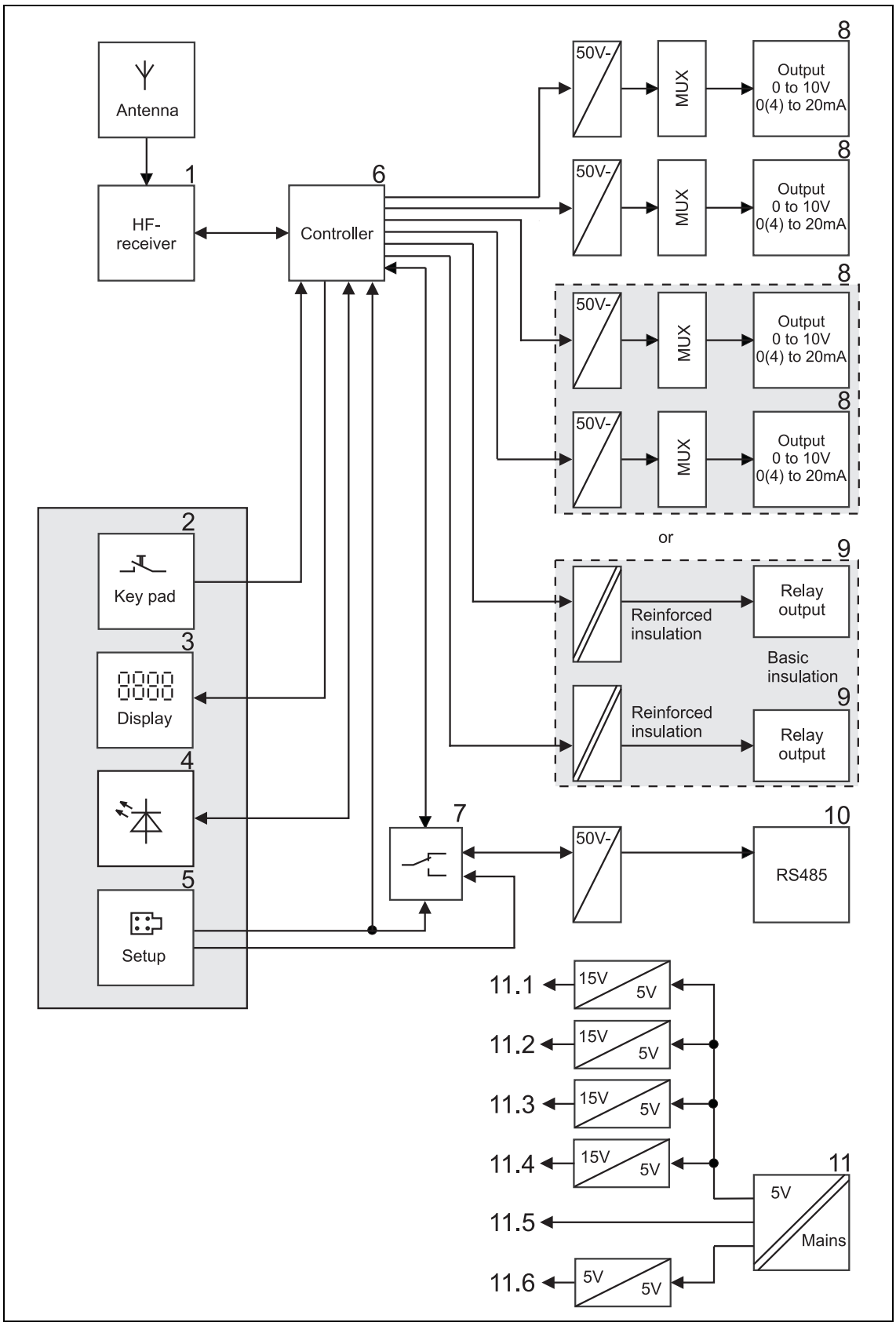


Figure 6: Function review of the receiver

1	Wireless transmitter	7	Automatic toggling of the interfaces
2	Keypad		
3	LCD	8	Analog outputs
4	Light diodes	9	Relay outputs
5	Setup interface	10	RS485 interface
6	Actual value calculation of the analog channels	11	Voltage supply

Wireless transmitter

The receiver is constantly active to receive the radio telegrams of the active transmitters. It checks every radio telegram received for its completeness.
If the radio telegram is valid, it is transferred to the processor for further processing, in the same manner as the demodulated measured data.

Keypad

The function keys permit the operation and configuration of the receiver without the set-up program.

⇨ Chapter 6 "Display and key functions", page 35

LCD

In the standard display, the two rows of the LCD display show the current values. On the commissioning and parameter level, they facilitate the operation and configuration dialog.

⇨ Chapter 6 "Display and key functions", page 35

Light diodes

The top bicolor light diode is green when voltage is applied, i.e. the unit is operative. It flashes red in the event of an impending collective alarm. The bottom yellow light diode flashes with every valid radio telegram (data package) of the transmitter. The flash frequency increases with the number of transmitters.

⇨ Chapter 6 "Display and key functions", page 35

Setup interface

The unit is equipped with a setup interface to allow configuration via the setup program. For this purpose, the front features a connector for interface lines with TTL/RS232 or USB/TTL converter for the connection to a PC.
The setup interface is factory-set with the following values: Baud rate: 9600 bit/s, Data format: 8 data bits, 1 stop bit, no parity,
Minimum response time: 0 ms, Device address: 1.

⇨ Chapter 9.1.3 "RS485 interface", page 64
⇨ Chapter 11 "Setup program", page 79

Actual value calculation of the analog channels

General information

The radio telegram detected by the receiver is transmitted to the controller for actual value calculation. Here the individual measured values are processed.

Now the controller calculates the respective measured value from the transmitter counting values. Linearization and temperature calculation automatically follow the probe

characteristic line. Each measured value can be checked for overrange and underrange by means of two limit values. The minimum and maximum measured values are saved in fly backs.

Radio timeout function

The measured values of the probe are monitored via a radio timeout function. Should an individual radio telegram be missing, the value received last will be frozen. If no new radio telegram is received throughout the entire timeout duration, the measured value is set to "no input value“ with the top LED flashing red.

Automatic changeover of the interfaces

Both interfaces are operated via the same communication module (UART = Universal Asynchronous Receiver Transmitter). The device interrupts communication via the RS485, i.e. the set-up connector has priority, when an interface cable is connected to the front set-up plug.

Analog outputs

A maximum of four analog outputs (current or voltage) are available. The measured value is scaled to the set values for zero point and end value. Measured values outside of these limits are detected as measuring overrange or underrange. In this case, the value set here in the parameter level (value for measuring overrange and underrange) is applied.

⇨ Chapter 5.2 "Connection diagram", page 32
⇨ Chapter 8 "Configuration of the receiver", page 47

Relay outputs

Depending on the design, the device has a maximum of two relay outputs. The status switching relay output 1 or 2 is determined by different control signals. The desired control signal and the output signal (n/c or n/o contact) for each relay can be set in the parameter level.

⇨ Chapter 5.2 "Connection diagram", page 32
⇨ Chapter 8 "Configuration of the receiver", page 47

RS485 interface

The unit is equipped with an RS485 interface with Modbus protocol to permit connection to higher ranking systems. Baud rate, data format, minimum response time and device address can be set via the keyboard or the setup program.

⇨ Chapter 5.2 "Connection diagram", page 32
⇨ Chapter 8 "Configuration of the receiver", page 47

Voltage supply

Voltage supply of the receiver is generated with a switch mode PSU from the mains voltage AC 110 to 240V.

For the electrical isolation of the output signals, further electrically isolated voltages for the analog and relay outputs (11.1 to 11.4), the supply of the electronics (11.5) and the interface (11.6) are created from the secondary voltage of the switch mode PSU.

⇨ Chapter 5.2 "Connection diagram", page 32

3.6 Data flow diagram

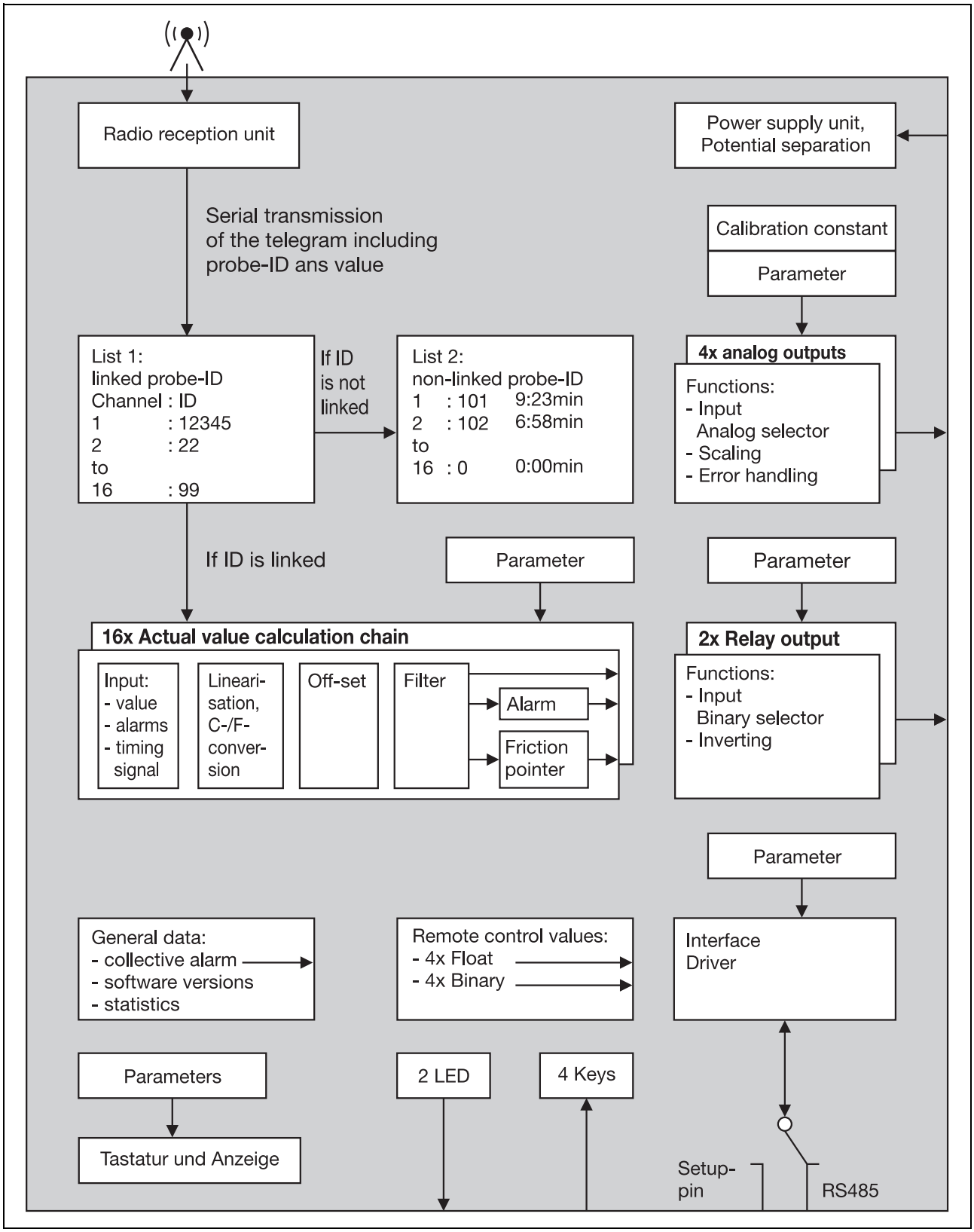


Figure 7: Data flow diagram in the receiver

4.1 Installation site and climatic conditions

4.1.1 Receiver

Installation site and climatic conditions

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

- As far as possible, the installation site should be vibration-free to prevent the screw-connections from working loose.
- The installation site should be free from aggressive media, e.g. acids and lye, and, if possible, free from dust, flour and other suspended matter to prevent blocking of the cooling slots.
- At the installation site, ensure a minimum spacing of 100 mm above the device to allow access to the unlocking slot required for dismantling with a screw driver. Keep a minimum spacing of 150 mm, if the antenna is directly fitted on the receiver. Several receivers can be fitted next to each other without spacing. (Attention: When several antennas are fitted directly, they can influence each other).

At the installation site, the ambient temperature may range between -20 and +50 C at a relative humidity of ≤ 85 % without condensation.

4.1.2 Antenna

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

⇨ Chapter 3.1 "Radio technology", page 13
⇨ Chapter 3.2 "General information about radio transmission", page 14
⇨ Chapter 4.4 "Fitting the antenna", page 27

4 Installation

4.2 Dimensions

4.2.1 Receiver

Type 902931/...

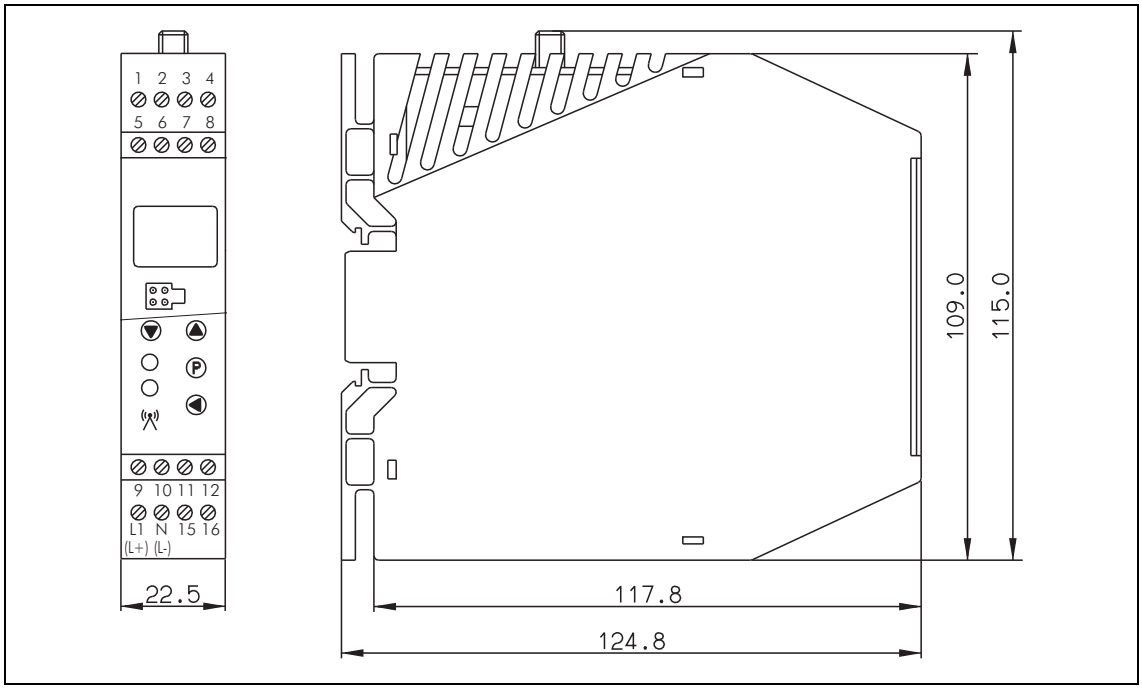


Figure 8: Receiver dimensions

4.2.2 Lambda/4 antenna

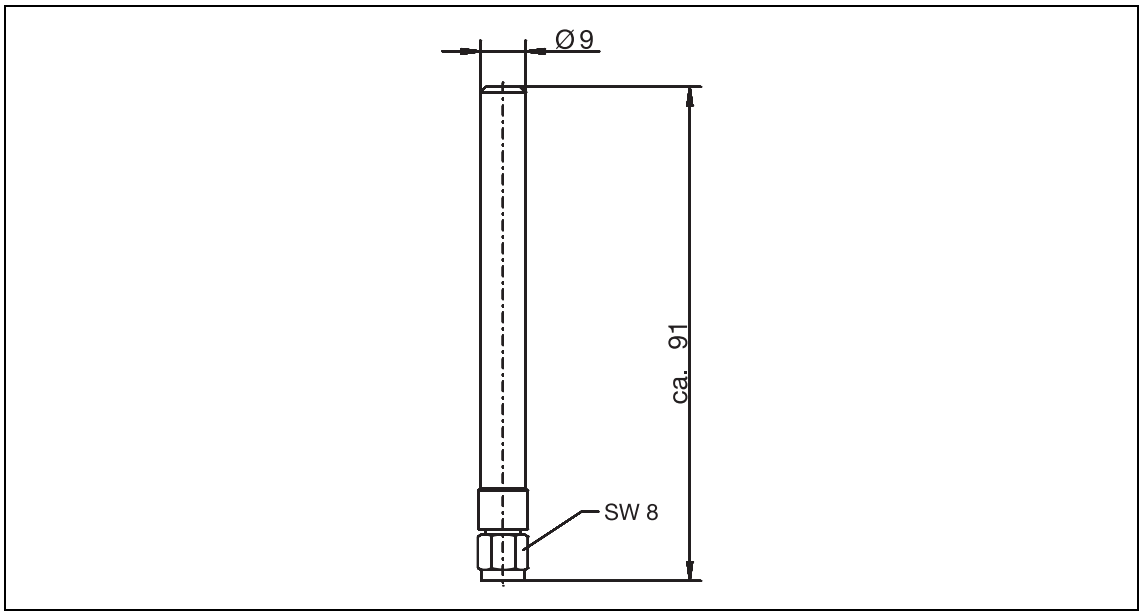


Figure 9: Lambda/4 antenna dimensions

4.2.3 Antenna wall holder for lambda/4 antenna

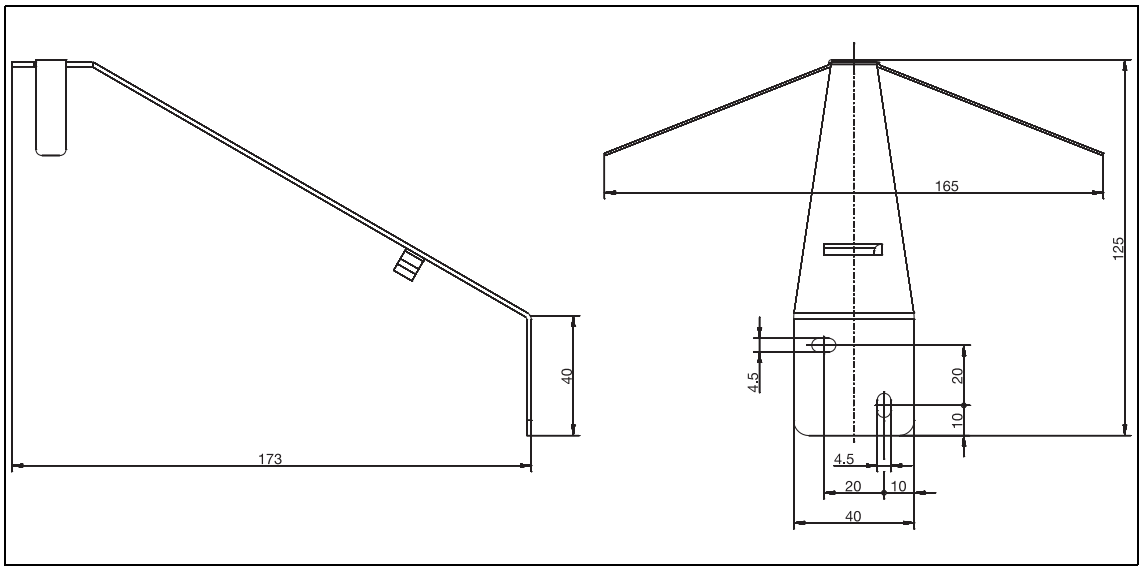


Figure 10: Dimensions of antenna wall holder for lambda/4 antenna

4 Installation

4.3 Receiver installation

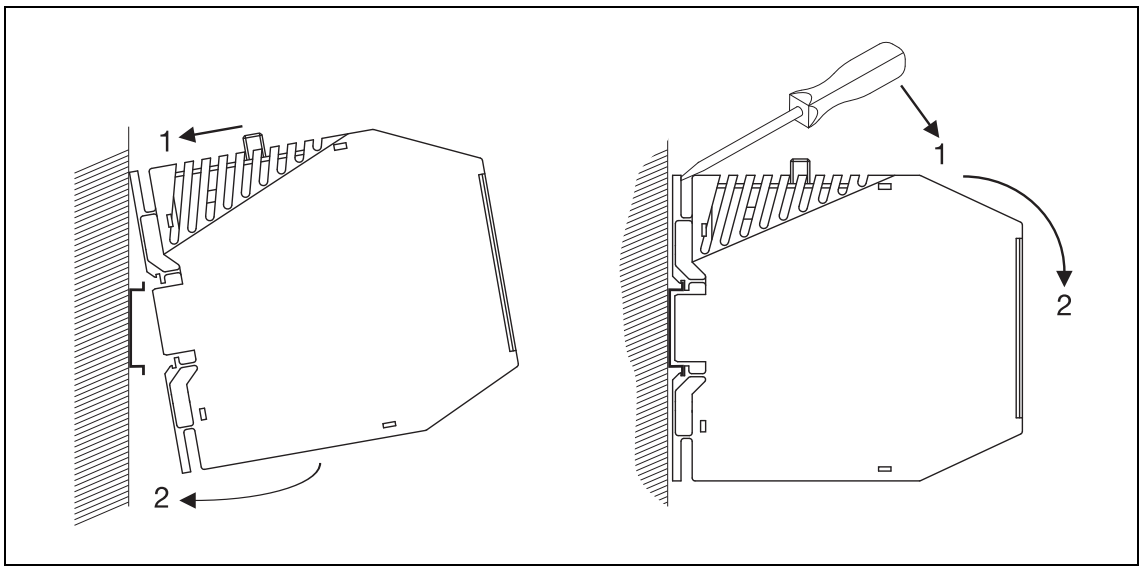


Figure 11: Installation (left) and disassembly (right) of the receiver

Fastening the receiver on the top hat rail

The receiver is intended for installation on a 35 mm top hat rail according to DIN EN 60 715. How to install/disassemble the receiver:

Installation

How to proceed:

Step	Activity
1	Hook the housing into the top hat rail from above.
2	Swing housing downward and against the wall until it engages.

Disassembly

How to proceed:

Step	Activity
1	Insert a suitable screw driver in the unlocking slot and press towards the device.
2	Swing the device out of the top hat rail from below and remove.

TIP!
At the installation site, ensure a minimum spacing of 100 mm above the device to allow access to the unlocking slot required for dismantling with a screw driver. Keep a minimum spacing of 150 mm, if the antenna is directly fitted on the receiver. Several receivers can be fitted next to each other.

4.4 Fitting the antenna

The range between the probe and the receiver is max. 300m in open air.
The antenna used and its correct positioning is a determining factor for both operating distance and reliability of the wireless connection. In practice, the most varied influences affect the wireless transmit distance. For this reason, careful thought should be given to the conditions prevailing at the installation site when selecting the type of antenna installation.

⇨ Chapter 3.1 "Radio technology", page 13

4.4.1 Antenna installation directly on the receiver

The Lambda/4 antenna supplied as standard can be directly screw-fitted CW on the receiver.

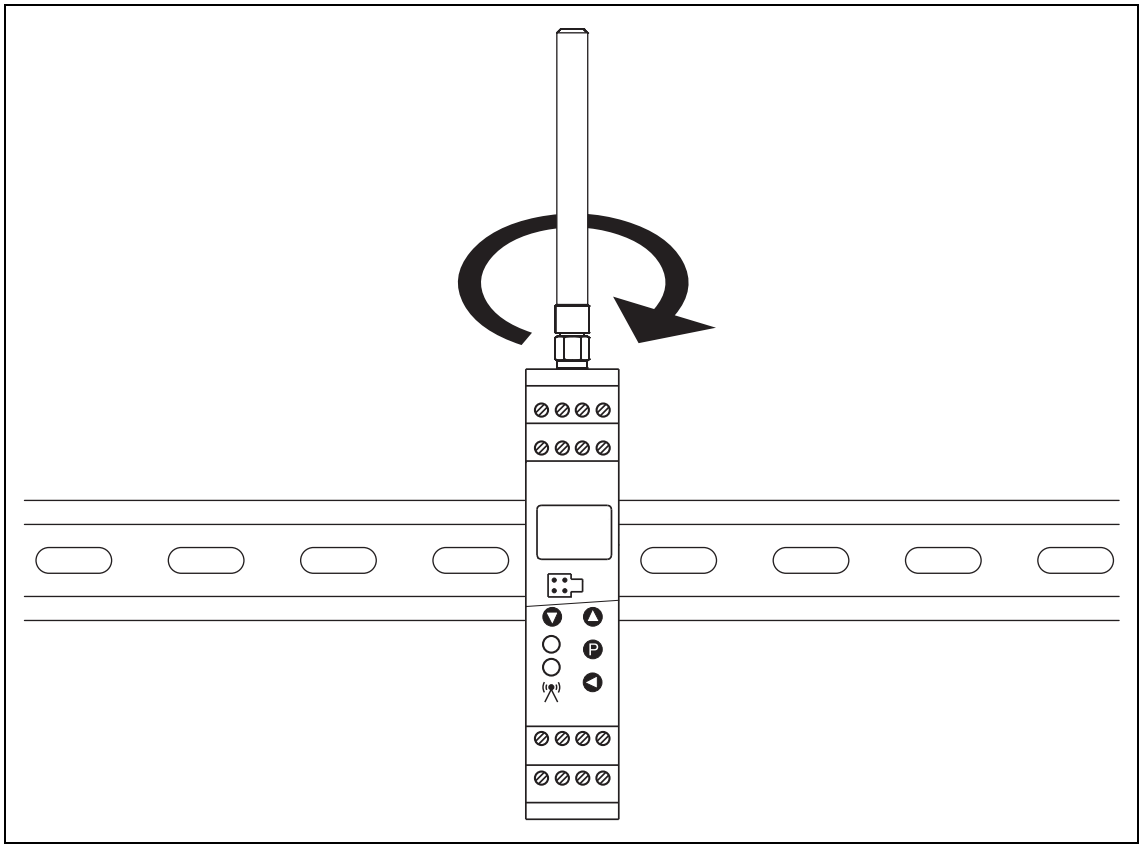


Figure 12: Antenna installation directly on the receiver

4.4.2 Antenna installation on the antenna wall holder

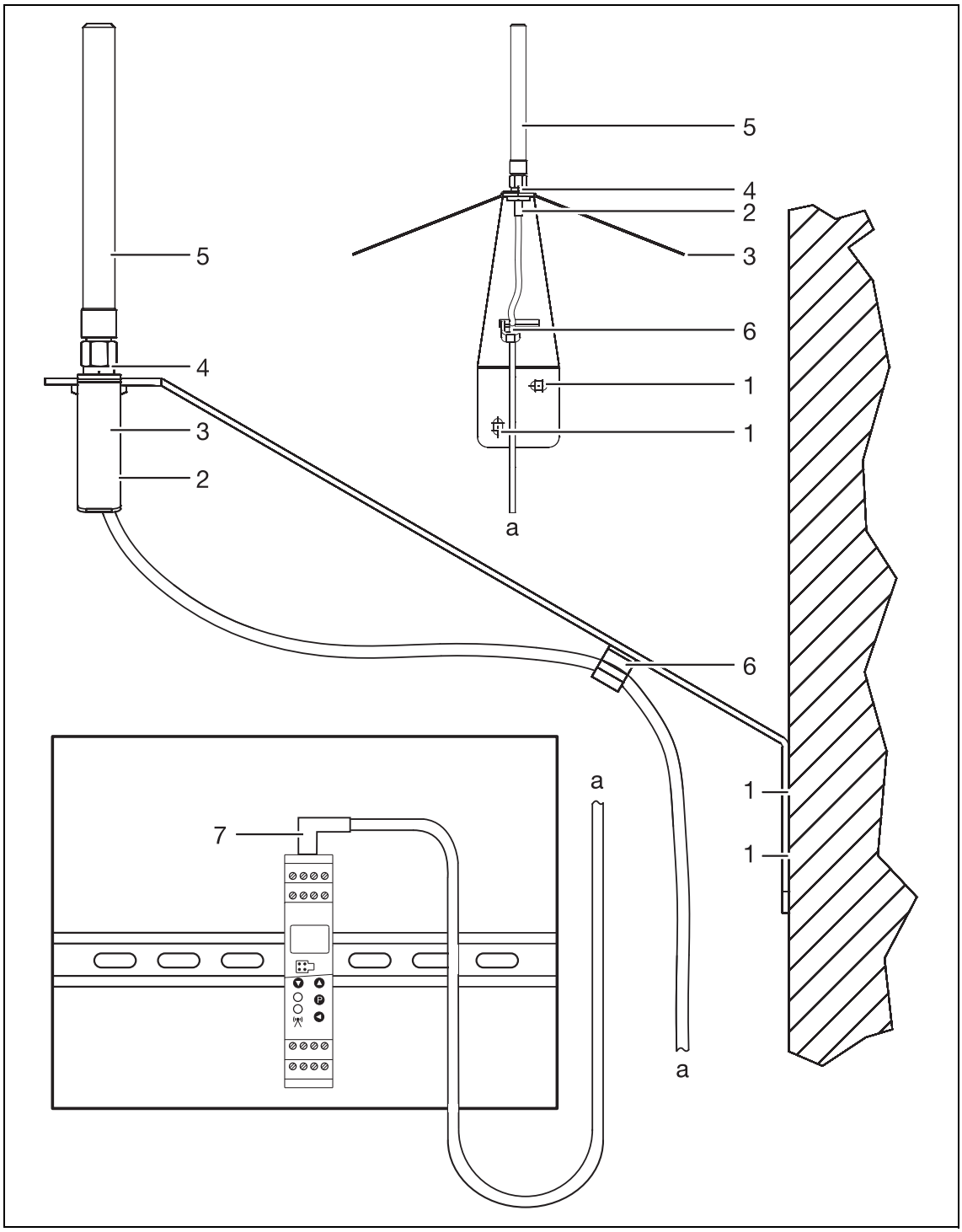


Figure 13: Antenna installation on the antenna wall holder

1 Drilled holes for wall holder fastening
2 Screw-connector for the antenna cable
3 Antenna antipole
4 Counter nut M 10
5 Lambda/4 antenna
6 Cable guide for antenna cable
7 SMA angle connector of the antenna cable

Best results for data transmission can be achieved with the optional antenna wall holder. The Lambda/4 antenna supplied as standard (length 85 mm) is simply screw-fitted to this antenna wall holder. An antenna cable with pre-assembled screw-type connections of 3 m, 5 m or 10 m length is available to connect the Lambda/4 antenna to the receiver.

This is how to install the antenna wall holder and the Lambda/4 antenna.
How to proceed:

Step	Action
1	Fit the antenna wall holder to the wall using the two half-round slotted wood screws M 4 x 35 mm supplied and the attendant dowels UV 6 x 35 R.
2	Push the screw-type connection through the bore hole into the antenna wall holder from below.
3	Fit the antipole at a right angle in relation to the antenna wall holder from above onto the thread of the screw-type connection.
4	Use nut M 10 to fasten the screw-type connection and the antipole clockwise to the antenna wall holder.
5	Screw-fit the antenna clockwise.
6	Suspend the antenna cable into the cable guide provided for this purpose.
7	Route the antenna cable to the switch cabinet, then screw the angle connector clockwise onto the receiver from above.

4 Installation

5.1 Installation notes

- The choice of cable, the installation and the electrical connection of the device must conform to the requirements of VDE 0100 "Regulations on the Installation of Power Circuits with Nominal Voltages below 1000 V" or the appropriate local regulations.
- The electrical connection must only be carried out by qualified personnel.
- The device is intended to be installed in switch cabinets, machines/plants or systems. Ensure that the customer's fuse rating does not exceed 20 A. Isolate the device on all poles prior to starting service or repair work.
- The load circuit must be fused for the maximum relay current, in order to prevent the output relay contacts becoming welded in the event of a short circuit occurring at that point.
- The electromagnetic compatibility conforms to the standards and regulations cited in the technical data.
- Run input, output and supply cables separately and not in parallel with one another.
- Sensor and interface cables should be shielded cables with twisted conductors. Do not run cables close to current-carrying components or cables. Ground the shielding on one side.
- Do not connect any additional loads to the supply terminals of the device.
- The device is not suitable for use in areas with an explosion hazard (Ex areas).
- In addition to a faulty installation, also incorrectly set parameters could impair the orderly function of the following process or lead to damage.

5 Electrical connection

5.2 Connection diagram

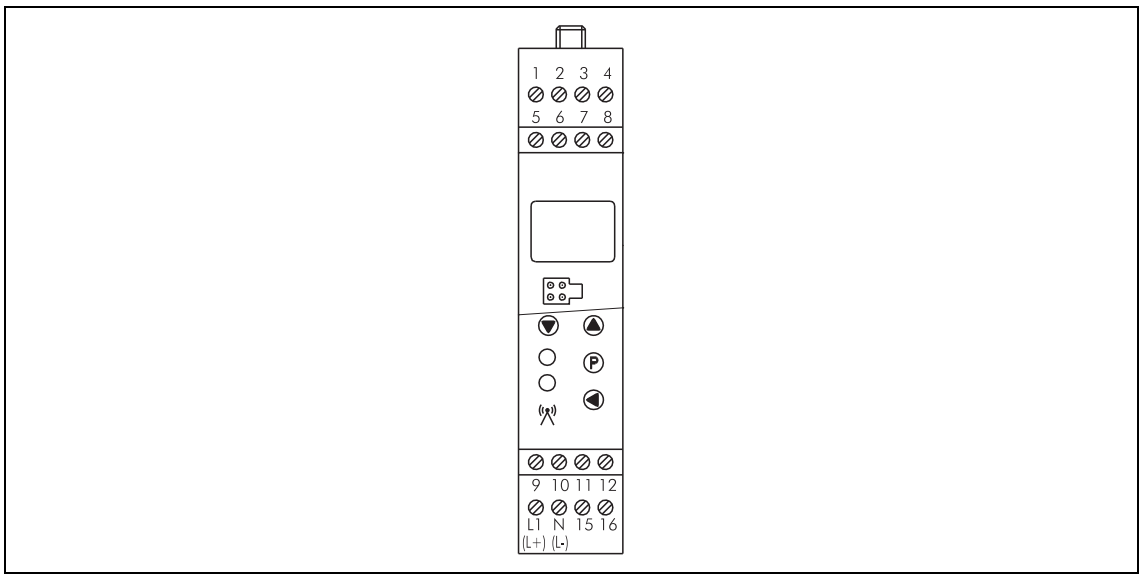
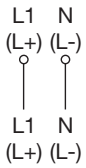


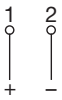
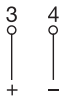
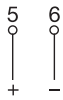
Figure 14: Front view with terminal designation

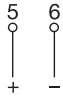
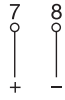
DANGER!
The electrical installation may carry voltage.
Risk of electrocution.
The electrical connection must only be carried out by qualified personnel.

Voltage supply

Voltage supply acc. to rating plate: L1 and N at AC 110 to 240V L+ and L- at AC/DC 20 to 30V	

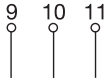
Outputs

3828-000	Analog output 1	Analog output 2	Analog output 3	Analog output 4
Voltage 0 to 10V or current 0(4) to 20mA				

3828-001	Relay output 1	Relay output 2	Analog output 3	Analog output 4
Voltage 0 to 10V or current 0(4) to 20mA				

Relay N/O, configurable as an N/C			

Digital interface

RS485		9 TxD+/RxD+ 10 GND 11 TxD-/RxD-	Transmission/receiving data + mass Transmission/receiving data -

5 Electrical connection

6.1 Normal display (ND) (measured values and signal quality)

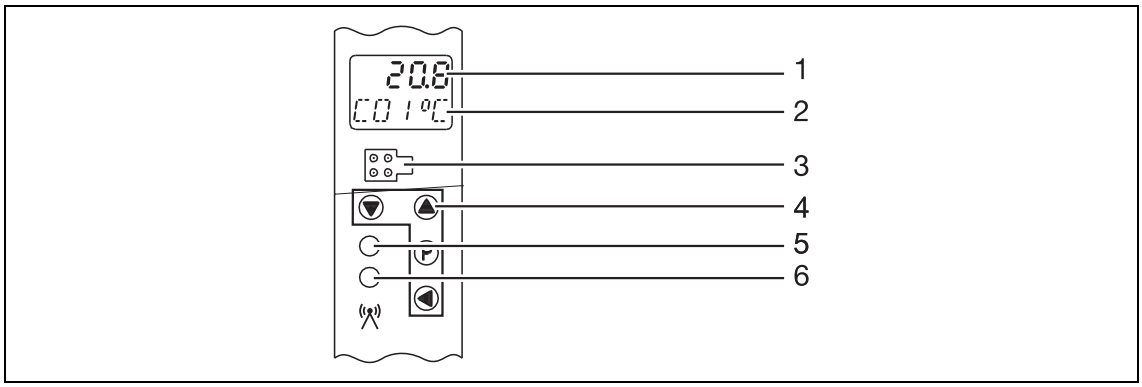


Figure 15: Partial front view of the receiver in the standard display

1 7-segment LCD
4.5mm, 4-digit

2 16-segment LCD,
4.0mm, 5-digit

3 Setup interface

4 Function keys and combinations

5 Bicolor LED
- green = operating status
- red flashing = multi-input alarm

6 Yellow short flashing LED
- Receipt control for each
Radio telegram from the probe

Line, top, 4-digit

Display	Function
123.4	Measured value without/with decimal point(s).
oooo	Overrange.
uuuu	Underrange.
t.Err	Only with thermocouple: Terminal temperature of the internal Pt1000 exceeds the valid range or internal Pt1000 is defective.
----	Radio timeout of the channel.
- 100	Display of the transmitter signal quality of the current channel (key), P Display range: 0 to 100 % in increments, Increments displayed: 0/20/40/60/80/100 %, 0 % = no transmission signal, 20 to 40 % = insufficient transmitter signal, 60 to 100 % = Transmitter signal OK.

A 1 A2 A 1A2	Flashing (alternating with measured value): Configurable alarm limit 1 or 2 or both are reached (see chapter , page). ⇨ Chapter 8.2.3 "Channel specific parameters", page 61

⇨ Chapter 12 "Detect and remedy faults/errors", page 91

Line, bottom, 5-digit

Display	Function
C01	Display of the current channel C01 to C16.
°C	Display of the unit, e.g. °C.
Low	Flashing (alternating with C01 to C16): The transmitter of this channel indicates low battery. Change battery immediately.

Top line and bottom line

Display	Function
no Link	No linked channel available. Only channels linked to transmitters are displayed. If no channel is linked, the display shows this information.

Keys and key combinations

Keys	Function
▲ or ▼	Selection of channels C01 to C16.
P	Display of the signal quality of the current channel and automatic return to the normal display.
◀ > 2s	Change-over to the commissioning/start-up level.
P > 2s	Change-over to the parameter level.

6.2 Commissioning/start-up level (In) (allocating the probe ID to a channel)

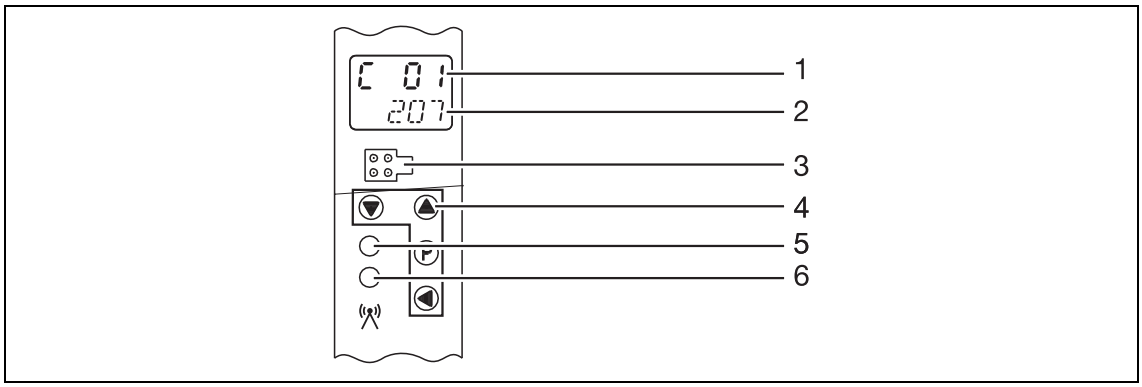


Figure 16: Partial front view of the receiver in the commissioning/start-up level

1 7-segment LCD 4.5mm, 4-digit

2 16-segment LCD, 4.0mm, 5-digit

3 Setup interface

4 Function keys and combinations

Bicolor LED
- green = operating status
- red flashing = multi-input alarm

6 Yellow short flashing LED
- Receipt control for each Radio telegram from the probe

Line, top, 4-digit

Display	Function
C 01	Display of the current channel C01 to C16.

Line, bottom, 5-digit

Display	Function
207	Display of the transmitter ID linked to the current channel.
..208	Position display with a default transmitter ID by editing digit by digit.
208 (flashes)	Display of the transmitter ID from the list of ID's received but not yet linked ID.
0	Display when the transmitter ID list is empty or when no transmitter on the channel is linked.

Keys and key combinations

Keys	Function
▲ or ▼	Selection of channels C01 to C16.

P	Change-over to the **next** probe ID from the probe ID list of IDs not assigned, application after editing digit by digit or deleting the probe ID = 0.
P > 2s	Linking currently displayed ID with channel.
◀	Direct entry of the probe ID to be linked by editing the desired probe ID digit by digit.
◀ > 2s	Return to the standard display (NA).

6.3 Parameter level (PA) (Parameter configuration)

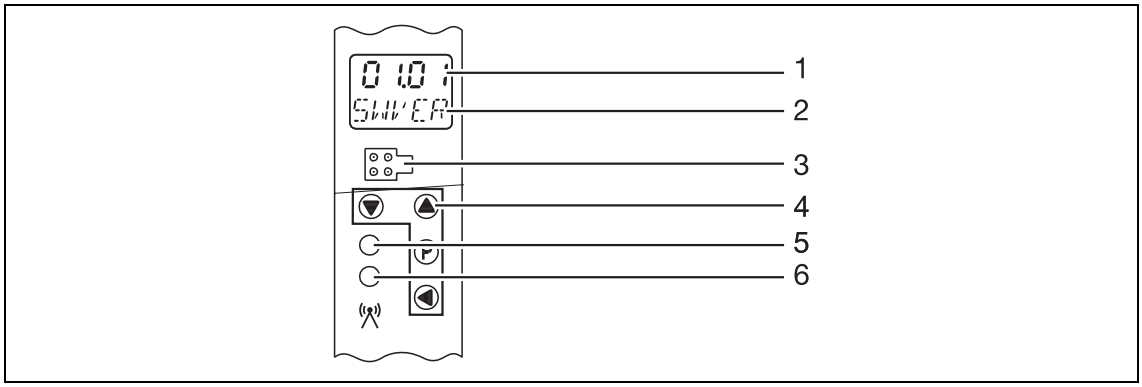


Figure 17: Partial front view of the receiver in the parameter level

1 7-segment LCD 4.5mm, 4-digit

2 16-segment LCD, 4.0mm, 5-digit

3 Setup interface

4 Function keys and combinations

5 Bicolor LED
- green = operating status
- red flashing = multi-input alarm

6 Yellow short flashing LED
- Receipt control for each Radio telegram from the probe

Line, top, 4-digit

Display	Function
oC	Display of the current parameter value.

Line, bottom, 5-digit

Display	Function
T-Un1	Designation of the current parameter value.

⇨ Chapter 8.2 "Parameter level (PA)", page 53

Keys and key combinations

Keys	Function
▲ or ▼	change to the next or previous parameter.
▲ > 2s	Changing to the first parameter of the next group (large jump).
▼ > 2s	Changing to the first parameter of the previous current group (large jump).
◀ > 2s	Return to the standard display (NA).
P	For editing, select the currently displayed parameter value.
P > 2s	If parameter editing is selected: Save the currently displayed value in Parameters.
▲ or ▼	If editing of a parameter is selected: Selection of the possible parameter settings, changing of values step by step.
◀	If editing of a parameter is selected: Direct entry of the parameter value through digit by digit editing of the desired parameter values (only possible with number values!).

6 Display and key functions

6.4 Light diodes (independent of level)

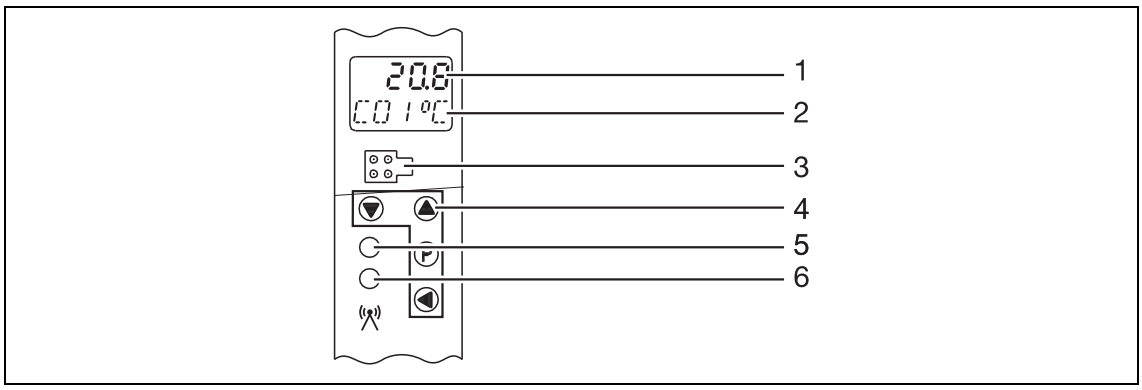


Figure 18: Partial front view of the receiver in all levels

1 7 segment LCD display, 4.5mm, 4 digit

2 16 segment LCD display, 4.0mm, 5 digit

3 Setup interface

4 Function keys and key combinations

5 Bicolor LED
- green light = Operating display
- red flashing light = collective alarm

6 Yellow LED briefly flashing
- Receipt control for each radio telegram from the probe

Top bicolor LED

Display	Function
green	Operating display: • Voltage applied • No alarm
flashing red	Collective alarm The collective alarm accepts the following error types: • OR link of all individual alarms • Radio timeout, channel 1 to 16 • Analog alarms 1, channel 1 to 16 • Analog alarms 2, channel 1 to 16 • Low battery, channel 1 to 16 • Save errors detected with power ON

⇨ Chapter 8.2 "Parameter level (PA)", page 53

Bottom yellow LED

Display	Function
yellow briefly lighting up	Receipt check of each individual radio telegram (data package) received from the probe. The more transmissions received the higher the flashing speed.

At the receiver

Operation and configuration of the receiver require four keys located at the front which have various functions depending on the menu. The dialog is supported by a 2-line liquid crystal display (LCD). Two light emitting diodes (LEDs) signal various operating statuses. The operation and configuration of the parameters are organized at three different levels:

- Normal display (display of measured values and signal quality)

⇨ Chapter 7.1 "Normal display (ND)", page 42

- Commissioning/start-up level (channel linking to transmitter ID)

⇨ Chapter 8.1 "Commissioning/start-up level (In)", page 47

- Parameter level (editing of configuration parameters)

⇨ Chapter 8.2 "Parameter level (PA)", page 53

Each of the two levels can be protected against unauthorized access by a code.

Via setup program for PC

Configuration via the setup program is more comfortable than using the receiver keyboard. The configuration data can be archived on data carriers and printed.

⇨ Chapter 11 "Setup program", page 79

7 Receiver operation

7.1 Normal display (ND)

The normal display is active when the receiver is connected and the voltage supply activated.
The measured value of the first transmitter is visible in the top line of the LCD display.
The channel designation is visible on the left and the selected unit on the right in the bottom line of the LCD display.
In the normal display, a maximum of 16 channels and their measured values or the signal quality of the transmitter signal received can be displayed.

7.2 Channels and their Display measured values

Linked channels available:

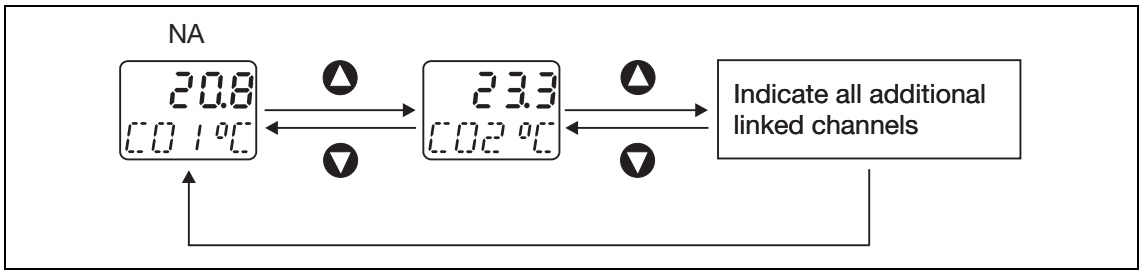


Figure 19: Display of all linked channels

The ▲ and ▼ keys can be used to display in succession all channels linked to transmitters and their measured values either in an ascending or descending order.

No linked channels available:

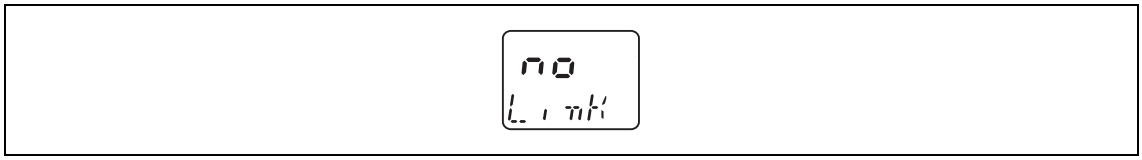


Figure 20: Display when no linked channels are available

The „no Link“ note signals that there are no channels linked to transmitters.

7.3 Display signal quality of the probes received

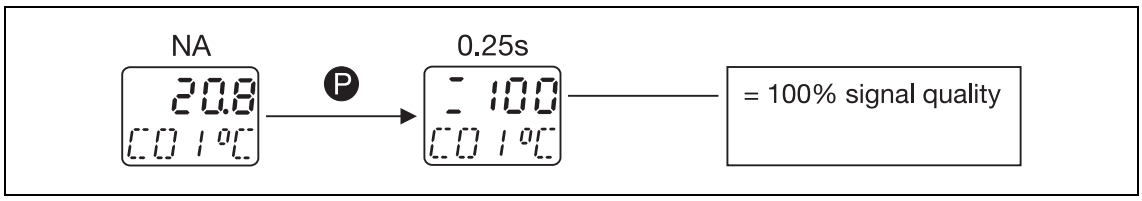


Figure 21: Signal quality display

Key P is used to show the signal quality of the current channel in percent in the standard display (NA) (see Figure 21, 100 %).
The display range between 0 and 100 % is displayed in increments.

Steps:	0/20/40/60/80/100 %
Display 0:	No transmission signal.
Remedy:	Check transmitter battery, optimize wireless transmit distance.
Display 20 to 40:	Insufficient transmission signal.
Remedy:	Check receiver antenna installation site
Display 60 to 100:	The signal quality is sufficient for reliable system operation.

⇨ Chapter 4 "Installation", page 23

TIP!
The displayed signal quality is calculated from the last five transmission intervals to be expected.

If a telegram is received in all five transmission intervals, the signal quality is 100%. If only four telegrams are received, the signal quality is reduced to 80%, etc.

Number of telegrams received in the last 5 transmission intervals.	**Signal quality display**
5	100 %
4	80 %
3	60 %
2	40 %
1	20 %
0	0 %

Table 1: Number of telegrams received and signal quality display

For an optimum positioning of probe and reception antenna, we recommend to set a very small transmission interval as a test. This reduces the waiting time until the signal quality display is updated.

7 Receiver operation

7.4 Changing to other Changing levels

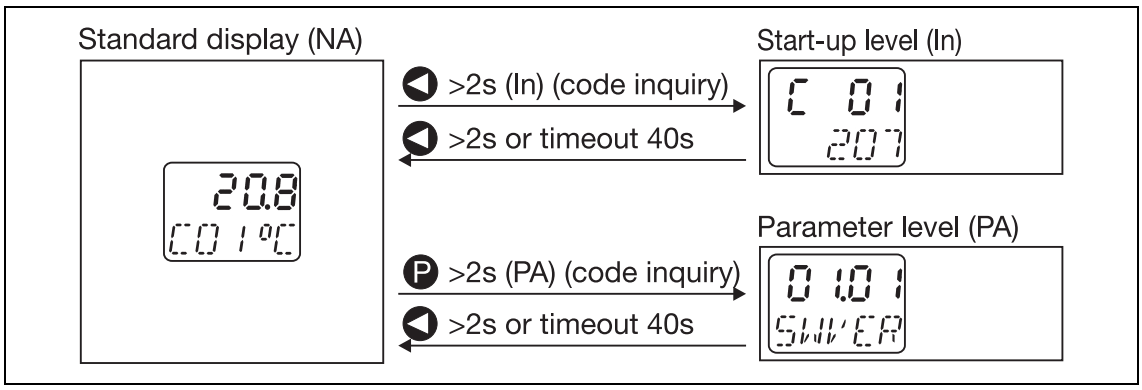


Figure 22: Change-over to different levels

Key ◀ > 2 s is used to change over to the commissioning/start-up level (In). Here the receiving channels of the unit are linked with the probe ID.
Key Ⓟ > 2 s is used to change over to the parameter level (PA). Here all functions of the receiver and the attendant parameters are defined.

Key timeout

If no key is pressed in these two levels for a period of 40 s the receiver automatically returns to the standard display (NA).

Code interrogation

The receiver features one code interrogation each for the change-over to the commissioning/start-up or the parameter level. This code interrogation, however, is not activated when delivered. In the parameter level (PA), a code (minimum 1 digit, maximum 4 digits) can be assigned separately for each level (In and PA).

⇨ Chapter 7.5 "Code interrogation", page 45

7.5 Code interrogation

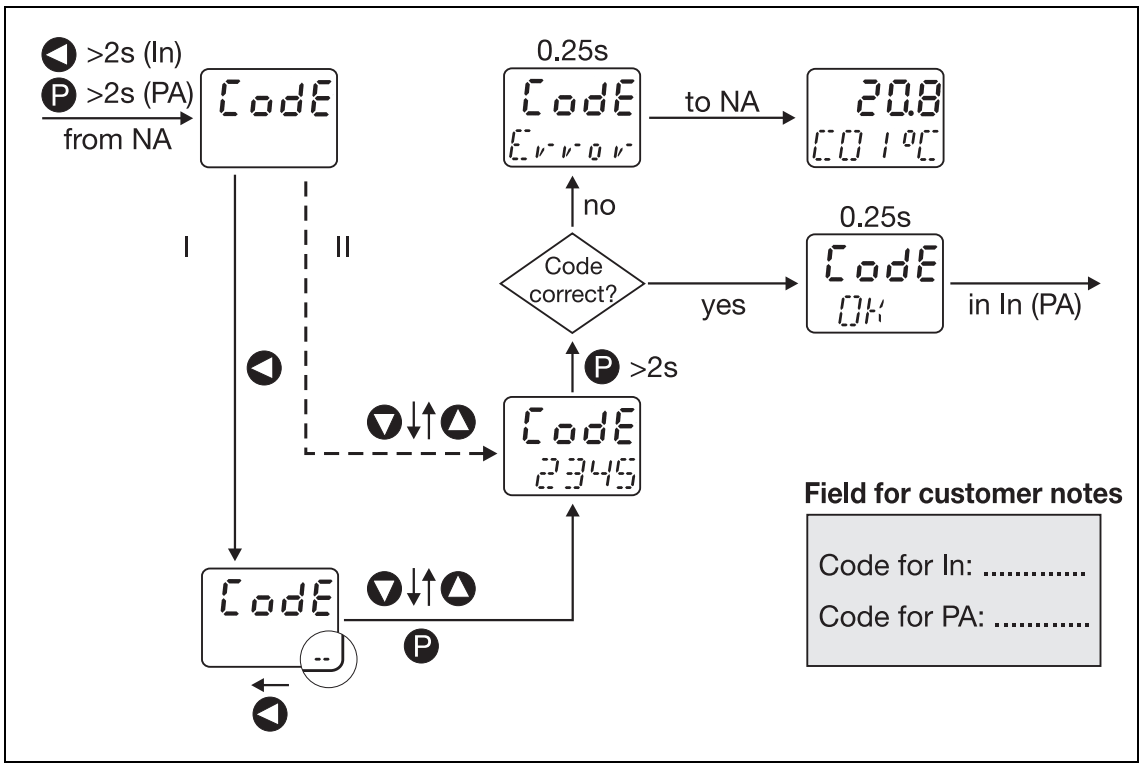


Figure 23: Code interrogation for the commissioning/start-up or parameter level

The code for changing over from the standard display (NA) into the commissioning/start-up or parameter level can be edited either directly or digit by digit.

Direct editing

This way of proceeding is selected if short codes are generally sufficient (see path II in Figure 23).

How to proceed:

Step	Action
1	Change over from the standard display (NA) to the commissioning/start-up level (In) by pressing the key ◀ > 2 s or changing over to the parameter level (PA) using the key P > 2 s. *When a code is assigned for the selected level, "CodE" appears on the display. The device waits for a code to be entered (min. 1 digit, max. 4 digits).*
2	Edit code using keys ▲ and ▼.
3	Confirm the code entry by pressing the key P > 2 s. *If the code is correct, "CodE OK" appears for 0.25s.* *The receiver changes over to the desired level.* *If the code is incorrect, "CodE Error" appears for 0.25s.* *The receiver returns to its standard display.*

Editing digit by digit

This way of proceeding is practical if longer codes are generally required (see path I in figure 23).

How to proceed:

Step	Action
1	Changing over from the standard display to the commissioning/start-up level (In) by pressing the key ◀ > 2 s. or changing over to the parameter level (PA) using the key P > 2 s. *When a code is assigned for the selected level, "CodE" appears on the display. The device waits for a code to be entered (min. 1 digit, max. 4 digits).*
2	Initiate code editing by pressing the ◀ key. *The bottom segments of the right digit are flashing.*
3	Edit digits using keys ▲ and ▼.
4	To confirm the first digit, press the ◀ key. *The bottom segments of the second digit from the right are flashing.*
5	Repeat steps 3 and 4 until all digits are edited (min. 1 digit, max. 4 digits).
6	Confirm the code by pressing the P key. *The bottom segments of the digits entered last have stopped flashing.*
7	Confirm the code entry by pressing the P > 2 s key. *If the code is correct, "CodE OK" appears for 0.25s.* *The receiver changes over to the desired level.* *If the code is incorrect, "CodE Error" appears for 0.25s.* *The receiver returns to its standard display.*

TIP!
To deactivate, set the code for the commissioning/start-up level to 0.

⇨ Chapter 8.2.2 "General parameters", page 56

8.1 Commissioning/start-up level (In)

The receiver channels are assigned to the transmitters in this level (linked with each other). This can be done conveniently via the setup program, or manually via the keyboard. The possibilities are described in the following.

Please note the following, independent of the method adopted:

- Assign each transmitter ID to a transmitter only once, as the receivers cannot differentiate between several transmitters having the same ID.
- A transmitter ID must also be linked to each individual receiver only once! After receiving a radio telegram, the receiver checks the channels 1 to 16, until it finds a coinciding link. For this reason, a second channel with the same link would not receive any input values.
  If for some reason the process value of a channel is emitted on two analog outputs simultaneously, the same channel has to be configured in two analog outputs with a selector.

⇨ Chapter 3.6 "Data flow diagram", page 22

8.1.1 Selection of a transmitter ID from the link list and assignment to a channel

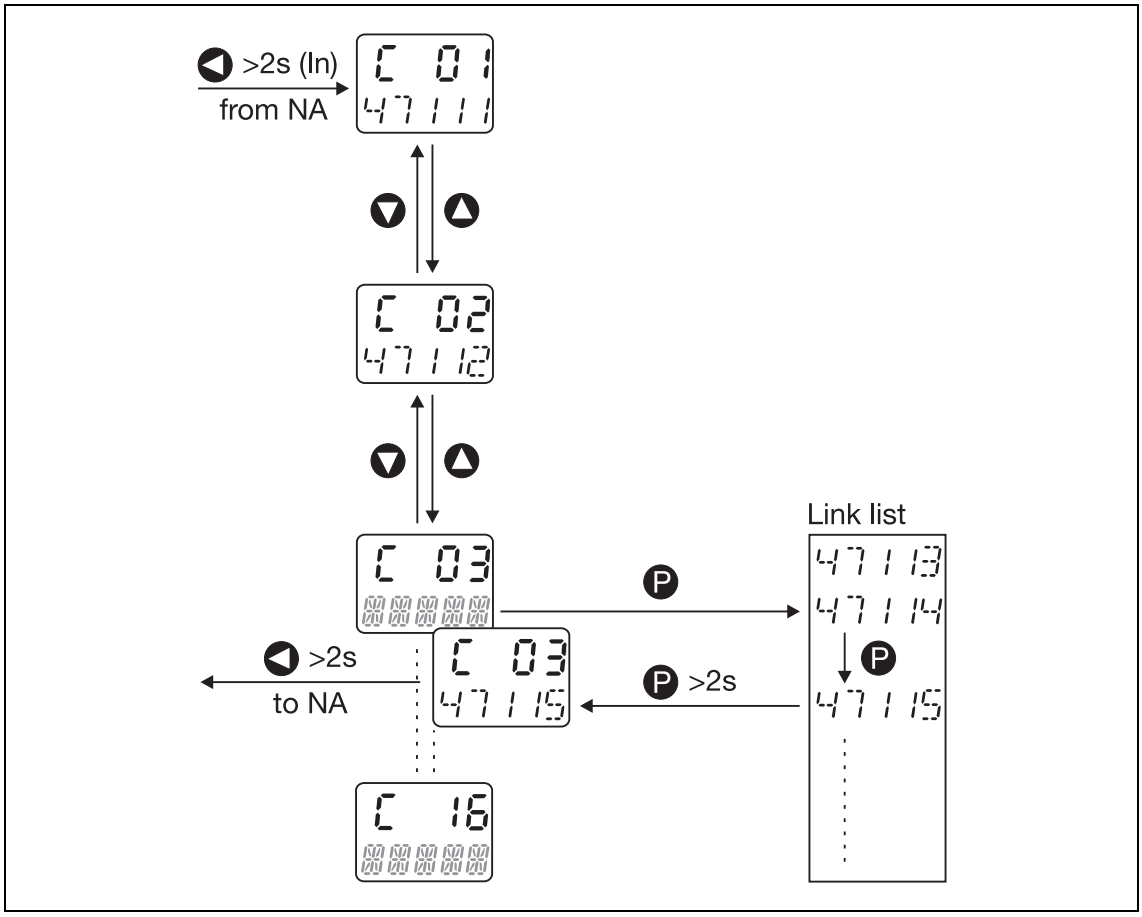


Figure 24: Selection of a transmitter ID from the link list and assignment to a channel

TIP!
The link list contains the IDs not linked and received within the last ten minutes. Transmitter IDs already linked are no longer displayed in the link list.

This way of proceeding is selected when both the transmitters and the receiver are active. Each receiver registers all transmitters received but not linked by itself in a link list allowing a maximum of 25 entries. This list is automatically generated. New transmitters are added automatically. If a transmitter does not signal for a period of ten minutes, it will be removed from the list. When opened, this list is „frozen“. The ID received last is offered first. It can be used to link the transmitter ID received with the individual receiver channels in the following manner.

How to proceed:

Step	Action
1	Change over from the standard display to the commissioning/start-up level (In) by pressing the ◀ key > 2s.
2	Select the channel of the receiver to be linked using the ▲ or ▼ keys (in figure 24, channel 3).
3	Invoke the link list with the P key. *The link list is frozen and the transmitter ID's sorted in the order reflecting the time they are received. The channel is displayed in the top line of the display (in the example 3). The currently assigned transmitter ID flashes in the bottom line*.
4	Press the P key to select the transmitter ID to be linked. *The selected transmitter ID flashes.*
5	Link the transmitter ID to channel 3 pressing the P key > 2s. *The selected transmitter ID no longer flashes.* *The "Link" information appears for 0.25s in the bottom line of the display.*
6	Return to the normal display pressing the ◀ key > 2s or key timeout 40s. *The display returns to the channel displayed last in the normal display.*

All channels can be linked with the received transmitter ID's in the manner explained above.

8.1.2 Manual assignment of a transmitter ID to a channel

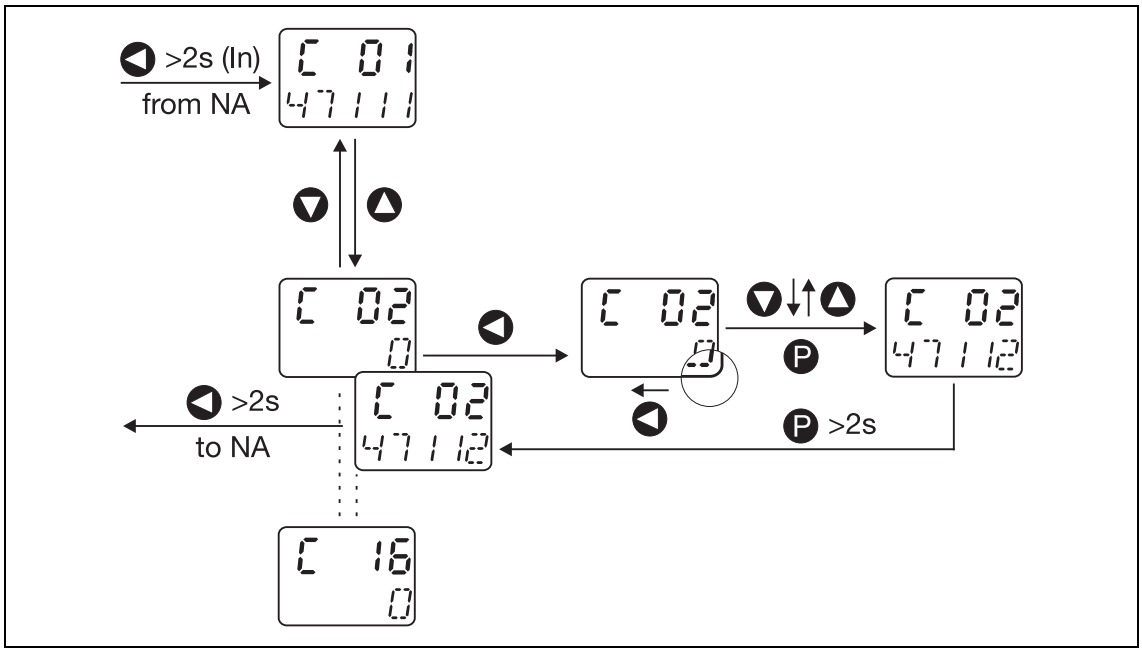


Figure 25: Manual assignment of a transmitter ID to a channel

This way of proceeding is selected when the receiver is to be prepared prior to putting the transmitters into operation. The transmitter ID (max. 5 digits) factory-lasered on the transmitter cone can be manually entered for a receiver channel. The function keys of the receiver can be used to assign the individual transmitter to a receiver channel. This guarantees unambiguous assignment of a transmitter (the measured value) to the selected receiving channel. Link the transmitters as follows:

How to proceed:

Step	Action
1	Change over from the standard display to the commissioning/start-up level (In) by pressing the ◀ key > 2s. *The display changes over to the commissioning/start-up level.*
2	Select the channel of the receiver to be linked using the ▲ or ▼ keys (in figure 25, channel 2). *0 appears on the right in the bottom line of the display.*
3	Initiate editing by pressing the ◀ key. *The bottom segments of the RH digit 0 are flashing.*
4	Edit digits using keys ▲ or ▼.
5	To confirm the first digit, press the ◀ key. *The bottom segments of the second digit from the right are flashing.*
6	Repeat steps 3 and 4 until all digits are edited (at least 1 digit, max. 5 digits).
7	Confirm the transmitter ID to be linked with the P key. *The entered transmitter ID completely flashes.*

Step	Action
8	Link transmitter ID to channel 2 (see figure 25) pressing the P key > 2s. *The entered transmitter ID no longer flashes.* *The "Link" information appears for 0.25s in the bottom line of the display.*
9	Return to the normal display using the ◀ key > 2s or key timeout 40s. *The measured value of the transmitter linked to channel 1 is displayed in the top line of the display. Channel designation 1 and the unit re-appear in the bottom line.*

All other transmitter ID's can be directly assigned to the desired channel in the manner explained above.

8.1.3 Assignment of a transmitter ID to a channel via interface

Select this way of proceeding if receiving channels are to be linked with permanently changing transmitters.

This could be necessary, for instance, for continuous furnaces or production lines that require a large number of throughfeeding transmitters to be read out at one single channel of a stationary receiver. Linking can then be carried out, e.g., by a PLC that has information on the currently throughfeeding product.

⇨ Interface description B90.2931.2.0
"Linked transmitter ID's in the Modbus address list“

8.1.4 Pre-configuration of all transmitter ID's using the setup program

This way of proceeding can be selected when the receiver is to be prepared prior to putting the transmitters into operation.

For this purpose, tick "Channel active" in the receiver channels in the setup program and take the ID (max. 5 digits) specified onto the transmitter cone over under "Transmitter ID“.

The setup data can be transmitted to the receiver in a block and saved in a file.

8.1.5 Configuration of customized transmitter ID's on the transmitter side

This method is selected when there are good reasons not to use the factory-provided transmitter ID's. Instead of the factory transmitter ID's, the transmitter can be assigned a customized transmitter ID. This requires the use of the setup program, knowing that the customized transmitter ID has to be stored in the transmitter beforehand via the setup interface. It should be clearly visible and durably affixed to the transmitter, or noted and kept at a different place.

The customized transmitter ID is linked on the receiver side in the same manner as the factory-provided transmitter ID's.

⇨ Chapter 8.1.1 "Selection of a transmitter ID from the link list and assignment to a channel", page 48
⇨ Chapter 8.1.2 "Manual assignment of a transmitter ID to a channel", page 50

The difference in the way of proceeding is that the ID assignment in pairs can also be changed on the transmitter side, which permits the use of, e.g., low, easy to remember ID's 1 to 16. However, take care not to assign an ID twice, otherwise the transmitters having the same ID cannot be differentiated by the receiver.

8.2 Parameter level (PA)

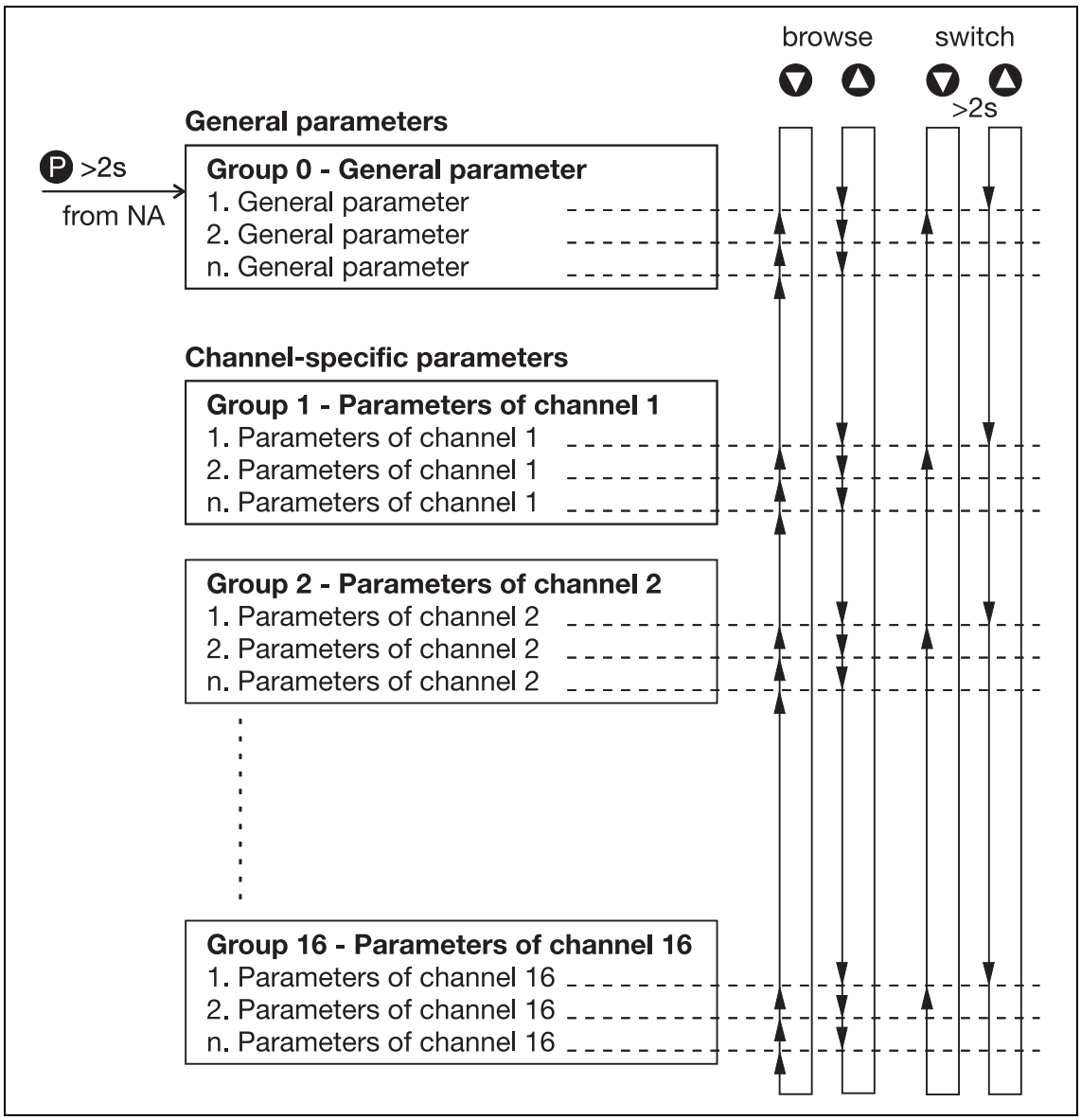


Figure 26: Browsing in steps and jumping in groups

The parameter level comprises an extensive list of editable parameters that are grouped in a user-friendly manner. The key functions shown permit quickly browsing up and down or jumping from one group to another.

In this level, the receiver is adapted to its task. Settings can be selected in the individual parameters or values entered within the factory-set limits. All parameters are described in Chapter 9 "Term definition", page 63to keep instructive and descriptive texts in the following tables separate from each other.

TIP!
Factory settings are shown bold.

8 Configuration of the receiver

Recommended procedure:

Step	Action
1	Read the parameter descriptions contained in Chapter 9 "Term definition", page 63, .
2	Enter the desired settings/values in the right column ! of the following tables.
3	Individually select and edit the parameters one after the other. *This is the only way to ensure parameter entry within the factory-set key timeout of 40 s, after the elapse of which the receiver automatically returns to the standard display. The selections/settings carried out so far remain unchanged.*

CAUTION!
Following each parameter change, wait at least 15 s prior to switching the receiver off, otherwise the change will not yet be saved.
This automatically takes place in the background. If, however, the receiver is switched off too early, a checksum error of the configuration data appears when starting the receiver again.
The bit 0 of the Error parameter is set, the top LED flashes red due to multi-input alarm and the parameters are set to their factory setting!

8.2.1 Editing parameters

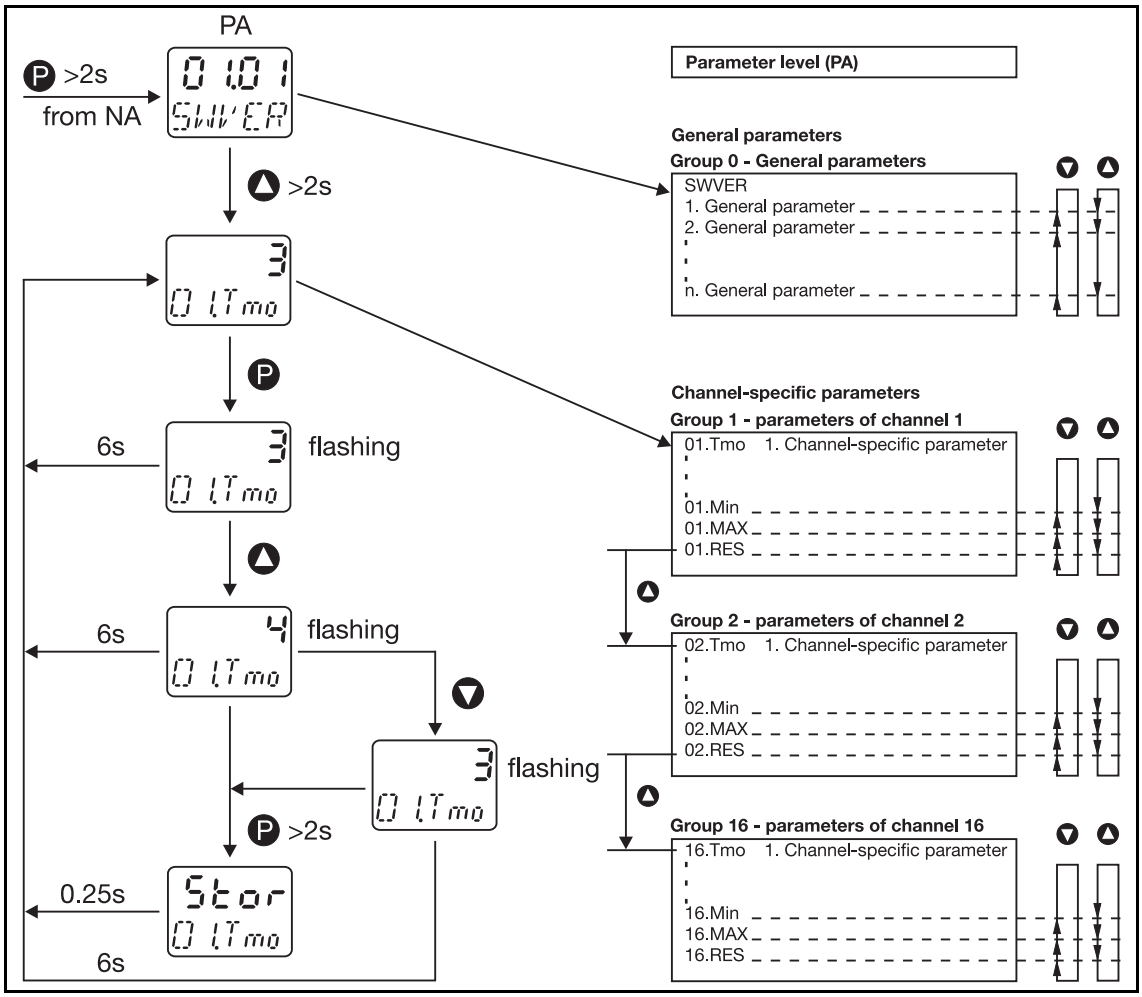


Figure 27: Editing parameters

8.2.2 General parameters

Device information

Parameters	Display bottom line	Display top line	Value range/Selection	✎
Software version	SWVER	01.01	**Display only, cannot be edited!**	
Hardware detection	HArdw	0 to 15	**Display only, cannot be edited!**	
Error (system error bits)	Error	0 to 3	**Display only, cannot be edited!** = Save errors detected with power ON	

CAUTION!
Error (system error bit) means:
At bit 0 (0x01) the receiver has initialized the configuration data to the factory setting.
Please check and, if necessary, reconfigure the settings!
At bit 1 (0x02) the receiver has initialized the calibration data to the factory setting.
The receiver needs to be recalibrated.

Device data

Parameters	Display bottom line	Display top line	Value range/Selection	✎
Temperature unit	T-Uni	°C	**°C** °F	
Code for Commissioning/start-up level	Cod.In	0	**0** to 9999 with 0 no password request	
Code for Parameter level	Cod.PA	0	**0** to 9999 with 0 no password request	
Receiving frequency	RF.FrQ	868.4 912.6 913.0 913.6 914.0 914.6 915.4 916.0 916.4 917.0 917.4	**868.4 MHz** Display only, cannot be edited! **915 MHz** In the frequency band, ten frequencies can be set.	

TIP!
The change to the receiving frequency only becomes effective after restarting the device (power OFF/ON).

RS485 interface

The following table displays the parameters of interface RS485 to be set. The setup connector is operated with fixed parameters independent of these parameters.

Parameters	Display bottom line	Display top line	Value range/Selection	✎
Baud rate	485.Bd	9600 19.2 38.4	**9600** bit/s 19200 bit/s 38400 bit/s	
Data format (Data bits/Parity/ Stop bits)	485.Fo	8n1 8o1 8E1 8n2	**8/none/1** 8/odd/1 8/even/1 8/none/2	
Minimum response time	485.tA	**30**	0 to 500 ms	
Device address	485.Ad	1	**1** to 254	
Customer replacement actual values in the event of an error	485.Er	**0**	-9999 to +9999	

Analog outputs 1 to 4

The following table shows the parameters of analog output 1 to be set. Identical setting possibilities apply to analog outputs 2 to 4 (for type T01.EC3 analog outputs 3 and 4).

Parameters	Display bottom line	Display top line	Value range/Selection		✎
Output signal type	A1.Mod	0-20 4-20 0-10	**0 to 20 mA** 4 to 20 mA 0 to 10 V		
Output size (Analog selector)	A1.SEL	1	0 **1 to 16** 17 to 20	no analog value **Actual value channel 1 to 16** Modbus remote control values analog 1 to 4	
Zero point	A1.Zer	**-30**	-9999 to +9999		
End point	A1.End	**+260**	-9999 to +9999		
Error behavior	A1.Err	ErLo **ErHi**	negative signals: < -0.1 mA/< 3.6 mA/< -0.1 V **positive signals:** > 21 mA/> 21 mA/> 10.5 V (depending on the output signal type)		

Relay outputs 1 to 2

The following table shows the parameters of relay output 1 to be set. Identical setting possibilities apply to relay output 2 (relay outputs exist with type T01.EC3).

Parameters	Display bottom line	Display top line	Value range/Selection	✎
Response	K1.Mod	**no** nc	**N/O contact (normally open)** N/C contact (normally closed)	
Control signal (Binary selector)	K1.SEL	0	0 not assigned 1 to 16 Radio timeout, Channel 1 to 16 17 to 32 Analog alarm 1, Channel 1 to 16 33 to 48 Analog alarm 2, Channel 1 to 16 49 to 64 Low battery, Channel 1 to 16 65 to 66 Relay status 1 to 2 67 Multi-input alarm 68 Multi-input alarm Radio timeout, Channel 1 to 16 69 Multi-input alarm Analog alarms 1, Channel 1 to 16 70 Multi-input alarm Analog alarms 2, Channel 1 to 16 71 Multi-input alarm Low battery, Channel 1 to 16 72 Multi-input alarm Analog alarms 1/2, Channel 1 to 16 73 to 76 Modbus Remote control value, binary 1 to 4 77 Fixed value ON 78 Fixed value OFF	

Modbus remote control values

Parameters	Display bottom line	Display top line	Value range/Selection	✎
Remote control value float 1 Remote control value float 2 Remote control value float 3 Remote control value float 4	FVAL1 FVAL2 FVAL3 FVAL4	**0** **0** **0** **0**	Float Value 1 (-9999 to +9999) Float Value 2 (-9999 to +9999) Float Value 3 (-9999 to +9999) Float Value 4 (-9999 to +9999)	

8.2.3 Channel specific parameters

Channels 1 to 16

The following table shows the parameters to be set for channel 1. The next table contains the same setting possibilities for channels 2 to 16.

Parameters	Display bottom line	Display top line	Value range/Selection	✎
Timeout of the radio telegram (radio timeout)	01.Tmo	**3**	2 to 20 transmission intervals	
Offset (Actual value correction)	01.OFF	**0.00**	-99.99 to +99.99	
Filter time constant	01.dF	0	**0** to 100 s	
Decimal point format	01.dP	Auto 0 1 2	Automatic decimal point xxxx. **xxx.x** xx.xx	
Customer-specific linearization	01.Lin	Lin tAb1 tAb2 tAb3 tAb4	**Linear** Table 1 Table 2 Table 3 Table 4	
Unit	01.Uni	0	0 to 15 (0=none, mm, cm, m, ml, Liter, hl, m^3, %, °C, °F, Ohm, kOhm, mV, kg, tons)	
Scaling start	01.SLo	**0**	-9999 to +9999	
Scaling end	01.SHi	**100**	-9999 to +9999	
Limit value alarm 1				
• Alarm type 1	01.A1m	OFF LoAL HiAL	**no alarm** Min. alarm (Actual value < Limit value 1) Max. alarm (Actual value > Limit value 1)	
• Limit value 1 for alarm type 1	01.A1L	**0**	-9999 to +9999	
Limit value alarm 2				
• Alarm type 2	01.A2m	OFF LoAL HiAL	**no alarm** Min. alarm (Actual value < Limit value 2) Max. alarm (Actual value > Limit value 2)	
• Limit value 2 for alarm type 2	01.A2L	**0**	-9999 to +9999	

Parameters	Display bottom line	Display top line	Value range/Selection	✎
Hysteresis for Min.+Max. alarms	01.HYS	0	**0.00** to 99.99 Difference in relation to the limit values for alarm switch off	
Alarm delay	01.ALd	0	**0** to 999s	
Fly back, bottom	01.Min	-9999 to +9999	**Display only, cannot be edited!** Minimum value fly back automatic decimal point	
Fly back, top	01.MAX	-9999 to +9999	**Display only, cannot be edited!** Maximum value fly back automatic decimal point	
Fly back reset	01.RES	 0 1	Fly back no reset reset	

TIP!
The "Customer specific linearization, Unit, Scaling start and scaling end" are only available for transmitters equipped with a potentiometer or voltage input.

9.1 General parameters

9.1.1 device information

Software version

Software version shows the current status of the device software (firmware). This information might be required for servicing.

Hardware version

The hardware version contains information about the installed receiver hardware (e.g. the reception frequency).

15 = 868.4 MHz reception frequency, 4 analog outputs14 = 915 MHz reception frequency, 4 analog outputs

13 = 868.4 MHz reception frequency, 2 analog outputs and 2 relay outputs12 = 915 MHz reception frequency, 2 analog outputs and 2 relay outputs

Error (system error bit)

Error (system error bit) means:At bit 0 (0x01) the receiver has initialized the configuration data to the factory setting. Please check and, if necessary, reconfigure the settings! At bit 1 (0x02) the receiver has initialized the calibration data to the factory setting. The receiver needs to be recalibrated.

9.1.2 Device data

Temperature unit

Unit (°C or °F) of the measured temperature displayed. The unit appears on the right in the bottom line of the standard display.

CAUTION!
The following is recommended after a change-over: 1. reset the fly back. 2. check the scaling of the analog outputs. 3. check the settings of the limit value alarms.

Code for the commissioning/start-up / parameter level

The commissioning/start-up level as well as the parameter level can be code protected. A code of a different length, min. 1 digit, max. 4 digit, in the range of 0 … 9999 can be assigned to each level. If you select 0 for the code, the code request will be inactive for the selected level.

Receiving frequency

ISM band 868.4 MHz (Europe) or 915 MHz (America, Australia, Canada and New Zealand).

In the frequency band, ten frequencies can be set.

9.1.3 RS485 interface

TIP!
Interface description Modbus B 90.2931.2.0
(The Modbus interface description is provided in the internet as download, free of charge.)

Baud rate

Transmission speed of the RS485 interface. If a master (PC or PLC) is connected to the interface, an identical baud rate must be selected on the master side.

Data bits/Parity/Stop bits

Data format of the RS485 interface. If a master (PC or SPS) is connected to the interface, select the same data format on the master side.

Minimum response time

The minimum response time is adhered to by the receiver prior to sending a response following a data request. The response time is required by the RS485 interface in the master, to be able to switch over the interface drivers from transmit to receive.

Device address

Under the set unit address, the receiver can be accessed via the RS485 interface. For this interface, the device address of the receiver may only appear once within a connection (several devices on one bus).

CAUTION!
These settings only refer to the RS485 interface. Independent of these parameters, the setup plug is operated with fixed parameters for transmission speed: 9600 baud, data format: 8n1, minimum response time: 0 ms and device address: 1.

Customer replacement actual values

The current display values can be exported from a receiver by a Modbus master via the addresses (hex) 00E7 to 0105.
In the event of an error (timeout, overrange, underrange, etc.) it reads a very large value (e.g. 9.0 x 10^{37} for radio timeout - see chapter 2.9.2 of the B 90.2931.2.0 "Modbus interface description") via these addresses.
The new customer replacement actual values on the addresses (hex) 0407 to 0425 are intended for all users, the modbus master of which cannot evaluate these large values.
In normal case (no errors pending), the customer replacement actual values contain the same values as the display values. In the event of an error, the customer replacement actual value programmed in the receiver is transmitted. Thus, the user is able to recognize errors.

9.1.4 Analog outputs 1 to 4

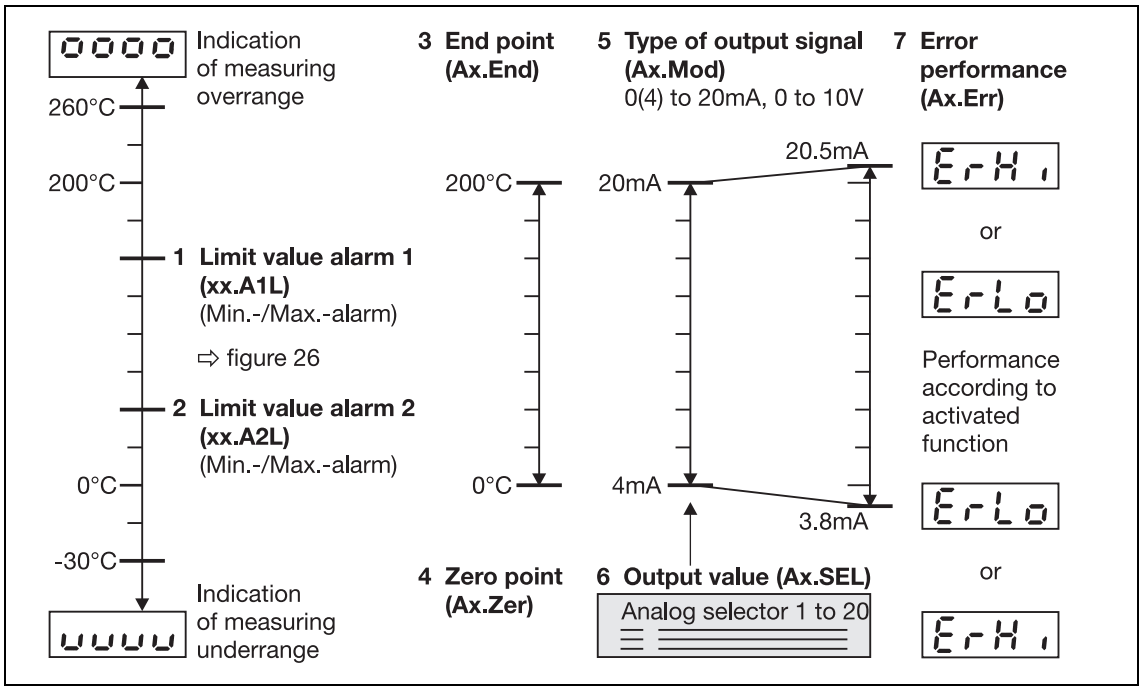


Figure 1: Analog outputs 1 to 4

Output signal type (Ax.Mod)

This function defines how the output is operated (see Figure 1Pos. 5). Current and voltage outputs are possible. Depending on the receiver type, two or four analog outputs are available.

⇨ Chapter 2.2 "Type designation", page 10

Output value (Ax.SEL)

The process value to be put out at the selected output is defined here (see Figure 1Pos. 6). In addition to the process values of the 16 wireless inputs, four Modbus remote control values are available in the analog selector.

Zero point (Ax.Zer) and end point (Ax.End)

The zero point and the end point (see Figure 1, Pos. 3 und Pos. 4) permit the entire measuring range or part of it to be displayed at the output (e.g. 0 to 200 °C).

Error behavior (Ax.Err)

The type of error message to become active under the following conditions is set here (see Figure 1Pos. 7):

- overrange/underrange
- Probe short circuit
- Probe break/wire break and
- alarms

ErHi (positive signals) and ErLo (negative signals) are possible.

The performance of the output signal in the event of underrange or overrange is shown in the following table.

9 Term definition

Measuring circuit monitoring of the analog outputs

Underrange: - current output 4 to 20 mA - current output 0 to 20 mA - voltage output 0 to 10 V	 dropping to 3.8 mA, then jump to the configured signals dropping to -0.1 mA, then jump to the configured signals dropping to -0.1 V, then jump to the configured signals
Overrange: - current output 4 to 20 mA - current output 0 to 20 mA - voltage output 0 to 10 V	 rising to 20.5 mA, then jump to the configured signals rising to 20.5 mA, then jump to the configured signals rising to 10.25 V, then jump to the configured signals
Probe short-circuit orprobe and wire break and alarms: - current output 4 to 20 mA - current output 0 to 20 mA - voltage output 0 to 10 V	 positive signals: > 21.6 mA negative signals: < 3.6 mA positive signals: > 21.6 mA negative signals: < -0.1 mA positive signals: > 10.5 V negative signals: < -0.1 V
Output performance	The output performance (positive or negative signals) can be set.

9.1.5 Relay outputs 1 to 2

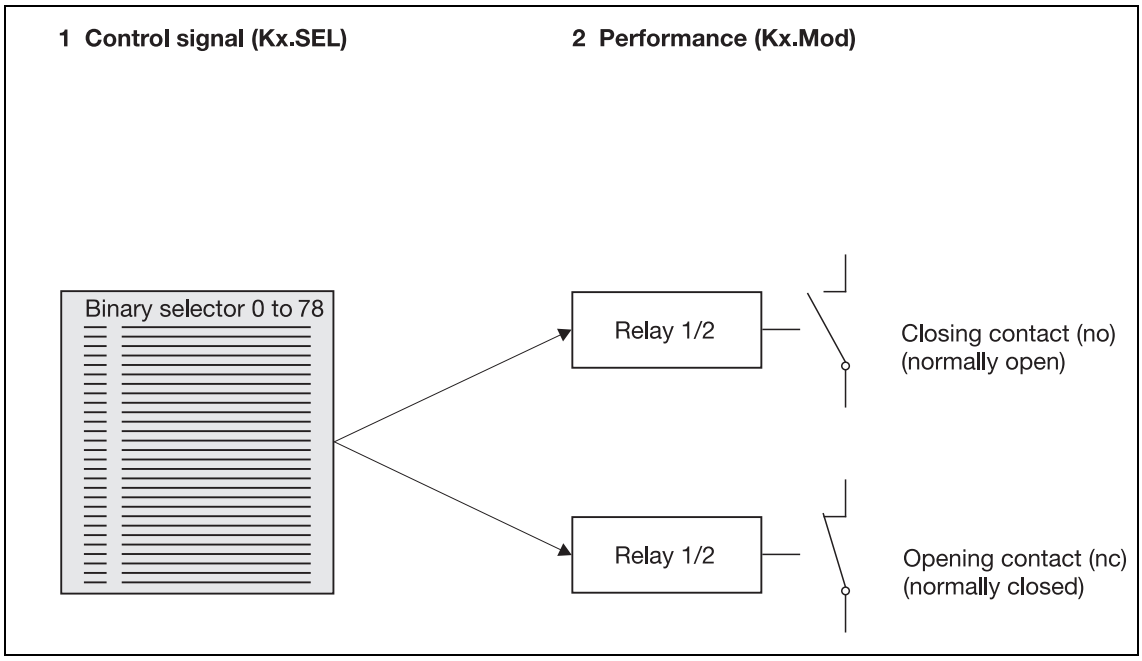


Figure 2: Performance of the relay outputs 1 to 2

Performance (Kx.Mod)

This function defines how the relay output is operated. N/C and N/O contacts are available (see Figure 2, Pos. 2). Not every receiver type provides relay outputs.

⇨ Chapter 2.2 "Type designation", page 10

Control signal (Kx.SEL)

The control signal (see Figure 2, Pos. 1) defines the status used to switch relay output 1 or 2. The following conditions can be set in the binary selector:

Relay inactive (not assigned)

The relays remain in their configured basic position (no/nc).

Radio timeout, channel 1 to 16

A relay is switched when the radio timeout is exceeded. Radio timeout is a configurable alarm bit which is set when the radio signal of a linked probe was not received for a long time.

Analog alarm 1 and 2, channel 1 to 16

A relay is switched when the limit value alarm 1 or 2 is activated.

Low battery, channel 1 to 16

A relay is switched when a probe battery has to be replaced.

Relay status 1 and 2

A relay is switched when it is accessed by another relay.

Due to the fact that the relay outputs in the receiver have only two pins, it is possible to get one change-over contact out of two relays: e.g. relay 2 is configured as a logical inverter (N/C).

Multi-input alarms

A relay is switched when an alarm is activated. Multi-input alarms can be:

- OR linkage of all individual alarms
- Radio timeout, channel 1 to 16
- Analog alarms 1, channel 1 to 16
- Analog alarms 2, channel 1 to 16
- Low battery, channel 1 to 16
- Save errors detected with power ON

⇨ Chapter 8.2 "Parameter level (PA)", page 53

Remote control values BOOLEAN 1 to 4

A relay is switched when the remote control value is set to ON. Remote control values are controlled via interface.

Fixed value ON/OFF

Depending on the selection, a relay is activated or deactivated.

9.1.6 Modbus remote control values FLOAT 1 to 4

Radio control values can be transmitted via the interface by a Modbus master (e.g. PLC) and displayed and processed by a receiver.

⇨ Operating manual B 90.2931.2.0 "Modbus interface description"

If the analog outputs are guided to these control variables via selector, the ROEMHELD receiver can also be used as a 4-channel analog output module.

In this manner, control values calculated by a PC program can be supplied in the process. Even a simultaneous operation as a 16-channel radio reception module and 4-channel analog output module is possible (see Figure 3).

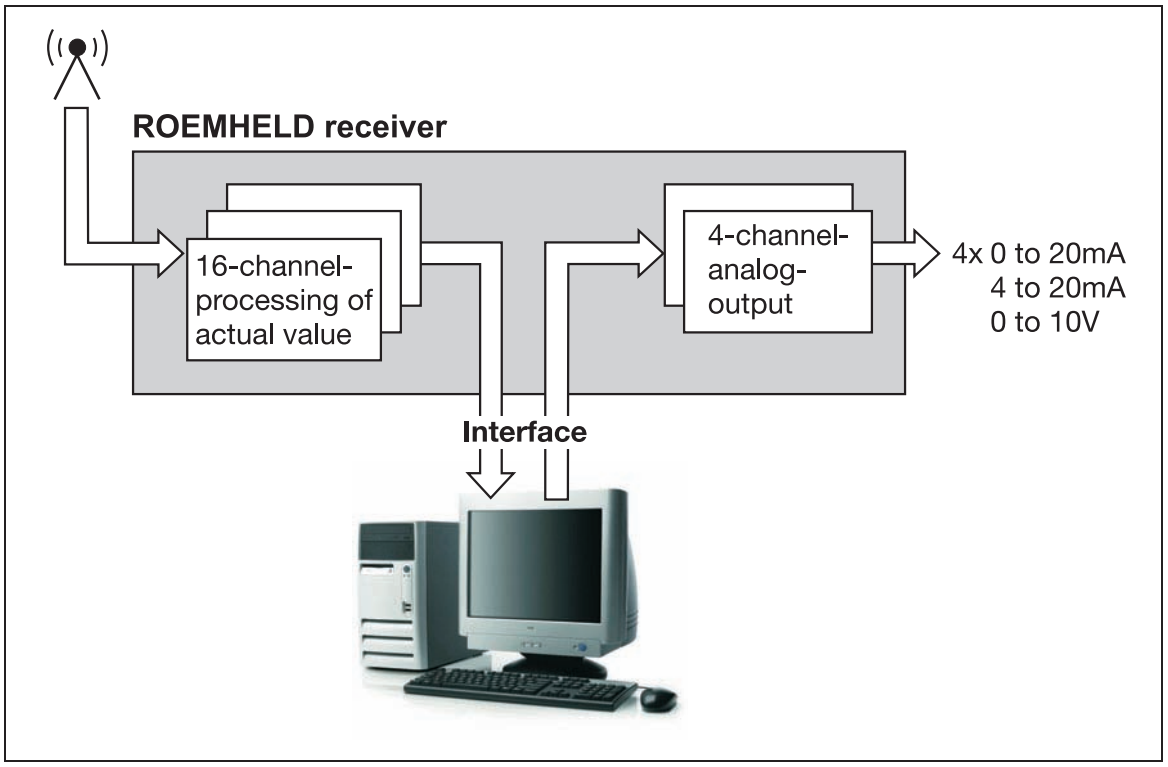


Figure 3: PC with visualization/control software

9 Term definition

9.2 Channel specific parameters

Radio telegram timeout [Radio timeout (xx.Tmo)]

Number of transmitter intervals during which one new probe value must have arrived. The set transmission interval of the transmitter is transmitted with the radio telegram. Once the first telegram is received, this value is saved in the receiver and the radio timeout monitoring function activated. If no new value from the transmitter is received throughout the entire timeout duration, the measured value is set to "no input value“, the alarm bit "Radio timeout“ of the channel is set, and the top LED flashes red.

Offset (xx.OFF)

This offset value (process value correction) is added to the measured input value with the correct sign. This permits a correction in the "+" as well as the "—" direction.

Examples:

measured value	Offset (Actual value correction)	displayed value
294.7	+0.3	295.0
295.3	-0.3	295.0

CAUTION!
The following is recommended after changing an offset: 1. reset the fly back. 2. check the scaling of the analog outputs. 3. check the settings of the limit value alarms.

Filter time constant (xx.dF)

This parameter is used to adapt the digital input filter to the task. 63 % of the alterations are acquired after 2x filter time constant at a step change. For a long filter time this means:

- high damping of interference signals
- slow reaction of the process value display to process value changes
- low limit frequency (2nd order low-pass filter)

Decimal point format (xx.dP)

Here the position of the decimal point is selected. No to max. 2 digits behind the decimal point are possible or the automatic display (one digit behind the decimal point as standard).

If the actual value exceeds the dimension which can be displayed with the decimal point format, decimal places (n) are discarded after the decimal point.

Customer specific linearization

Four customer specific linearizations are available in addition to the linear linearization. The corresponding linearization tables must be created with the setup program.

To be able to use the customer specific linearization, a suitable transmitter must be linked and the probe type of the transmitter must be configured to Potentiometer or Voltage.

The parameter is only available for receivers, the hardware version of which is 1 or higher or the device software version of which complies at least with version 03.01.

⇨ Chapter 2.1 "Rating plate", page 9

⇨ Chapter 11.5 "Customer-specific linearization", page 85

Unit

For probes, the probe type of which is configured to Potentiometer or Voltage, one of 15 units can be selected. The unit is shown in the receiver display.

The parameter is only available for receivers, the hardware version of which is 1 or higher or the device software version of which complies at least with version 03.01.

⇨ Chapter 2.1 "Rating plate", page 9

⇨ Chapter 11.5 "Customer-specific linearization", page 85

Scaling start, scaling end

For probes, the probe type of which is configured to Potentiometer or Voltage, the input measuring range (e.g. 0 to 50 mV) can be scaled to a range defined by the user (e.g. 0 to 250). The corresponding unit is configured by the Unit parameter.

The parameter is only available for receivers, the hardware version of which is 1 or higher or the device software version of which complies at least with version 03.01.

⇨ Chapter 2.1 "Rating plate", page 9

⇨ Chapter 11.5 "Customer-specific linearization", page 85

Alarm type 1/2 (xx.A1m/xx.A2m)

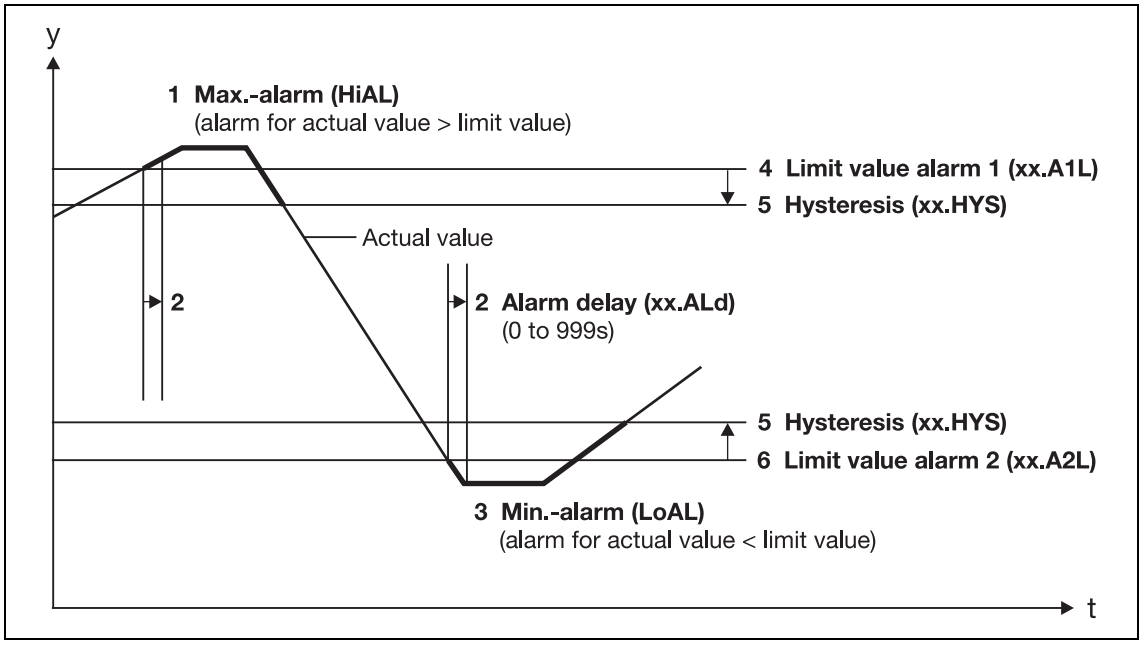


Figure 4: Setting the alarm functions

High alarm (HiAL)

Alarm when the positive limit value is exceeded (after the alarm delay time has elapsed), not taking the hysteresis into account (see Figure, 4 Pos. 1). Reset conditions: Going below the positive limit value - hysteresis.

Low alarm (LoAL)

Alarm when the negative limit value is gone below (after the alarm delay time has elapsed), not taking the hysteresis into account (see Figure 4, Pos. 3). Reset condition: Exceeding the negative limit value + hysteresis.

9 Term definition

Limit value alarm 1/2 (xx.A1L/xx.A2L)

The limit value for the selected alarm type 1 and 2 is set here (see Figure, 4Pos. 4 and Pos. 6).

Hysteresis (xx.HYS)

Hysteresis is the gap between the set limit value alarms. 1 or 2 is always set as a positive value for the Max. and Min. alarm (see Figure, 4Pos. 5).

Alarm delay (xx.ALd)

This parameter is used to suppress short-term faults (see Figure 4, Pos. 2). The alarm signal is only activated after the set time has elapsed and the limit value overrange or underrange is still pending.

TIP!
The alarms can be configured as window function (min/max) or as pre-alarm or main alarm (min/min or max/max).

CAUTION!
Alarm in the event of probe break or short-circuit
Even the definitive faulty values probe break (display "oooo“) or short-circuit (display "uuuu“) only lead to a set alarm bit and, thus, to a multi-input alarm with the LED flashing red when at least one alarm (regardless of LoAL or HiAL) was configured!
If you only want to receive probe break / short-circuit alarms without any other limit value monitoring, activate an alarm using a limit value outside of the range of occurring actual values.
Example:
Your actual value can be between -10 to +200°C.
Pure probe break / short-circuit alarms can be achieved, e. g. by a HiAL configuration with a limit value of 300°C or a LoAL configuration with a limit value of -100°C.

Fly back down/up (xx.Min) and up (xx.MAX)

The minimum and maximum values for each channel are saved and shown on the display when requested. In this context, overrange and underrange are not taken into account. These values can be reset using the keyboard or via interface. Having reset the fly back, the current value is taken over and the fly back function restarts.

⇨ Chapter 8.2.3 "Channel specific parameters", page 61
⇨ Chapter 10 "Display and reset fly back", page 75

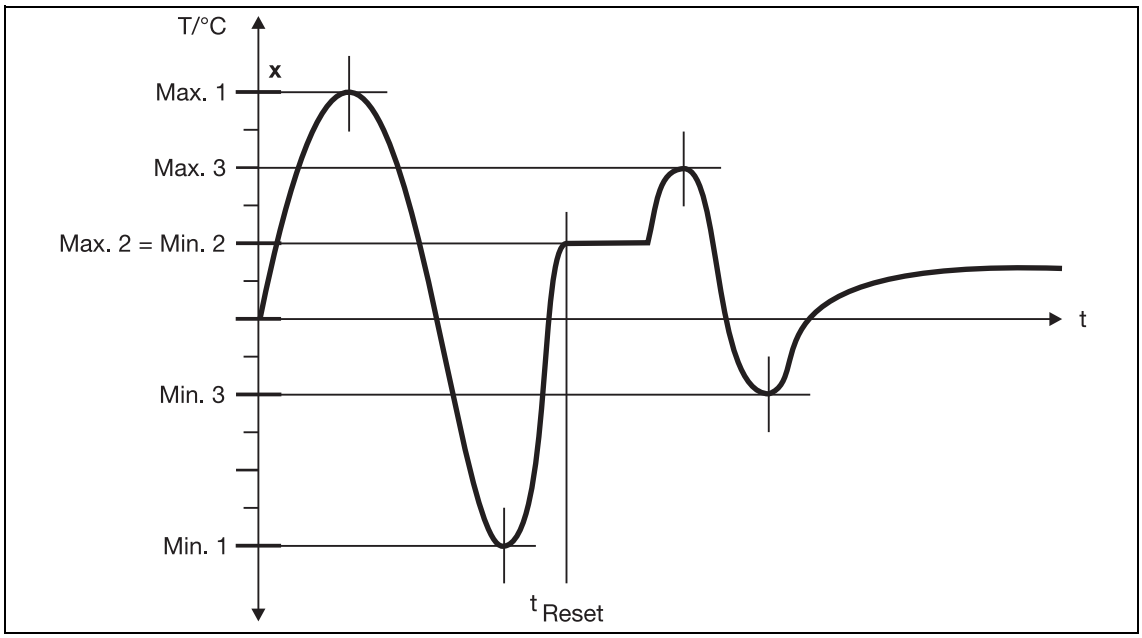


Figure 5: Time sequence of the fly back functions

Figure 5 shows the time sequence of the fly back functions 'down' (xx.Min) and up (xx.MAX). The Value Max.1 is saved in the first positive half-wave of the process value curve, value Min.1 in the first negative half-wave. These values can be reset using the keyboard, in the example at point t_{Reset}.
Having reset the fly backs, the current value is taken over (max.2 = min.2) and the fly back function restarts. The next saved values are Max.3 and Min.3.

9 Term definition

The fly back values of channels 1 to 16 cannot be shown in the standard display. For this purpose, change to the parameter level and therein to 'channel-specific parameters'. At the end of the selection list of groups 1 to 16 (channels 1 to 16) three parameters (see table) relevant for the fly back function are shown.

Parameters	Bottom line display	Top line display	Range/ Selection
Fly back down	xx.Min	-9999 to +9999	Display only, cannot be edited! Minimum value fly back, with automatic decimal point
Fly back up	xx.MAX	-9999 to +9999	Display only, cannot be edited! Maximum value fly back, with automatic decimal point
Reset fly back	xx.RES	0 1	**Fly back** do not reset fly backreset fly back

TIP!
To perform this function you have to know how to browse step-by-step between parameters and how to jump between groups 1 to 16 (channels 1 to 16) s.

⇨ Chapter 8.2 "Parameter level (PA)", page 53

The display shows the two fly back values at the top and bottom in two lines. The bottom line has the fly back type xx.Min or xx.MAX. In the display of the device, xx is replaced by the numbers 1/2/3/ to 16 indicating the selected channel. The upper line shows the attendant measured value.
For the „Reset fly back“ parameter, the bottom display shows xx.RES (for Reset).

This parameter offers the following setting possibilities:

- no reset, i.e. the fly back function of the selected channels remains.
- reset, i.e. both fly back values (Min. and Max.) are deleted.

The next two pages have a description of how the fly back values of channels 1 to 16 can be displayed and reset.

10 Display and reset fly back

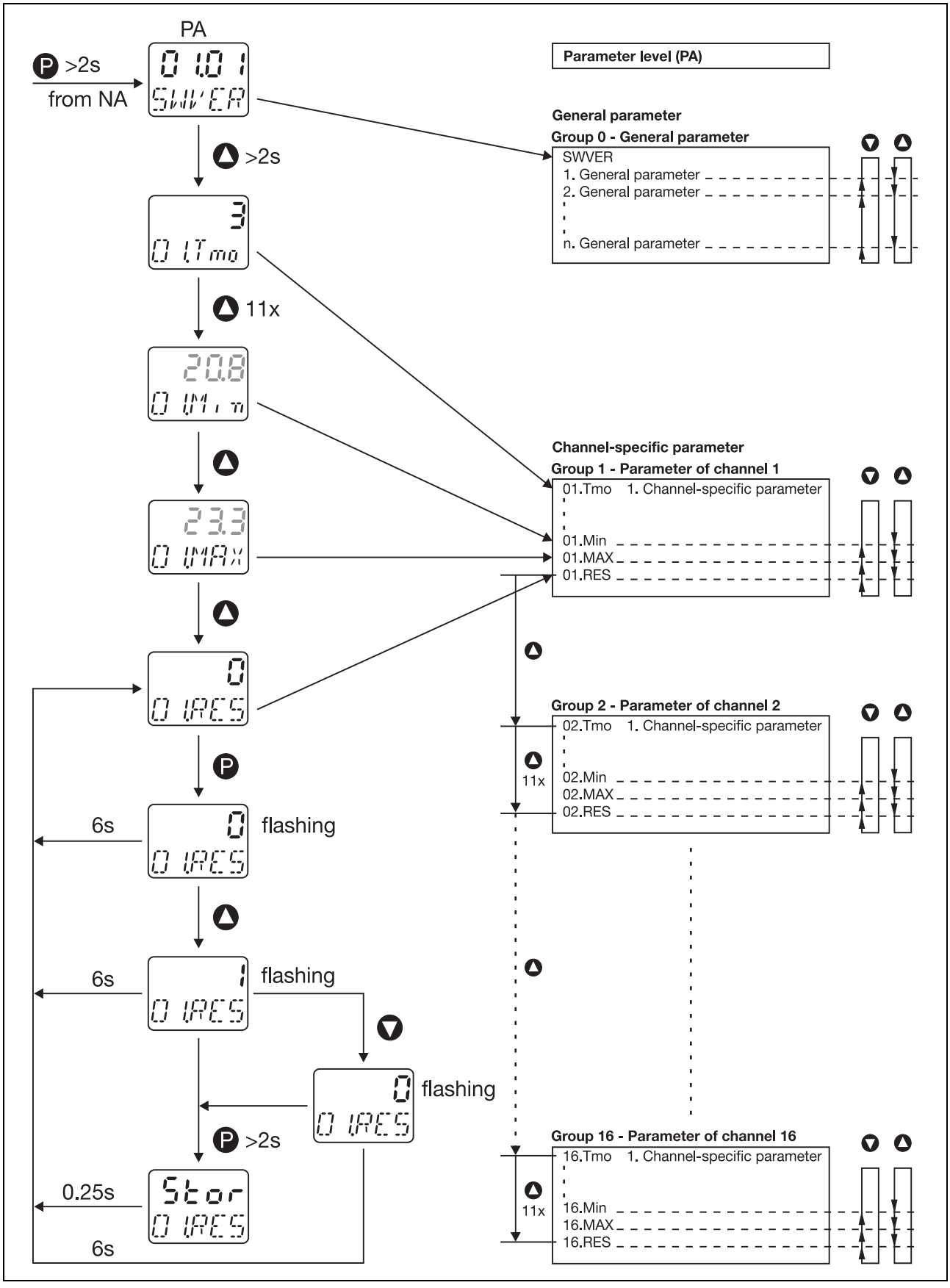


Figure 6: Fly back functions

How to proceed:

Step	Activity
1	Leave the standard display (NA) and move to the parameter level (PA) by pressing key P > 2s. *In the bottom line, the display shows the first General Parameter Software version (SWVER).*
2	Go to the Channel-specific Parameter by pressing key ▲ > 2s. *In the bottom line, the display shows the 1st parameter of the 1st channel Timeout of the radio telegram [Radio timeout (01.Tmo)].*
3	Leaf to the Bottom Fly Back parameter (01.Min) of the 1st channel by pressing key ▲. *In the top line, the display shows the minimum value of the 1st channel.*
4	Leaf to the Top Fly Back parameter (01.MAX) of the 1st channel by pressing key ▲. *In the top line, the display shows the maximum value of the 1st channel.*
5	Leaf to the Reset Fly Back parameter (01.RES) of the 1st channel by pressing key ▲. *The display shows „0“, i.e. the fly back is active.*
6	Select Reset Fly Back by pressing key P. *The display „0“ flashes.*
7	Select Reset Fly Back by pressing key ▲. *The 1 displayed in the top line flashes.* *This selection can be reversed by step 8.*
8	Select No Reset of Fly Back by pressing ▼. The 0 in the top line flashes.
9	Apply Reset Fly Back function, step 7 (or Do Not Reset Fly Back function, step 8) by pressing key P > 2s. *The display shows Stor (storage) for 0.25s and then jumps to Reset Fly Back (01.RES).*

10 Display and reset fly back

11.1 General information about the setup program

The setup program serves to configure transmitters and receivers by means of a PC. The configuration data can be archived on data carriers and printed.

The setup program can be used to overwrite changed parameters with the factory settings at any time.

The connection between receiver and PC is established via a PC interface (USB/TTL or TTL/RS232 converter).

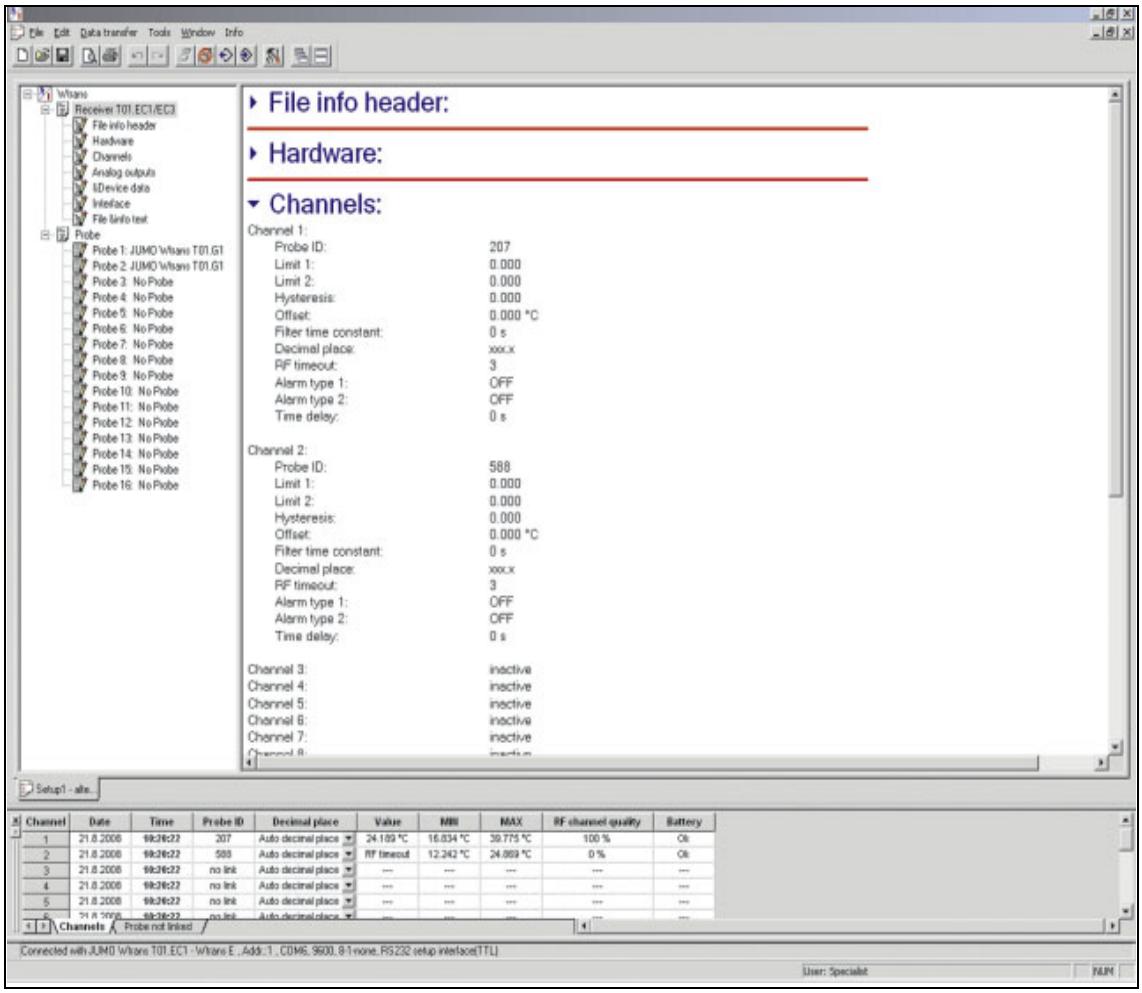


Figure 7: Setup program

The setup program permits a comfortable and clearly structured setting of the large number of device parameters. Settings made once can be saved on a data carrier as a file and transmitted one to one to several devices.

With an online connection to the device, the bottom screen section, the „Diagnosis window“, shows process values and further informative values of all channels in parallel.

TIP!
For configuration, the receiver must be connected to the power supply.

⇨ Chapter 5.2 "Connection diagram", page 32

11 Setup program

11.2 Hardware and software prerequisites

The following hardware and software prerequisites must be fulfilled for operation and the software installation:

Minimum configuration

- Intel Pentium III[1] or higher
- Microsoft Windows 2000 or XP[2]
- 256MB central memory
- CD drive
- Mouse
- one free USB port or
- one free serial interface (depending on the interface/port used)
- 120MB free fixed disk memory

Recommended configuration

- Intel Pentium 4[1]
- Windows XP[2]
- 512MB central memory

Information about Windows 2000 or XP

If several users are managed on the computer, ensure that the user is logged in, who will work with the program later. Ensure that the user has administrator rights while installing the software. Once installation is completed, the rights can be restricted again.

In the event of non-observance of this information, correct and complete installation cannot be guaranteed!

[1] Intel and Pentium are registered trademarks of Intel Corporation.

[2] Microsoft and Windows are registered trademarks of Microsoft Corporation.

11.3 Connect PC and receiver to each other

The connection between receiver and PC is established via a PC interface TTL/RS232 converter and adapter (socket) or USB/TTL converter and adapter (socket).

TTL/RS232

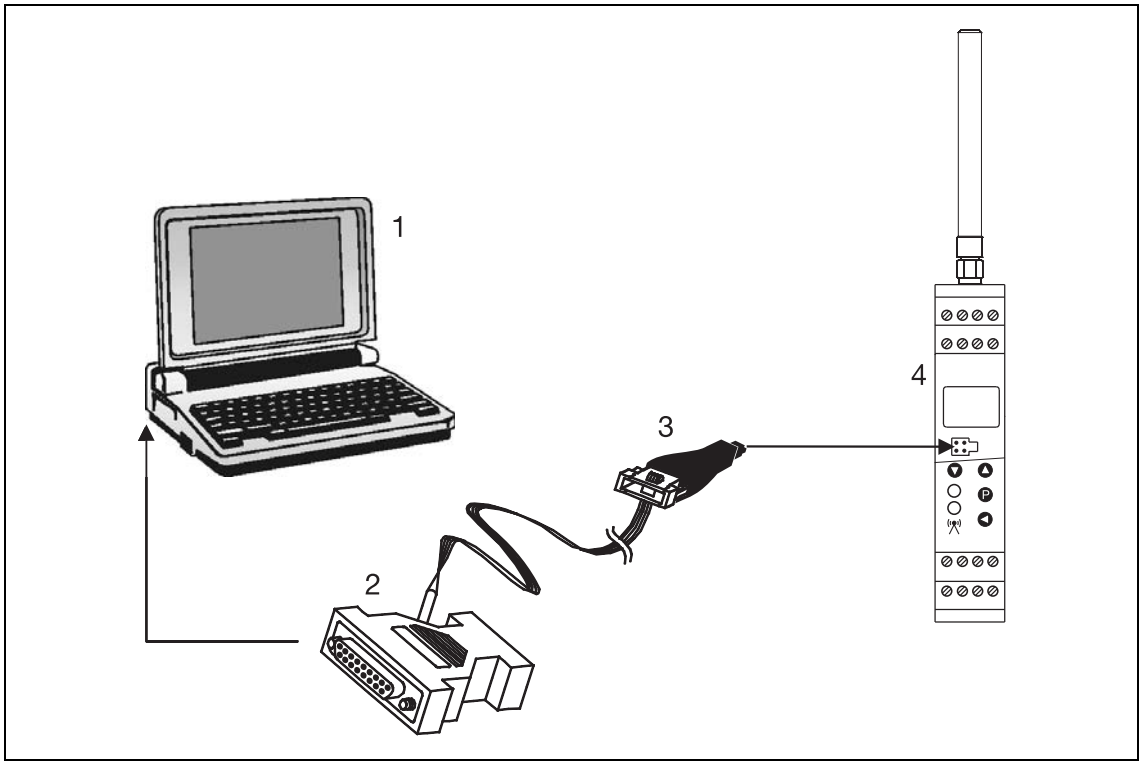


Figure 8: Connect receiver and PC with each other via TTL/RS232 converter and adapter socket

1	PC	3	4 pole adapter socket
2	RS232 plug	4	Receiver interface

How to proceed:

Step	Activity
1	Connect the RS232 plug (2) to the PC (1).
2	Connect the 4-pin adapter socket (3) to the interface of the receiver (4).

11 Setup program

USB/TTL

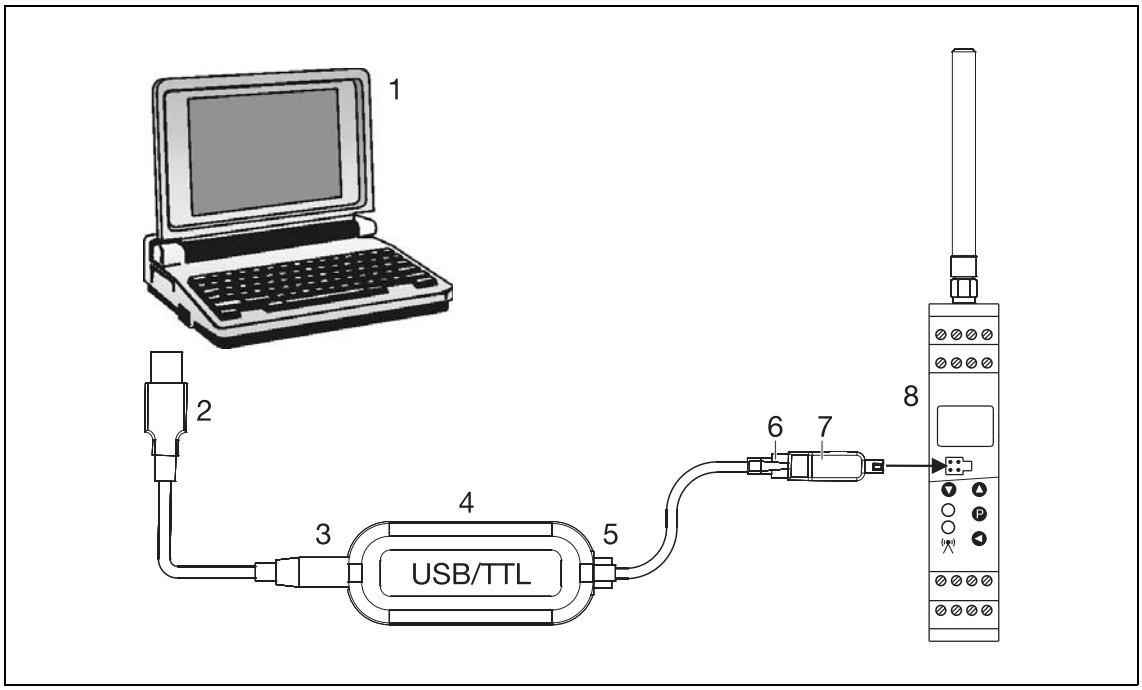


Figure 9: Connect PC and receiver with each other via USB/TTL converter and adapter socket

1	PC	5	RJ-45 plug
2	USB plug	6	Adapter of the modular line
3	USB socket	7	4 pole adapter socket
4	USB/TTL converter	8	Receiver interface

How to proceed:

Step	Activity
1	Plug the USB plug of the USB cable (2) to the PC (1).
2	Connect the USB socket of the USB cable (3) to the USB/TTL converter plug (4).
3	Connect the RJ-45 plug (5) of the modular line to the RJ-45 socket of the USB/TTL converter (4).
4	Connect the 4-pin adapter socket (7) to the adapter of modular line (6).
5	Connect the 4-pin adapter socket (7) to the port of the receiver (8).

11.4 Configuration of the receiver

This chapter explains the configuration of a receiver via the setup program. Prerequisite being that the receiver and the PC are connected via an interface.

11.4.1 Establishing the communication

A differentiation is made between two different way of proceeding when establishing the communication between receiver and setup program:

- Establishing the communication using the "Assistant for device settings".
  This is the case when the setup program is used for the first time
  (device list empty).
- Establishing the communication without using the "Assistant for device settings".
  This is the case when receiver/transmitter and setup program have already communicated (list of devices with entries).

Establishing the communication using the assistant

How to proceed:

Step	Activity
1	Start the setup program.
2	Select the "Establish connection" function in the "Data transfer“ menu. *Once the setup program is started, the "Assistant for the device settings" appears.*
3	Select the receiver under the "Device version" and confirm by pressing "Continue".
4	Confirm the PC communication interface "Serial interface" by pressing "Continue" saving.
5	Select the COM interface (e.g. COM1) and confirm with "Continue“.
6	Select the device address (e.g. 1) and confirm with "Continue“.
7	Exit the assistant by pressing "Finish". *The device list with the selected receiver appears.*
8	Click on the "Connect" button. *The device list is closed, the assistant terminated and the communication between receiver and setup program established.*

Prerequisite for the procedure described above being the communication of the PC executed via a COM interface (virtual COM interface for USB/TTL).

When using the USB/TTL converter, the additional possibility exists to establish the connection directly via a USB interface.

How to proceed:

Step	Activity
1	Start the setup program.
2	Select the "Establish connection" function in the "Data transfer“ menu. *Once the setup program is started, the "Assistant for the device settings" appears.*
3	Select the receiver under the "Device version" and confirm by pressing "Continue".
4	Select the PC communication interface "USB-TTL converter“ and confirm with "Continue“.
5	Select the connected converter (e.g. USB <-> Serial (LID:...)) and confirm with "Continue“.
6	Select the device address (e.g. 1) and confirm with "Continue“.
7	Exit the assistant by pressing "Finish". *The device list with the selected receiver appears.*
8	Click on the "Connect" button. *The device list is closed, the assistant terminated and the communication between receiver and setup program established.*

Establishing the communication without using the assistant

How to proceed:

Step	Activity
1	Start the setup program.
2	Select the "Establish connection" function in the "Data transfer“ menu. *The device list containing all devices entered is mapped in.*
3	Select the desired receiver by clicking with the left mouse key.
4	Click on the "Connect" button. *The device list is closed, the assistant terminated and the communication between receiver and setup program established.*

11.4.2 Reading out the current receiver parameters

How to proceed:

Step	Activity
1	In the "File" menu select the "New" function. *The "Device assistant" starts.*
2	Select „Aut. detection and data transfer from the device“ and confirm with „Continue“.
3	Exit the overview of the read out settings by pressing "Finish". *The current settings are imported into the setup program.*

11.4.3 Editing receiver parameters

How to proceed:

Step	Activity
1	Use the navigation tree to select the desired main parameter of the receiver (e.g. channels) by a double click with the left mouse key. *The channel parameters are mapped in.*
2	Edit the parameters concerned.
3	Confirm editing with „OK“.
4	Store the parameters in the „File“ menu with the „Store“ function.

11.4.4 Transmit new parameters to the receiver

How to proceed:

Step	Activity
1	In the "Data transfer" menu select the "Data transfer to device" function. *The current parameters are transmitted to the receiver*
2	Finish communication between setup program and receiver in the „Data transfer“ menu with the „Disconnect connection“ function.

11.5 Customer-specific linearization

Due to the customer specific linearization (max. 40 grid points or polynomial of fourth order), probes can be connected, which are not defined by the ex-factory linearization.

To activate the customer specific linearization, ensure that "Potentiometer" or "Voltage" is configured as the sensor type on the transmitter. The Customer specific linearization parameter must be configured to "tAb1 to tAb4" in the channel specific parameters on the reiceiver.

In the **EDIT > CUSTOMIZED LINEARIZATION** menu, the user can define the linearization.

How to proceed:

Step	Activity
1	Select one of the tables 1 to 4.
2	Select the linearization method, table (grid point) or formula (polynomial).
3	Edit parameters.
4	Exit the entry by pressing OK.

Table

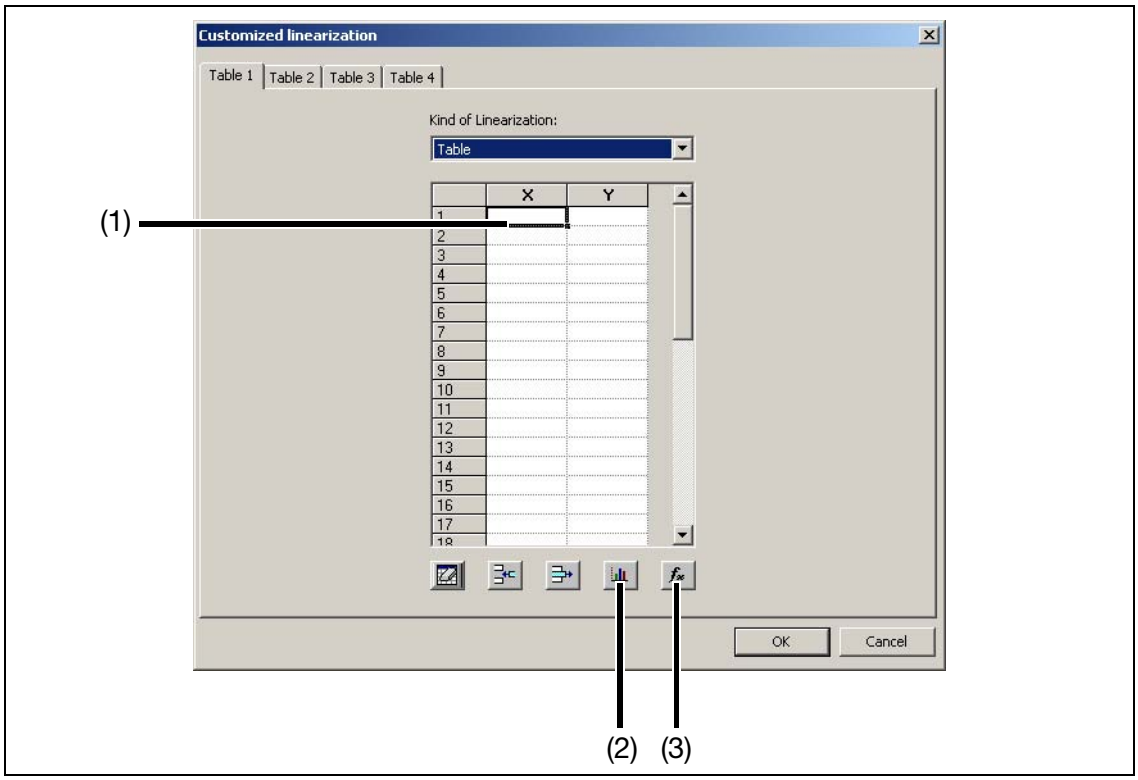


Figure 10: Customer-specific linearization - Table

- The user enters the X and Y value pairs of the grid points in area (1).
- When actuating button (2), the user can display the linearization curve graphically and check it.
- The user can convert the entered grid points to a polynomial when using button (3). The view automatically changes from table to formula and can be toggled by the user. Both curves appear in the graphic display.

TIP!
The linearization set when actuating the OK button is used by the device.

Formula

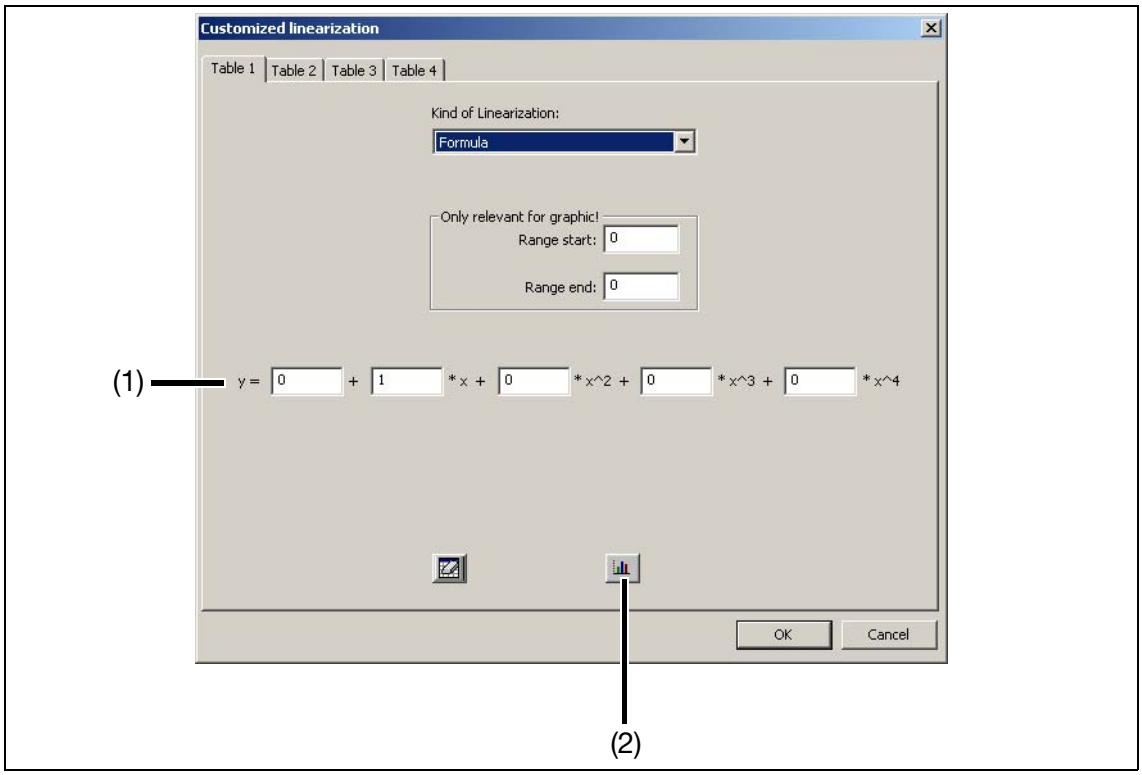


Figure 11: Customer-specific linearization - Formula

- The user enters the coefficients and the polynomial formula in area (1).
- When actuating button (2), the user can display the linearization curve graphically and check it.

TIP!
The manual entry of coefficients has no influence to the X and Y value pairs in the table.

11 Setup program

11.6 OnlineChart

The OnlineChart function is available for the user as an option for the setup program (from version 216.03.xx). This function can be used to display max. eight analog and four binary channels graphically (detection rate 2 seconds) and record them throughout a time period of 48 hours. The recorded data is saved together with the setup file.

OnlineChart is activated by the user, e.g. via the menu **SCREEN > ONLINECHART**.

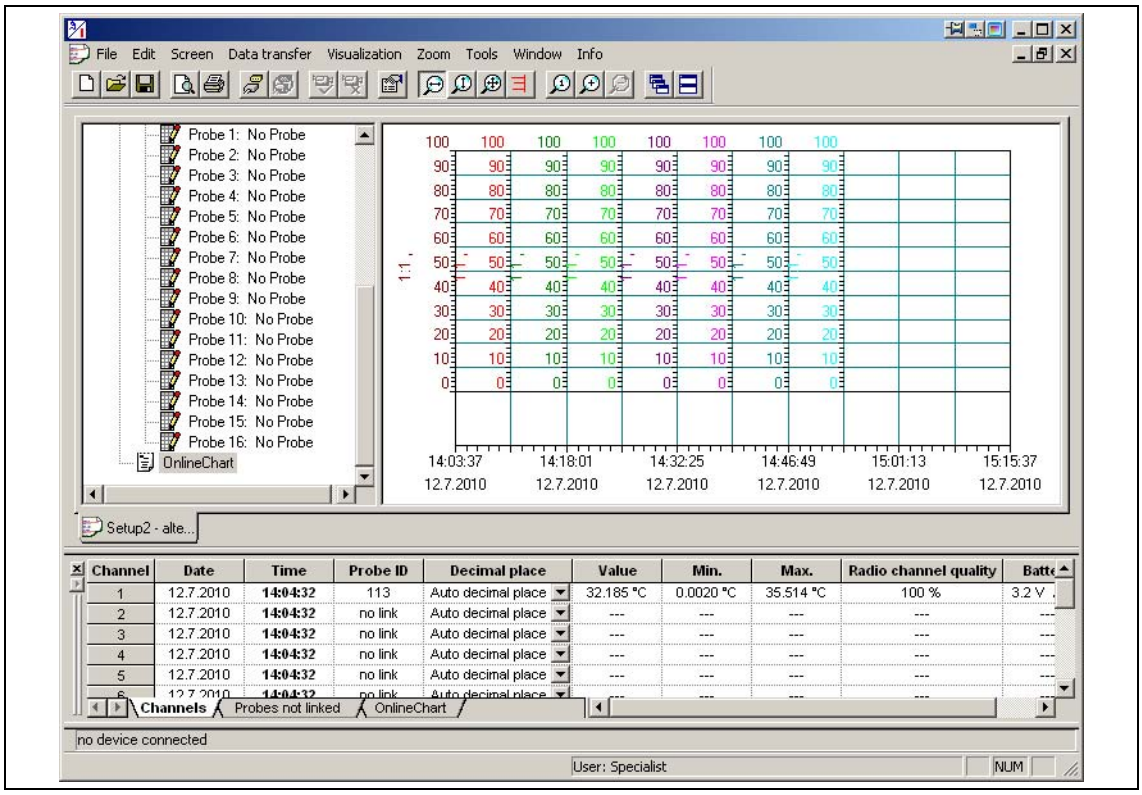


Figure 12: OnlineChart after the first start

Start OnlineChart

How to proceed:

Step	Activity
1	Establish connection to the receiver (e.g. via the menu **DATA TRANSFER > ESTABLISH CONNECTION**).
2	Start recording (e.g. via the menu **VISUALIZATION > START**).

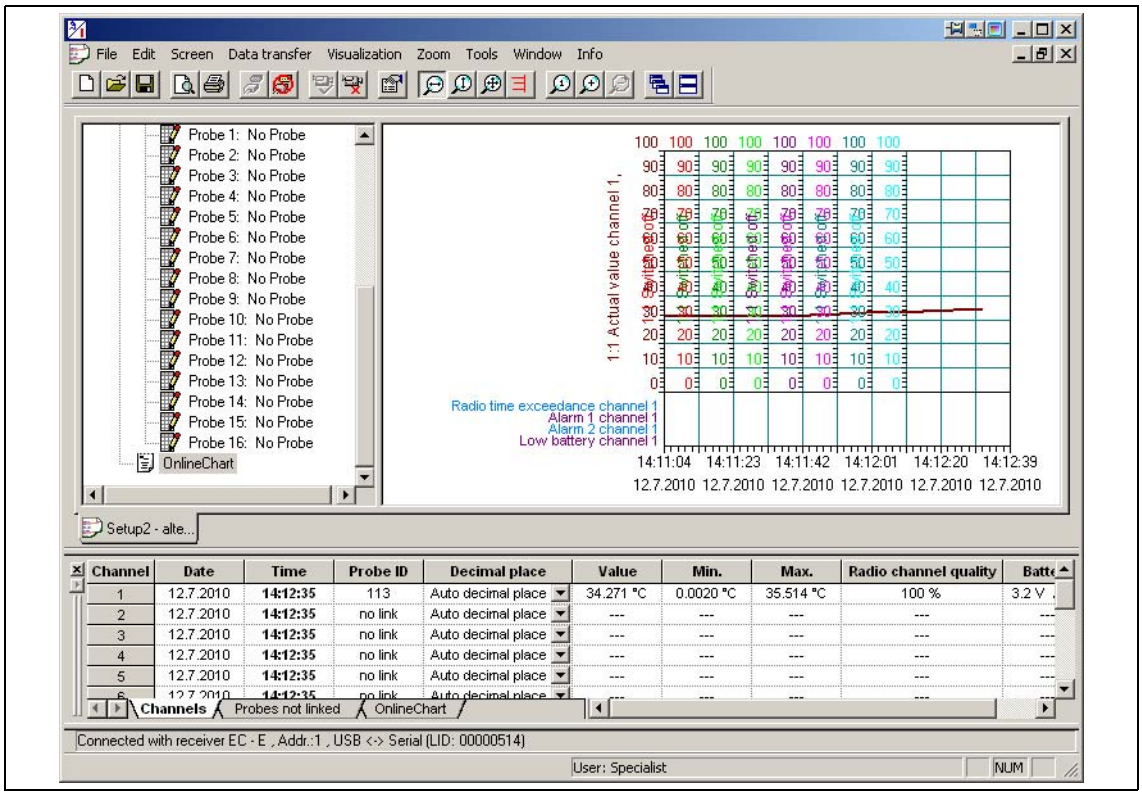


Figure 13: OnlineChart with active recording

Exit OnlineChart

How to proceed:

Step	Activity
1	Exit recording (e.g. via the menu **VISUALIZATION > EXIT**).
2	Disconnect the connection to the receiver (e.g. via the menu **DATA TRANSFER > DISCONNECT**).

OnlineChart evaluation

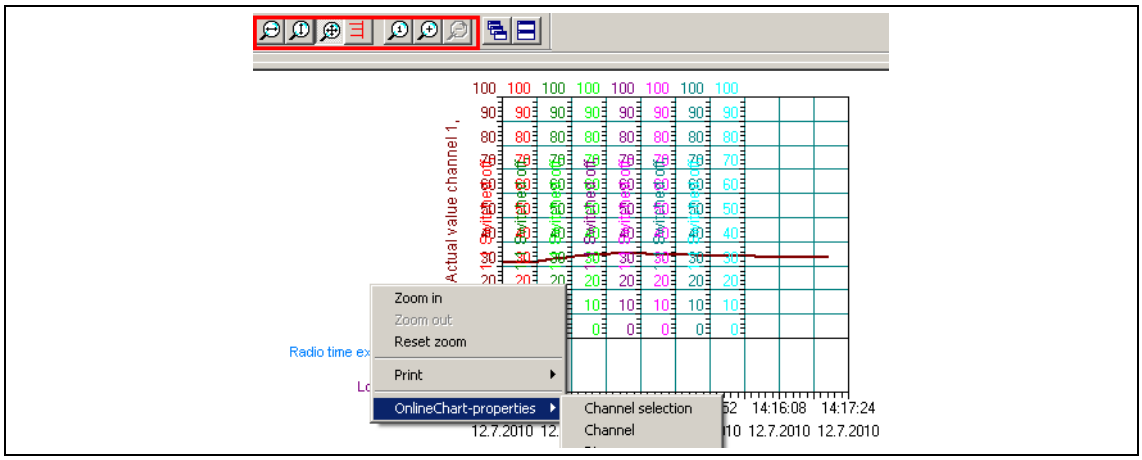


Figure 14: Evaluation functions

With the symbols displayed in the figure 14 the user can inspect the recorded measured values. The display features can be additionally influenced by clicking on the RH mouse key within the graphic.

Top line

Display	Error and remedy
oooo	(Overrange) Remedy: Check transmitter for probe break.
uuuu	(Underrange) Remedy: Check transmitter for short-circuit.
t.Err	Incorrect terminal temperature Remedy: Cool down the terminals of the thermocouple transmitter to the admissible temperature range.
----	Radio timeout of the channel. Remedy: Optimize transmission distance and, if necessary, increase radio timeout parameter, change transmitter battery.
- 0	During signal quality display of the current channel (key) no transmitter signal is present. Ⓟ Remedy: Optimize transmission distance and, if necessary, increase radio timeout parameter, change transmitter battery.
CodE	Code interrogation for changing to the commissioning/start-up or parameter level is active. Remedy: Enter the code. This function is not active when delivered. In the parameter level (PA), a code (minimum 1 digit, maximum 4 digits) can be assigned separately for each level (In and PA).

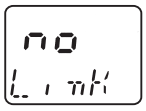
TIP!
If a code was entered in the parameter level, write it down and keep it safely for a later level access.
For this purpose, a field for an entry by the customer is provided in this manual.
If the code cannot be found, please contact the customer service department.

⇨ Chapter 7.4 "Changing to other Changing levels", page 44

Display	Error and remedy
Display dark	Device does not start. Remedy: Check voltage supply/cabling.
yellow LED does not light up	Device does not receive radio telegrams. Remedy: Check all transmitters installed for their battery status. Do the set radio frequencies of transmitters and receivers coincide? Is the antenna screw-fitted to the receiver or connected by cable? Are the locations of transmitter and receiver antenna suitable for radio transmission (not encapsulated in metal etc.)?
	Interface RS485 does not function or is faulty. Remedy: Check cabling including polarity, use a screened cable for longer connection/interference source distances. With RS485 question and answer are on the same line. Especially with several slaves, set the minimum response time for all stations sufficiently high, so that even the slowest station will not discard telegrams directed to it.

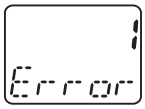
12 Detect and remedy faults/errors

Top line and bottom line

Display	Error and remedy
	No linked transmitter available. Remedy: Link active transmitter.

⇨ Chapter 8.1.1 "Selection of a transmitter ID from the link list and assignment to a channel", page 48

⇨ Chapter 8.1.2 "Manual assignment of a transmitter ID to a channel", page 50

Display	Error and remedy
	Error (system error bit) means: At bit 0 (0x01) the receiver has initialized the configuration to the factory setting. Please check and, if necessary, reconfigure the settings! At bit 1 (0x02) the receiver has initialized the calibration data to the factory setting. **The receiver needs to be recalibrated.**

Top bicolor LED

Display	Error and remedy
flashing red	Collective alarm The collective alarm accepts the following error types: OR linkage of all individual alarms Remedy: Check the following alarms: • Radio timeout channel 1 to 16 • Analog alarm 1, channel 1 to 16 • Analog alarm 2, channel 1 to 16 Radio timeout, channel 1 to 16 Remedy: Optimize transmit distance, increase radio timeout parameter, change transmitter battery. Analog alarms 1, channel 1 to 16 Remedy: Check measured value or entry of the channel sending the alarm. Analog alarms 2, channel 1 to 16 Remedy: Check measured value or entry of the channel sending the alarm. Low battery signal of transmitters 1 to 16. Remedy: Change battery. Save errors detected with power ON. Remedy: see „Error“ parameter above.

13.1 Technical data

Input

Number of probes	Max. 16 probes can be received per receiver.
Receiving frequency	868.4 MHz (Europe), 915 MHz (America, Australia, Canada and New Zealand); in the 915 MHz frequency band, ten frequencies can be set
Open air range	Max. 300 m when using the antenna wall holder and the 3meter long antenna cable. When installing the antenna directly onto the receiver, a reduced range of approx. 40 % must be taken into account.
Measuring range limits	depending on the sensor set
Configuration	using the keys at the device or the setup program
Unit	°C, °F, various units for potentiometer and voltage, can be set on the device or using the setup program

Analog outputs

Number	4 analog outputs for basic type 3828-000 2 analog outputs for basic type 3828-001
Output signal: - Current - Voltage	using the keys at the device or via the setup program load-independent direct current 0 to 20 mA or 4 to 20 mA Direct current 0 to 10 V
Transmission behavior	linear, freely scalable
Burden (at current output)	≤ 500 Ohm
Load (at voltage output)	≥ 10 kOhm
Setting time for temperature changes	The setting time depends on the transmission interval set in the probe.
Setting time after switching on or reset	≤ 5 s
Adjustment conditions	AC 230 V/22 °C (±3 K) or DC 24 V/22 °C (±3 K)
Accuracy	≤ ±0.1 %[1] (accuracy includes adjustment, linearization, burden influence, load influence and voltage supply influence)
Residual ripple	≤ ±0.2 %[1]
Electrical isolation	The analog outputs are electrically isolated from each other and the interfaces.
Isolation voltage	50 V

[1] All accuracy specifications in % from the measuring range end value of 20 mA or 10 V.

Measuring circuit monitoring of the analog outputs

Underrange: - Current output 4 to 20 mA - current output 0 to 20 mA - Voltage output 0 to 10 V	 dropping to 3.8 mA, then jump to the configured signals dropping to -0.1 mA, then jump to the configured signals dropping to -0.1 V, then jump to the configured signals
Overrange: - Current output 4 to 20 mA - current output 0 to 20 mA - Voltage output 0 to 10 V	 rising to 20.5 mA then jump to the configured signals rising to 20.5 mA then jump to the configured signals rising to 10.25 V then jump to the configured signals
Probe short circuit or probe and wire break and alarms: - Current output 4 to 20 mA - current output 0 to 20 mA - Voltage output 0 to 10 V	 positive signals: > 21 mA negative signals: < 3.6 mA positive signals: > 21 mA negative signals: < -0.1 mA positive signals: > 10.5 V negative signals: < -0.1 V
Output performance	The output performance (positive or negative signals) can be set.

Relay outputs

Number	2 relay outputs for basic type 902931/30
Relay	N/O contact configurable as N/C contact
Contact rating	max. 3 A at AC 230 V resistive load
Contact life	150 000 operations at 3 A / AC 230 V resistive load 350 000 operations at 1 A / AC 230 V resistive load 310 000 operations at 1 A / AC 230 V and cos phi > 0.7
Electrical isolation	Relay to analog outputs and interface; test voltage AC 3700 V (reinforced insulation) Relay to relay; test voltage AC 2300 V (basic insulation) **Mixed switching of mains voltage AC 230 V and SELV or PELV voltage is not permissible due to the basic insulation between the relays.**

Electrical data

Voltage supply	AC 110 to 240 V +10/-15 %, 48 to 63 Hz or AC/DC 20 to 30 V, 48 to 63 Hz
Power consumption	12 VA
Electrical connection	Screw terminals up to 2.5 mm^2
Electrical safety	as per DIN EN 61010, Part 1 Overvoltage category III, pollution degree 2, for installation into a switch cabinet as per DIN EN 50178
Electrical isolation	The voltage supply is electrically isolated from the analog outputs, the relays and the interfaces.
Test voltage	AC 3700 V

Environmental influences

Ambient temperature range	-20 to +50 °C without condensation (even with close mounting)
Storage temperature range	-30 to +70 °C
Temperature coefficient	≤ ±0.005 %[1]/K; per K deviation from the reference temperature 22 °C (±3 K)
Climatic conditions	rel. humidity ≤ 85 % without condensation as per DIN EN 60721-3-3 3K3
Vibration resistant	max. 1 g at 10 to 55 Hz as per DIN IEC 60068-2-6
EMC - emitted interference - interference resistance - radio frequency range	DIN EN 61326-1 Class A - For industrial applications only - Industrial requirements ETSI EN 300 220-1, V 1.3.1

[1] All accuracy specifications in % from the measuring range end value of 20 mA or 10 V.

Casing

Material	Polyamide
Flammability class	UL 94 V-2
Dimensions withantenna screw-connection (W x H x D)	22.5 mm x 115.0 mm x 117.8 mm
Installation	Top hat rail 35 mm x 7.5 mm as per EN 60715
Protection type	IP20 as per DIN EN 60529
Operating position	vertical ⊥
Weight	approx. 200 g

13 Supplement

Interfaces

Setup interface	
- Baud rate	9600
- PC interface	with TTL/RS232 or USB/TTL converter
RS485 interface	
- Protocol	Modbus
- Baud rate	9600, 19200, 38400
- Device address	1 to 254
- minimum response time	0 to 500 ms

LCD display

top line	4-digit, 7-segment display, 4.5 mm high
bottom line	5-digit, 16-segment display, 4.0 mm high

13.2 Table: Assignment of probes to the receiver channels

Possibility to enter in this table, which probe is assigned with with probe ID or probe color coding to which receiver channel.

⇨ Chapter 8.1.1 "Selection of a transmitter ID from the link list and assignment to a channel", page 48
⇨ Chapter 8.1.2 "Manual assignment of a transmitter ID to a channel", page 50
⇨ Chapter 8.1.5 "Configuration of customized transmitter ID's on the transmitter side", page 52

Receiver channel	Probe ID	Probe color coding
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		

Electronic pressure sensor with radio transmission

Receiver unit with analogue and digital interface, measuring range 0 to 16/ 0 to 250/ 0 to 600 bar

1 Declaration of conformity

CE

Manufacturer
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Responsible person for the documentation:
Dipl.-Ing. (FH) Jürgen Niesner, Tel.: +49(0)6405 89-0.

This declaration of conformity applies to the following products:

Products of data sheet F9750. The following types or part numbers are concerned:

- 3828-000;
- 3828-001

We herewith declare that the products described comply with the basic safety and health requirements of the aforementioned EU directives in their design and construction, as well as in the version marketed by us.

The following additional EU directives were applied:

- **2014/53/EU,** Radio Equipment Directive
- **2011/65/EU,** RoHS

The following harmonised standards have been applied:

DIN EN 300220-1; 2017-05, Short range devices (SRD) operating in the frequency range 25 MHz to 1000 MHz - Part 1

DIN EN 300220-2; 2018-09, Short range devices (SRD) operating in the frequency range 25 MHz to 1000 MHz - Part 2

DIN EN 61326-1; 2013-07, Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1

DIN EN 61010-1; Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1

The technical documents according to the specified guidelines were created for the products.
The manufacturer obligates to provide the special documentation of the products to national authorities on demand.

If the product is modified and not approved by us, this declaration will become invalid.

i.V. Ralph Ludwig

Ralph Ludwig
Head of Research and Development

Römheld GmbH
Friedrichshütte

Laubach, 27.08.2025

2 Declaration of conformity

CE

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Dipl.-Ing. (FH) Jürgen Niesner, Tel.: +49(0)6405 89-0.

This declaration of conformity applies to the following products:
Pressure switches of data sheet F9500.
The following types or part numbers are concerned:

- 3828002
- 3828003
- 3828010

We herewith declare that the products described comply with the basic safety and health requirements of the aforementioned EU directives in their design and construction, as well as in the version marketed by us.

The following additional EU directives were applied:

- **2014/53/EU,** Radio Equipment Directive
- **2011/65/EU,** RoHS

- **2014/68/EU,** Directive for pressure devices

The following harmonised standards have been applied:

DIN EN 300220-1; 2017-05, Short range devices (SRD) operating in the frequency range 25 MHz to 1000 MHz - Part 1

DIN EN 300220-2; 2018-09, Short range devices (SRD) operating in the frequency range 25 MHz to 1000 MHz - Part 2

DIN EN 61326-1; 2013-07, Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1

DIN EN 61326-2-3; 2013-07, Electrical equipment for measurement, control and laboratory use – EMC requirements - Part 2-3

EN 62479

DIN EN 61010-1; Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1

The technical documents according to the specified guidelines were created for the products.
The manufacturer obligates to provide the special documentation of the products to national authorities on demand.

If the product is modified and not approved by us, this declaration will become invalid.

i.V. Ralph Ludwig

Ralph Ludwig
Head of Research and Development

Römheld GmbH
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Laubach, 27.08.2025