

# Operating Instructions



## Digicomb for differential pressure P1900XXXXDXX

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## Brief description

The electronic differential pressure measuring instrument "DIGICOMB" is conceived for various measuring tasks in the test laboratory and is served for the measuring instrument monitoring.

A maximum of 2 sensors with standard signals can be connected to the digital display. The 5-digit display shows the measurements and/or the calculated value of the measurement. During programming, the display is used to indicate the set values and the user prompts. A maximum of 4 relays are available to monitor threshold values. Via the serial interface, data can be communicated from and to the device. This Digicomb is manufactured like your order. In the display shows the difference pressure between the two sensors.



The maximum static pressure may not be higher than the nominal pressure of the sensor.

## Safety instructions for the digital display

Please read the users guide before installation and keep it for future reference.

### 1.1. Proper use

The digital display is designed for the evaluation and display of transmitter signals (standard signals). With the setpoints, it is possible to perform simple control tasks.

**Danger!** Careless use or improper operation can result in personal injury and/or damage to the equipment.



### 1.2. Control of the device

The panel meters are checked before dispatch and sent out in perfect condition. Should there be any visible damage, we recommend close examination of the packaging. Please inform the supplier immediately of any damage.

### 1.3. Installation

The digital display must be installed by a suitably **qualified specialist** (e.g. with a qualification in industrial electronics).

### 1.4. Notes on installation

- There must be no magnetic or electric fields in the vicinity of the device, e.g. due to transformers, mobile phones or electrostatic discharge. <sup>1</sup>
- The **fuse rating** of the supply voltage should not exceed a value of **6A N.B. fuse**.
- Do not install **inductive consumers** (relays, solenoid valves etc.) near the device and **suppress** any interference with the aid of RC spark extinguishing combinations or free-wheeling diodes.
- Keep input, output and supply lines separate from one another and do not lay them parallel with each other. Position go and return lines next to one another. Where possible use twisted pair.
- Screen off and twist sensor lines. Do not lay current-carrying lines in the vicinity<sup>1</sup>. Connect the **screening on one side** on a suitable potential equaliser.
- The device is not suitable for installation in areas where there is a risk of explosion.

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<sup>1</sup> see technical data

- Any electrical connection deviating from the connection diagram can endanger human life and/or can destroy the equipment.
- Do not install several devices immediately above one another (ambient temperature)<sup>1</sup>

## Assembly

The digital display is intended for **installation** in a **control panel**. Before assembly, a cut-out must be made to accommodate the device. The sizes and tolerances are given in the technical data.

On **front** of the digital display are the **operating** and **display elements**.

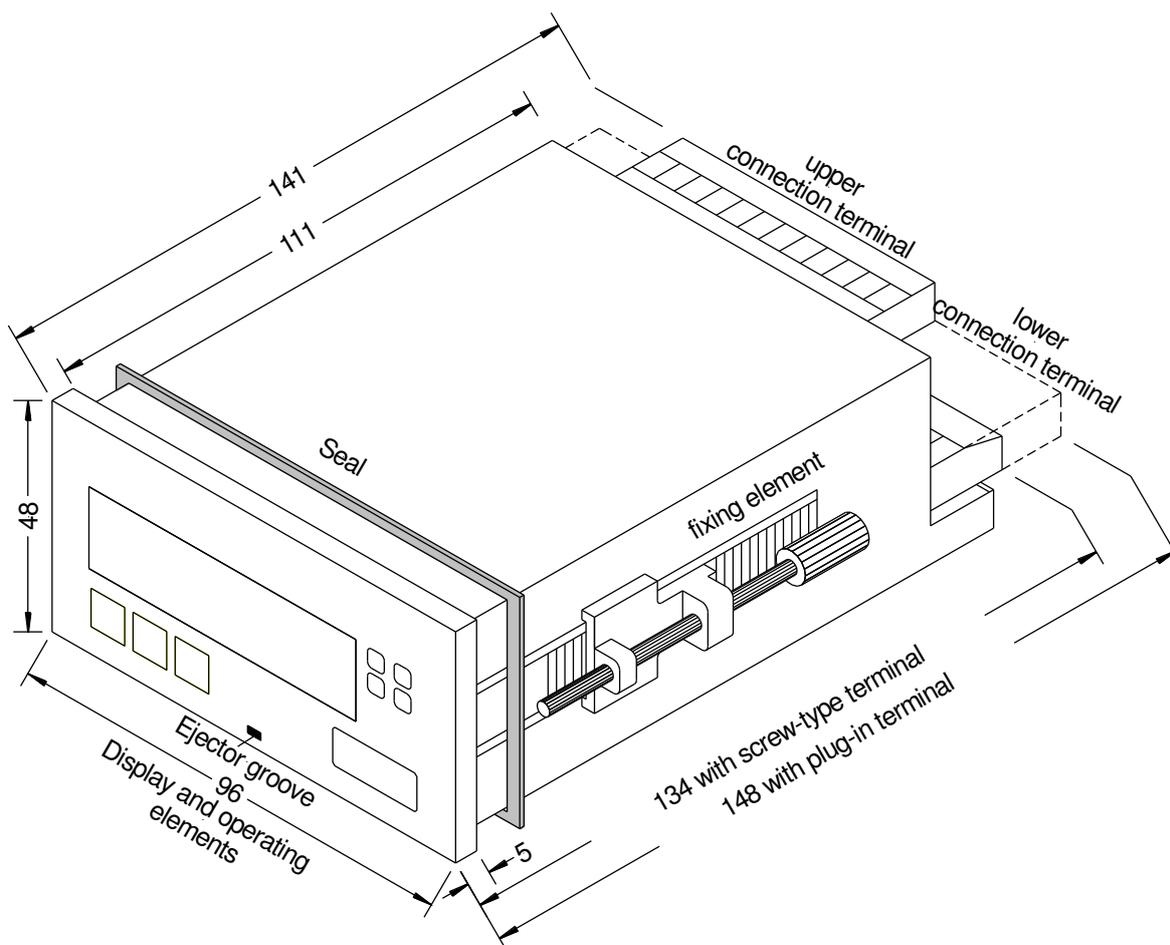
On the **sides** are the fixing elements to mount the device in the panel.

On the **back** are the terminals for all the **electrical connections**.

A sealing strip is inserted between the contact surface of the front collar and the control panel.

### 1.5. Insertion in the panel cut-out

- I. Before inserting the unit, the **side fixing elements** must be pulled from the rail. To do this, slightly raise the screw head of the fixing element and pull the fixing element backwards at the same time.
- II. Lay the sealing strip around the unit and push it up against the front collar. Then push the unit from the front **through the cut-out**.
- III. Then place the fixing elements into the guide rails from the rear. While doing this, hold the unit from the front secure in the cut-out. Then, using a slotted screw driver, push the fixing elements as far as possible towards the front panel from the rear. Check that the sealing strip is properly positioned between the front collar and the control panel and correct it if necessary.
- IV. Finally secure the device by tightening the screws on the fixing elements until they turn freely. The fixing elements have a slip coupling to prevent any overtightening of the thread; they hold the unit tight with the optimum amount of force.



View of the digital display

## 1.6. Dismantling

To remove the unit, follow the same steps as described for **Assembly** in reverse order.

For the version featuring the protective system IP65, a **new sealing** strip must be used **when** the unit is **replaced**.

## 1.7. Dimension strip

A strip with a physical unit can be inserted in the dimension window.

To do this, take the following steps:

- I. Insert a slotted screw driver (size 0 blade) in the ejection slot at the bottom of the front panel and lever out the front.
- II. On the back of the front panel, towards the outer edge is a slit in to accommodate the appropriate strip.
- III. Insert a suitable dimension strip.
- IV. Insert the front panel into the front collar of the unit and press slightly against the upper and lower edges so that it snaps back into the housing.
- V. Check that the plastic elements on the front have not bent the LEDs towards the back. This is the case if the digits are not sharp. If this does happen, remove the front panel again and replace it carefully.

## Electrical connection

All the necessary signals for operation are connected to the rear terminals.

### 1.7.1. Upper connecting terminals

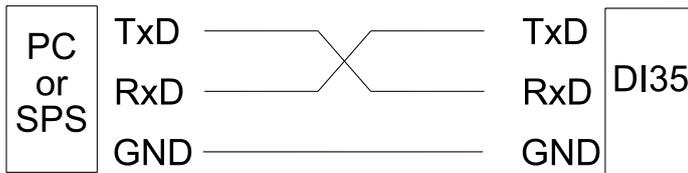
The setpoints are tapped on the 12-pole connector strip. Depending on the version, there are between zero and four changeover contacts (**N**ormally-**C**lose, **COM**mon, **N**ormally-**O**pen).

Relay 1			Relay 2			Relay 3			Relay 4		
21	22	23	24	25	26	27	28	29	30	31	32
NC	NO	COM	NC	NO	COM	NO	NC	COM	NO	NC	COM

Via the 3-pole connector strip, a serial interface is connected. If neither of the two options are implemented in the unit, the respective connecting terminals will be missing.

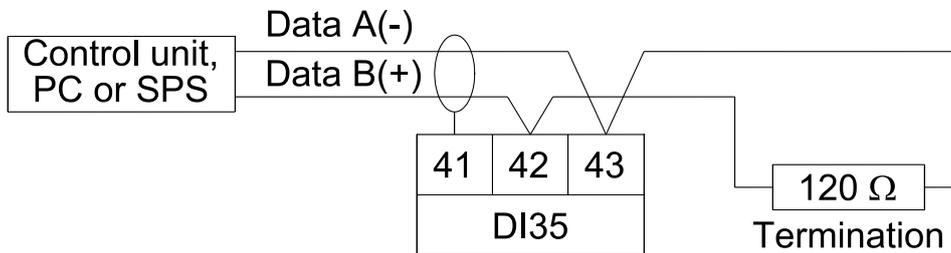
RS232			or			RS485		
41	42	43				41	42	43
GND (RS)	TxD	RxD				GND (RS)	Data B (+)	Data A (-)

The lines for the **RS232 interface** must be connected crosswise, so that TxD of the P1900XXXXdXX is connected to RxD of the other device and RxD of the P1900XXXXdXX to TxD of the other device.



Connection pattern PC or SPS ⇔ digital display

The **RS485 interface** is connected via a shielded data line with a twisted pair. At each end of the bus, a termination of the bus lines must be connected. This is necessary to guarantee reliable data transmission on the bus. For this, a resistance of 120 Ohm is inserted between the lines Data B (+) and Data A (-).



**Caution!** The potential reference can lead to a compensating current (interface ⇔ measuring input) with a non-galvanically insulated interface and can thus affect the measuring signals.

### 1.7.2. Lower connecting terminals

Input signal, analogue output, sensor supply and supply voltage are connected to the lower connecting terminal.

**Terminal 1**                      **Not Connected**



**Danger!** A potential should never, under any circumstances, be connected to **Terminal 1**. This can lead to personal injury and destroy the unit.

**Terminal 2–7**                      **Input signal**

The **two input signals** are connected to these terminals.

Terminals 4 and 7 lie on the same potential, but are, from a technical point of view, assigned to the individual channels and should be used accordingly.

1	2	3	4	5	6	7
NC	Input 1 [Volt]	Input 1 [mA]	GND (1)	Input 2 [Volt]	Input 2 [mA]	GND (2)

**Terminals 8–9**                      **Analogue output**

The signal for the analogue output is provided on these terminals. Depending on the capabilities of the unit, a current or voltage signal can be tapped.

8	9
Analogue output +	Analogue output –

**Terminals 10–11**                      **Sensor supply**

The sensor supply is provided on these connectors. The sensor supply is galvanically insulated from the measuring input. The voltage of the sensor supply varies according to the capabilities of the unit.

10	11
Sensor supply +	Sensor supply –

**Terminals 13–14**                      **Supply voltage**

The supply voltage for the unit is connected to these terminals. The supply voltage is galvanically insulated from the measuring input.

13	14	Supply voltage
L+	L–	24V DC voltage
L	N	115 or 230V AC, depending on version

**Terminal 12** Digital input

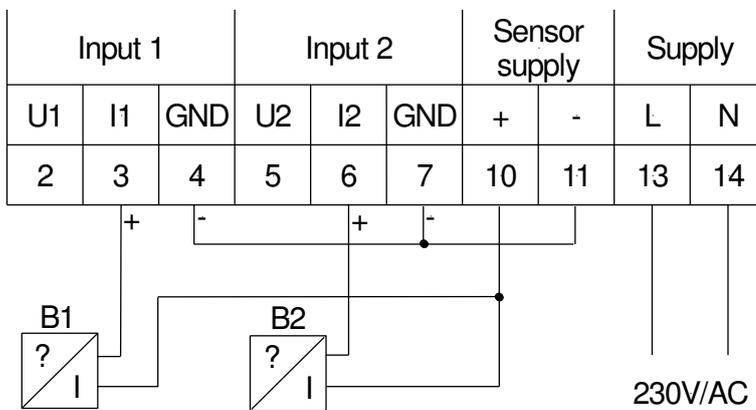
With the implemented option "Digital input", a potential-free contact can be connected to this terminal for controlling specific functions in the unit such as reset, taring, hold etc. For this function, it is necessary to also implement the same sensor supply as is used for supply and to which this connection electrically relates.

12
Digital input

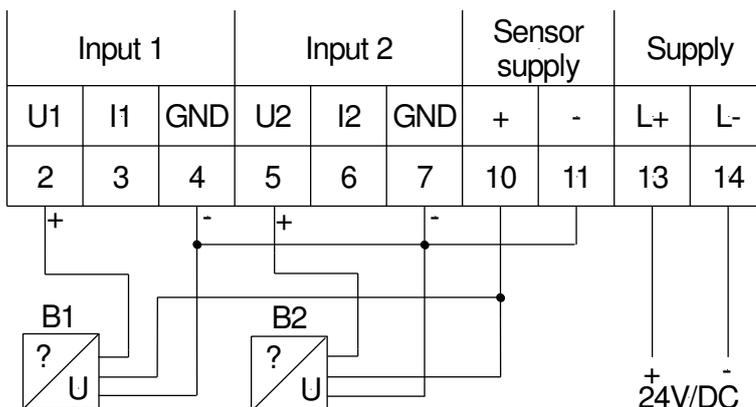
**1.8. Connecting examples**

This section gives a few examples of practical connections. Other connection options can be combined from the various examples.

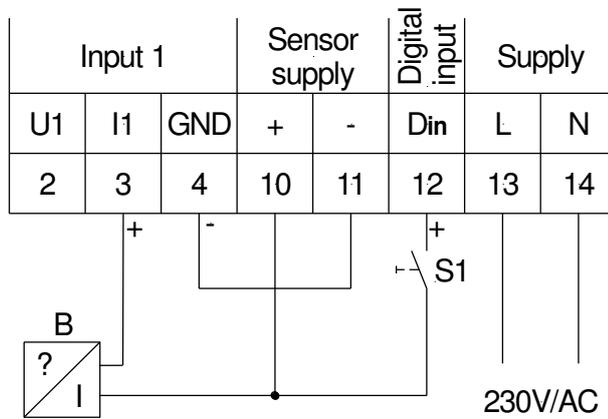
1. Measuring two current signals from 2-line transmitters using the sensor supply; supply voltage 230 V/AC



2. Measuring two voltage signals from 3-line transmitters using the sensor supply; supply voltage 24 V/DC



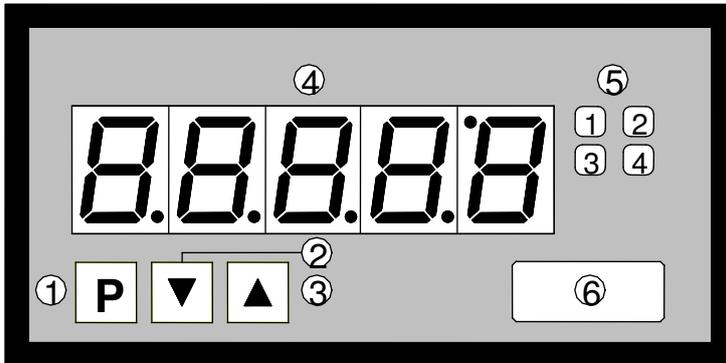
- Measuring a current signal from a 2-line transmitter using the sensor supply; connecting the digital input; supply voltage 230 V/AC



## Operation

The unit is operated via the [P], [UP] and [DOWN] keys.

### 1.9. Operating and display elements



- 1 Program key [P]
- 2 Minus key [DOWN]
- 3 Plus key [UP]
- 4 Seven-segment display
- 5 Setpoint display 1-4
- 6 Dimension window

#### 1.9.1. Keys

The P1900XXXXdXX has three keys with which you can parameterise and call up various functions during operation.

1	Program key [P]	With the program key, you can call up the programming mode or perform various functions in the programming mode.
2	Minus key [DOWN]	With the minus key, you can call up the MIN memory or alter parameters in the programming mode.
3	Plus key [UP]	With the plus key, you can call up the MAX memory or alter parameters in the programming mode.

#### 1.9.2. Displays

The P1900XXXXdXX has a **5-digit**, 7-segment display and four LEDs.

4	Seven-segment display	The seven-segment display displays measurements or, during programming, the program numbers or parameters.
5	Setpoint display	The setpoint display indicates the state of the relays. If a relay is switched, the LED lights up. If relays are not implemented, these displays can be used for the optical feedback of threshold values.

#### 1.9.3. Dimension window

6	Dimension window	The dimension window shows the factory-set <b>physical unit</b> for the measurement. The dimension can also be changed by the user as described in Chapter 1.7
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### 1.10. Switching on

Before switching on you have to check all the electrical connections to make sure they are correct. On completion of the installation, the device can be switched on by applying the supply voltage.

### 1.11. Starting sequence

During the switching-on process, a segment test is performed for approx. 1 s, whereby all LEDs on the front (including setpoint LEDs) are triggered. After this, the type of software is indicated for approx. 1 s and then, also for 1 s, the software version. After the starting procedure, the unit changes to operation/display mode.

### 1.12. MIN/MAX memory

The measured minimum and maximum values of the respective inputs (Channel 1, Channel 2 and arithmetic) are saved in a volatile memory in the unit and are lost when the unit is switched off.

You can call up the contents of the memory by pushing (less than 1 s) the [UP] or [DOWN] key. The relevant value is indicated for approx. 7 s. By briefly pressing the same key again, you will return immediately to the display mode.

When changing back to the display mode, the P1900XXXXdXX will first show the name of the next display value (Ch1, Ch2 or Ar); see 5.5. 'Display switchover between two input channels'.

[UP]       ⇒    Display of the MAX value  
[DOWN]   ⇒    Display of the MIN value

You can erase the value shown in the display by simultaneously operating the [UP] & [DOWN] keys. The erasure is acknowledged by horizontal bars.

### 1.13. Display switchover between two input channels

With the P1900XXXXdXX, you can **temporarily** switch the display between the various channels by means of the keyboard.

If you press the [UP] or [DOWN] key for longer than 1 s, the unit will switch over to the next display channel. You can run through the channels forwards with [UP] key or backwards with the [DOWN] key.

**Display:** Channel 1       **Ch1**  
          Channel 2       **Ch2**  
          Arithmetic      **Ar**  
          Channel 1       **Ch1**  
          etc.

#### **Example:**

Under program number (PN15≥3), the calculation (**Ar**) is parameterised as the permanent display. Let us assume you want to display the input value for Channel 1.

Press the [UP] key for at least one second. The P1900XXXXdXX acknowledges the change to Channel 1 by briefly displaying **Ch1**, after which you can let the key go. The display indicates the input value for Channel 1 for approx. 7 s. After this, the P1900XXXXdXX changes back to the parameterised display (arithmetic **Ar**). The renewed change in the display is also confirmed by the appearance of **Ar**. To change several steps in one direction, you must take your finger of the key between times.

### 1.14. Overflow/Underflow

An **overflow** of the display is indicated by horizontal bars at the top of the 7-segment display.

An **underflow** of the display is indicated by horizontal bars at the bottom of the 7-segment display.

### 1.14.1. Overflow / underflow of the arithmetic calculation

The channel calculation is a floating point operation with the decimal point parameterised as (PN18). Every overflow or underflow of a channel leads to a defined display in the calculation. This defined setting ensures that the corresponding setpoints go into a **defined state**.

Formula	Channel 1	Channel 2	Result
(Channel 1 + Channel 2) * Constant factor	Overflow	OK or Overflow	Overflow
(Channel 1 + Channel 2) * Constant factor	Underflow	OK or Underflow	Underflow
(Channel 1 + Channel 2) * Constant factor	OK or Overflow	Overflow	Overflow
(Channel 1 + Channel 2) * Constant factor	OK or Underflow	Underflow	Underflow
(Channel 1 + Channel 2) * Constant factor	Overflow	Underflow	Overflow
(Channel 1 – Channel 2) * Constant factor	Overflow	OK or Underflow	Overflow
(Channel 1 – Channel 2) * Constant factor	Underflow	OK or Overflow	Underflow
(Channel 1 – Channel 2) * Constant factor	OK or Overflow	Underflow	Overflow
(Channel 1 – Channel 2) * Constant factor	OK or Underflow	Overflow	Underflow
(Channel 1 – Channel 2) * Constant factor	Under-/Overflow	Under-/Overflow	Overflow
(Channel 1 * Channel 2) * Constant factor	Overflow	OK or Overflow	Overflow
(Channel 1 * Channel 2) * Constant factor	Underflow	OK or Underflow	Underflow
(Channel 1 * Channel 2) * Constant factor	OK or Overflow	Overflow	Overflow
(Channel 1 * Channel 2) * Constant factor	OK or Underflow	Underflow	Underflow
(Channel 1 * Channel 2) * Constant factor	Overflow	Underflow	Overflow
(Channel 1 / Channel 2) * Constant factor	Overflow	any	Overflow
(Channel 1 / Channel 2) * Constant factor	Underflow	any	Underflow
(Channel 1 / Channel 2) * Constant factor	OK	Overflow	Underflow
(Channel 1 / Channel 2) * Constant factor	OK	Underflow	Underflow
(Channel 1 * 100 / Channel 2)	Overflow	any	Overflow
(Channel 1 * 100 / Channel 2)	Underflow	any	Underflow
(Channel 1 * 100 / Channel 2)	OK	Overflow	Underflow
(Channel 1 * 100 / Channel 2)	OK	Underflow	Underflow

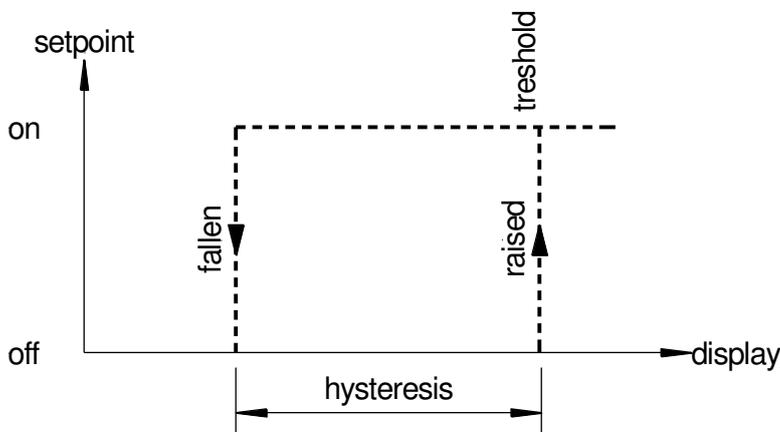
### 1.15. Relay

With the aid of the LEDs next to the 7-segment display, you can view the switching state of the relays. An active relay is indicated by the relevant LED lighting up.

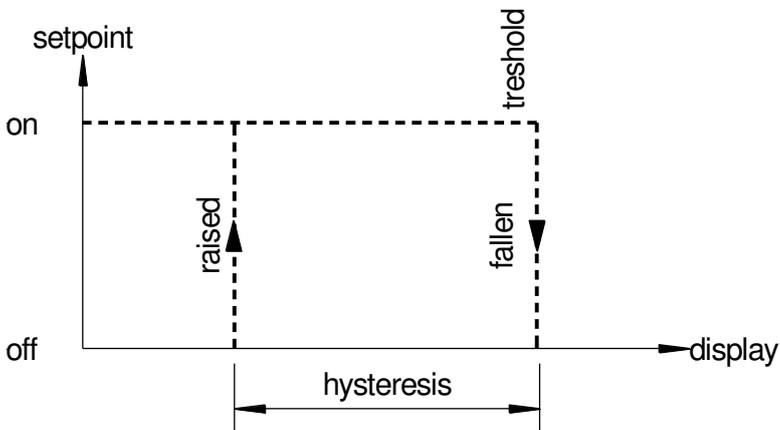
The relays have the following properties with regard to their switching characteristics:

<b>Setpoint x</b>	Deactivated, activated
<b>Threshold</b>	Threshold value for switchover
<b>Hysteresis</b>	Width of the window between the switch thresholds
<b>Operating principle</b>	active above SP value / active below SP value
<b>Switch-on delay</b>	Time between reaching the threshold and the resultant switching on of the relay
<b>Switch-off delay</b>	Time between reaching the threshold and the resultant switching off of the relay

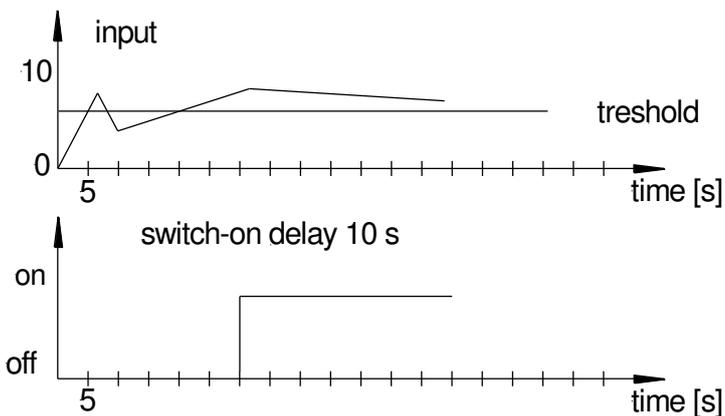
**active above SP value**  
The setpoint is off below the threshold and on reaching the threshold.



**active below SP value**  
The setpoint is on below the threshold and switched off on reaching the threshold.



**Switch-on delay**  
The relay is on 10 s after reaching the threshold; briefly exceeding the threshold does not lead to the relay being switched on. The switch-off delay functions in a similar manner, in other words it keeps the setpoint switched on until the parameterised time has elapsed.



### 1.15.1. Optical response, flashing display

The switching on of one or more setpoints can also be set to trigger a flashing of the display to enhance the optical response.

#### Example:

Let us assume the threshold for flashing of the display is set at setpoint 2.

If setpoint 1 is exceeded and setpoint 2 is not, the setpoint **LED 1** lights up permanently.

If setpoint 2 exceeds the threshold, the 7-segment display will start to flash, setpoint 1 will light up permanently and setpoint LED 2 will flash.

The flashing enhances the optical response and the operator sees immediately that an important threshold has been exceeded with this unit.

### 1.16. Analogue output

The **analogue output** is used to rescale the determined values. It is possible to place the reference on one of the two input channels or on the arithmetic value. The analogue output is parameterised via the two program numbers PN20 (full scale) and PN21 (offset). With the offset value, the value is set at which the analogue output indicates the minimum value, and the full scale value the value at which the output indicates its maximum value. The reference of the analogue output is set with program number PN22.

It is possible in this way to rescale the input signal of a measuring transducer or to change it to a different standard signal.

### 1.17. Digital input

The digital input can be used to trigger certain specific functions in the unit, but will not be dealt with in more detail here.

## Interface

The P1900XXXXdXX can be optionally programmed or configured via an interface. The units do not have any standard interface.

Pressing the ENTER or <CR> key is always denoted by ↵.

### 1.18. Operating modes PN34

The interface can be operated in various modes that can be parameterised via the PN34.

#### PN34=0

**Standard mode** in which the unit only replies if called on to do so. This mode is used only for configurations.

#### PN34=1

**Transmission mode** in which the measurements are transmitted via the serial interface cyclically with the set measuring time.

The transmission mode is interrupted on receipt of “ > ↵ “ and the unit changes to standard mode. To change back to transmission mode, the display must be restarted, either by entering the command **S** ↵ or by switching the device off and on.

With the transmission mode, the display value is transmitted via the interface in ASCII format. Minus signs and decimal points are also transmitted so that the output can be displayed directly on a terminal or processed by a SPS. Zeros at the front are suppressed during transmission. With an over or underflow, the display transmits horizontal bars (hyphens) " - - - - - ↵ ".

**Examples** ↵ " ; "-9.99 ↵ " ; "999.99 ↵ " ; "-123.4" ; " - - - - - ↵ "

With the aid of this simple protocol structure, the display data can be transferred very easily to a PC etc. and further processed there. In the simplest case, a terminal program from the operating system is sufficient to store the received data in a file.

### 1.19. RS232 / RS485

For configuration, a terminal program or special configuration tool (e.g. “PM-Tool”) can be used. The communication is a straight point-to-point connection. The baud rate is set to 9600 baud, with 8 data bits, without parity and one stopbit.

Configuration is performed by transmitting **ASCII symbols**.

The structure of a command: *Program number / Command / Value/ ↵*

<i>Program number</i>	see program number table
<i>Command</i>	= describe a parameter with a decimal value <b>B</b> describe a parameter with a binary value
<i>Value</i>	A value from the range of values given in the program number table
↵	ENTER or <CR>, conclusion of any command

Below, for example, the value for program number 61 is parameterised with a value of 5,000.

"61=5000.↵"

All values are written directly into the **EEPROM** of the unit and are valid after changing into operating mode. In contrast, the communication parameters of the interface only become effective after restarting the display.

To simplify the input, there is no need for "." (dots) and "," (commas).

In the basic setting, a message is not acknowledged, which enables the parallel programming of several displays. To check the overall configuration, a checksum can be called up on the LED display.

Successful programming is indicated by a "PROG" in the LED display.

The content of a program number (PN61) is called up by sending the program number to the unit.

"61↵"            reply: e.g. "5000↵"

The unit sends the corresponding value (5000) in ASCII.

The binary value of a program number (PN2) is requested, with a "B" added as a result of sending the program number.

"2B↵"            reply: e.g. "1B13987234↵"

The unit sends the binary value of the A/D-converter in ASCII.

The allocation of a simple parameter is carried out via the program number and the parameter.

"0=1↵"

Channel 1 is parameterised to an input signal of 0...10 V.

A calibration point always consists of a pair of values, the display value and the binary value, which are described in the following two steps.

The assignment of a display value to a calibration point (PN1) is carried out by inserting a "=" between the program number and the display value.

"1=12000↵"

When an appropriate input signal is received, the display shows 12,000.

The assignment of a binary value to a calibration point (PN1) is carried out by inserting a "B" between the program number and the binary value.

"1B13987234↵"

In the case of a matching binary value from the A/D converter, the display works with the display value parameterised under PN1.

Any entry that cannot be interpreted is acknowledged with an "Err" in the display.

In the normal condition, the display does not send an acknowledgement back. Only when the value is called up or the acknowledgement mode is activated by the ">" command does the display send a response from then on. This mode is exited after restarting the unit or 15 s after receiving the last command.

If a non-existent program number or an unknown command is sent, the display will acknowledge this with a "?" via the interface.

### 1.19.1. Serial special commands

In addition to the program number control, special commands are also possible. In the following table, the ↵ has been dispensed with at the end of the command.

Command	Acknowledgement	Function
S		Restart the display
Q		Change display mode
A	Display value	Call up display value via the interface
B	Binary value	Call up binary value by the interface
U		Load default configuration
P		Call up test total
>	>	Activate interface acknowledgement

### 1.19.2. Treatment of calibration points

Before parameterising the calibration points, the desired measuring input must be selected under PN0/5. With measuring inputs in which a factory calibration exists (PN0/5 = 1, 2, 3), the desired display value for the full scale (PN1) and offset (PN2) must be preset.

With all other variations (PN0/5 = 0), the binary value of the measuring input must also be fixed which can be called up via the command "B ↵" with the sensor signal connected. This is also necessary when parameterising the calibration points (PN101...130 and PN141...170), because the factory calibration cannot be used for this.

A calibration can be carried out in accordance with one of the following methods:

#### I. Sensor calibration

Calibration with sensor (PN0/5 = 0 or PN101...130 or PN141...170)

The desired sensor signal must be connected to the measuring input and the channel to be calibrated must be activated under PN15. For the calibration, the binary value must be called up from the unit via the command "B↵". On doing this, the present binary value of the A/D converter will be returned as the response.

"B↵" Response: e.g. "8388608↵"

This value is then saved with the command

"2B8388608↵"

After this, the display value for the measuring value must be entered. Entering the decimal point is dispensed with and only the desired number of places is entered. The decimal point is preset via PN3. If, for example, 10.0 is to be indicated on the display for the scaled offset, then "2=100↵" and then "3=1↵" must be transmitted to the display.

#### II. Factory calibration

Calibration without sensor (PN0/5 = 1, 2, 3)

When calibrating without a sensor, only the scaled display value must be preset for PN1 and PN2. If, for example, PN0 = 3 (4...20 mA measuring input) then only the scaled display value for the measurement 20 mA needs to be preset for PN2 and the scaled measurement for the measurement 4mA for PN2. Should the display value for 4 mA correspond to "0.00" and for 20 mA to "150.00", then the commands "1=15000↵", "2=0↵" and "3=2↵" must be transmitted one after the other. The binary values preset for PN1 and PN2 are irrelevant for this.

#### III. Adjusting the measuring input (PN0/5 = 0)

Should measuring errors occur because of the age of the sensor or for other reasons; this can be balanced out by simple adjustment of the binary calibration

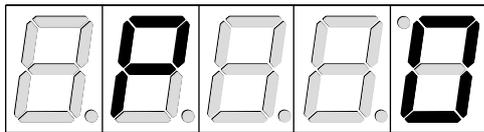
points. To do this, it is merely necessary to call up the binary measurement via the command "B ↵" with the sensor signal connected, and to transfer it to the respective offset (e.g.: "2B8799010↵") or full scale (e.g. "1B15678342").

**IV. Copying the configuration to another P1900XXXXdXX**

An existing calibration can only be transferred from one unit to another with the aid of PC software (e.g. PM Tool). The PC software must be able to call up the factory calibration of the source and the target units. A more detailed description has been dispensed with here.

**Programming**

In the display, the program numbers (PN) are shown, right-justified, as a three-digit number with a P in front of them.



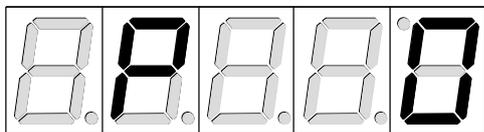
Display of e.g. program number 0

**1.20. Programming procedure**

The entire programming of the P1900XXXXdXX is done by the steps described below.

**Change to programming mode**

Pushing the [P] key changes to programming mode. The unit goes to the lowest available program number. If the programming lock is activated, the key must be pushed for at least 1 s.

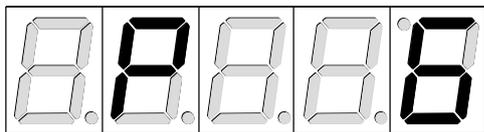


**Example:**

Change to programming mode by pushing key [P]. The first released program number (PN) appears, in this case PN0.

**Change to other program numbers**

To change between individual program numbers, hold the [P] key down and push the [UP] key for changing to a higher program number or the [DOWN] key for changing to a lower number. By keeping the keys pushed, e.g. [P] & [UP], the display will begin, after approx. 1 s, to automatically run through the program numbers.

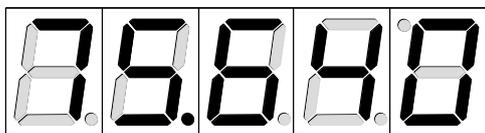


**Example:**

Keep key [P] pushed and push the [UP] key several times until PN6 appears in the display. Under this parameter the full scale of the input 2 can be changed.

Change to the parameter

Once the program number appears in the display, you can push the **[DOWN]** or **[UP]** key to get to the parameters set for this program number. The currently stored parameters are displayed.

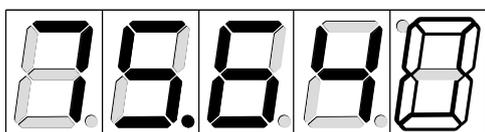


**Example:**

By pushing the **[DOWN]** or **[UP]** key, the currently stored value for PN6 appears in the display. In this case, it is 75,640.

**Changing a parameter**

After changing to the parameter, the last digit of the respective parameter flashes on the display. The value can be changed with the **[UP]** or **[DOWN]** key. To move to the next digit, the **[P]** key must be briefly pushed. Once the highest digit has been set and confirmed with **[P]**, the lowest digit will begin to flash again.



**Example:**

The 0 is flashing. This is the last digit and asks if you want to change it. Let us assume the figure is to be changed from 75,640 to 75,000.

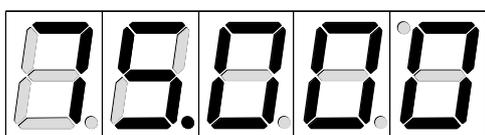
Briefly push the **[P]** key to move to the next digit. The 4 begins to flash. Change the figure by

pushing **[UP]** or **[DOWN]** to change the digit from 4 to 0. Briefly push the **[P]** key to move on to the next digit. The 6 begins to flash. Change the digit by pushing **[UP]** or **[DOWN]** to move the 6 to a 0. Briefly push the **[P]** key to move to the next digit. The 5 and 7 do not need to be changed.

**Saving parameters**

**All parameters** must be acknowledged by the user by pushing the **[P]** key for one second. The changed parameters are then taken over as the current operating parameters and saved in the EEPROM.

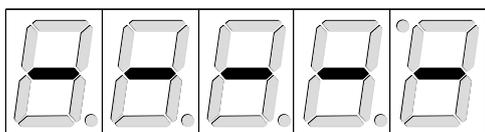
This is confirmed by horizontal bars lighting up in the display.



**Example:**

Save the parameters by pushing **[P]** for 1 s.

**All the newly entered data are confirmed** by the unit. If no confirmation is received, the relevant parameters have not been saved.



**Example:**

You receive confirmation from the unit that the changes have been saved through the appearance of horizontal bars in the middle segments.

### **1.20.1. Changing from programming to operating mode**

If no key is pushed in the programming mode for about 7 sec, the unit will return automatically to operating mode.

### 1.20.2. Security setting, user level PN50 to 52

With the parameters in the **security settings**, access to the program numbers is **regulated** through the setting of various **user levels**. The user levels divide the access into various levels. The user is **only** given **access to the settings authorised by the system operator**, such as the setting of thresholds. The lower the figure for the user level given under PN 52, the lower the level of security of the unit parameters against user intervention.

User level ( PN 52 = )		0	1	2	3	4	5	6	7	8
Access to:	PN									
Display brightness	19	X	X	X	X	X	X	X	X	X
Programming lock	50	X	X	X	X	X	X	X	X	X
Serial number	200	X	X	X	X	X	X	X	X	X
Setpoint parameters	59...95	X	X	X	X	X	X	X		
Interface parameters (option)	34	X	X	X	X	X				
Analogue output parameters (option)	20...22	X	X	X	X	X				
Measuring input parameters	0...18	X	X	X						
Linearisation parameters for measuring	100...170	X	X	X						
Authorisation codes / User level	51, 52	X								

User levels 1, 3, 5 and 7 are reserved user levels for which the authorization is in each case the same as the next lower level.

The parameterised user level PN52 is active as long as the authorisation code PN51 and programming lock PN50 are different. On delivery both parameters are set to 0000, so that the programming lock is deactivated.

When changing to programming mode, the unit always jumps to the first free program number. If the user level is parameterised as PN52 = 3, then access to the program numbers of the setpoints is, for example, released but it is not possible at this user level to change the measuring input (PN0).

In order to have access to all program numbers at a later stage (equivalent to user level 0), the four-digit code saved under PN51 must be entered again to release PN50 and then be acknowledged by activating key [P] for approx. 1 s. After this, access to all program numbers is released.

**Caution!** If the authorisation code becomes lost, the unit can be set to the default value 0000 at the manufacturer's without any data loss.

### 1.20.3. Input channels and offset

The P1900XXXXdXX has **two input channels** to which standard signals (optionally 0 ... 10 V, 0 ... 20 mA or 4 ... 20 mA) can be connected. As input signals, **different signals** can be received, in other words Channel 1, for example, can be used for voltage and Channel 2 for current. For every channel, any desired **offset** can be set.

The **offset shift** can be adjusted **for every channel with PN 4 and 9**. This makes it possible to balance out any deviations from the basic accuracy or sensor drifts.

### 1.20.4. Two-channel measurement with calculation

The measurement is performed in an alternating process by switching between the two input channels during the set measuring time. The time for the relevant individual measurement is highly dependent on the parameterised measuring time.

After this, the two measured values are set off against each other according to the function selected in PN15, and the result is shown in the display. The arithmetic functions of the unit

are based on floating point arithmetic, and integrate the parameterised decimal points in the calculation.

### 1.20.5. Single-channel measurement

A **single-channel measurement** is performed when one of the measuring channels is selected as the display value via **PN15**. In this case only the selected channel is measured and displayed, which means that the measuring time (PN14) can be set at a lower value (100 ms). Should 200 ms have been set from carrying out a two-channel measurement, this value will not be changed.

If the P1900XXXXdXX is parameterised to a single-channel measurement, no access is possible to the program numbers of the activated channel.

The channel on which no measurement is carried out and the arithmetic result receives the measuring/display value "0" (zero). As a result, setpoints or the analogue output that are parameterised to these channels are shifted to a defined state.

### 1.21. Arithmetic functions

With the P1900XXXXdXX, the measured values can be set off against each other by various mathematical functions.

In the given examples, the values of the channels and the constant are fixed as follows:

Channel 1 = 100.0  
Channel 2 = 40.00  
Constant = 20  
Display = xxxx,x

#### **Addition** (Channel 1 + Channel 2) \* Constant

With this function, the two scale signals are added and subsequently multiplied by a constant.

Example:  $(100.0 + 40.00) * 20 = 2800.0$

This function can be used to display inflow/outflow volumes, weighing technology etc.

#### **Subtraction** (Channel 1 – Channel 2) \* Constant

With this function, Channel 2 is subtracted from Channel 1 and then multiplied by a constant.

Example:  $(100.0 – 40.00) * 20 = 800.0$

This function can be used to display differences etc.

#### **Multiplication** (Channel 1 \* Channel 2) \* Constant

With this function, the two scaled signals are multiplied with each other and then multiplied by a constant.

Example:  $(100.0 * 40.00) * 20 = 80000.0$

This function can be used to display power, energy etc.

#### **Ratio** (Channel 1 / Channel 2) \* Constant

With this function, the ratio is formed between the scaled signals of Channel 1 and Channel 2 and then multiplied by a constant.

Example:  $(100.0 / 40.00) * 20 = 50.0$

This function can be used to display mixing ratios etc.

**Percent** (Channel1 \* 100 / Channel 2)

With this function, the scaled signal from Channel 1 is multiplied by 100 and then divided by the scaled signal from Channel 2.

Example:  $(100.0 * 100) / 40.00 = 250.0$

This function can be used to display a percentage ratio.

## 1.22. Calibration modes

The P1900XXXXdXX is equipped with inputs for a standard signal, allowing various applications with regard to adapting to the measuring task. For this purpose, a suitable calibration mode must be selected with which the input is configured in accordance with the measuring signal. For this purpose, the unit offers two possibilities: **Factory calibration** and **sensor calibration**.

### 1.22.1. Factory calibration

All the units are calibrated in the factory, whereby offset and full scale were saved for the various measuring ranges.

For these parameters, new scaled display values can be allocated which are used for scaling the measurement on the display. For the offset, an input signal of 0 is assumed and for full scale, the specific full scale of the parameterised measuring range.

For parameterising, **no sensor signal** has to be applied because stored values are used. Because of the differing input signals, the corresponding input configuration must be parameterised via PN 0/5.

For a sensor signal with 4...20 mA on channel 1, e.g. PN0 = 3 has to be parameterised.

### 1.22.2. Sensor calibration

With **sensor calibration** (PN0/5 = 0), the unit can be calibrated directly **via the sensor signal or via a calibrator**. For this purpose, the **measuring signal must be connected** to the inputs of the unit. The respective display value must then be programmed under program numbers PN1 & PN6 (full scale) and under PN2 & PN7 (offset).

Through this process with two calibration points, the unit is matched up with the measuring section.

A linearisation can be activated for more far-reaching adjustments to the characteristic curve of the sensor.

### 1.22.3. Linearisation

With the linearisation, the PU5 offers the possibility for **linearising non-linear** sensors for displaying the measurements and for their further processing (analogue output).

**In addition** to the 2-point calibration, a maximum of **30 calibration** points can be programmed.

**Example:**

To program e.g. 5 additional calibration points, 5 must be entered under PN 100. Subsequently, for each of the calibration points, the voltage/current must be applied to the unit and the respective display value programmed under the following program numbers PN101 – PN105.

The sensor signal must be consistently parameterised. A gap of at least +1 digit to the previous display value must be adhered to, otherwise the input will be refused and no confirmation of the saving will be given – see Saving parameters.

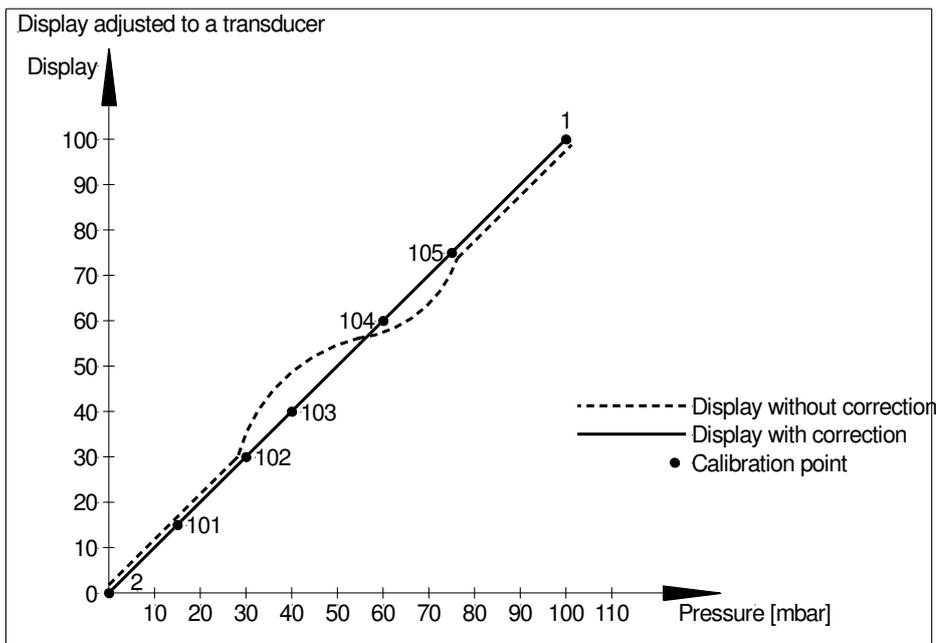
Linearisation of a pressure transducer for 0...100 mbar with an output of 0...20 mA.

The display value before correction can be either calculated from the known characteristic line of the transducer or is determined empirically.

The non-linear range between 0...75 mbar. For calibration point 101, this means:

A pressure of 15 mbar, the transducer delivers 3.3 mbar instead of the ideal value of 3.0 mbar. Since 20 mA in the display corresponds to 100.0 mbar, 3.3 mA in the display corresponds to 16.5 mA before the correction.

Calibration point (PN)	Pressure [mbar]	Output Transducer [mA]	Display before correction (IN)	Desired display (OUT)
2	0	0,5	2,5	0,0
101	15	3,3	16,5	15,0
102	30	6,2	31,0	30,0
103	40	9,2	46,0	40,0
104	60	11,4	57,0	60,0
105	75	14,7	73,5	75,0
1	100	20,0	100,0	100,0



## Program table

The program table lists all the program numbers (PN) with their function, range of values, default values and user level.

PN	Function	Range of values	Default	User level
<b>Channel 1</b>				
0	Measuring input	0 = sensor calibration 1 = 0...10 V 2 = 0...20 mA 3 = 4...20 mA	0	2
1	Full scale	-9999...99999	10000	2
2	Offset	-9999...99999	0	2
3	Decimal point	00000...0,0000	none	2
4	Offset shift	-9999...99999	0	2
<b>Channel 2</b>				
5	Measuring input	0 = sensor calibration 1 = 0...10 V 2 = 0...20 mA 3 = 4...20 mA	0	2
6	Full scale	-9999...99999	10000	2
7	Offset	-9999...99999	0	2
8	Decimal point	00000...0,0000	none	2
9	Offset shift	-9999...99999	0	2
<b>General settings</b>				
13	Display time	0,1 ... 10,0	1,0	2
14	Measuring time	0,20...10,00 s (two ch.) 0,10...10,00 s (one ch.)	0,20	2
15	Arithmetic function 1 Channel 1 no calculation 2 Channel 2 no calculation 3 (Channel 1 + Channel 2) * constant <b>addition</b> 4 (Channel 1 – Channel 2) * constant <b>subtraction</b> 5 (Channel 1 * Channel 2) * constant <b>multiplication</b> 6 (Channel 1 / Channel 2) * constant <b>ratio</b> 7 (Channel 1 * 100 / Channel 2) <b>percent</b>	1...7	3	2
16	Constant	-9999...99999	1	2
17	Decimal point for constant	0...4	0	2
18	Decimal point for calculation	00000...0,0000	0	2
19	Display brightness	0...9 (0=bright / 9=dark)	3	8
<b>Analogue output</b>				
20	Full scale	-9999...99999	10000	4
21	Offset	-9999...99999	0	4

PN	Function	Range of values	Default	User level
22	Reference for analogue output	0 = none 1 = ch 1 2 = ch 2 3 = arithmetic function	3	4
<b>Interface</b>				
34	Interface behaviour	0 = standard operation 1 = transmission operation	0	4
<b>Security settings</b>				
50	Programming lock	0000...9999	0000	8
51	Authorisation code	0000...9999	0000	8
52	User level	0...8	0	0
<b>Flashing of the LED display</b>				
59	Display flashing (approx. 0.5s ) no flashing Flashing at setpoint 1 Flashing at setpoint 2 Flashing at setpoint 3 Flashing at setpoint 4 Flashing at setpoint 1 and 2 Flashing at setpoint 3 and 4 Flashing at setpoint 1, 2, 3 and 4	0 = no flashing 1 = flashes with 1 <sup>st</sup> 2 = flashes with 2 <sup>nd</sup> 3 = flashes with 3 <sup>rd</sup> 4 = flashes with 4 <sup>th</sup> 5 = flashes with 1 <sup>st</sup> and 2 <sup>nd</sup> 6 = flashes with 3 <sup>rd</sup> and 4 <sup>th</sup> 7 = flashes with 1 <sup>st</sup> , 2 <sup>nd</sup> , 3 <sup>rd</sup> and 4 <sup>th</sup>	0	6
<b>Setpoint 1</b>				
60	Reference for Setpoint 1	0 = deactivated 1 = ch1 2 = ch2 3 = arithmetic function	1	6
61	Threshold	-9999...99999	1000	6
62	Hysteresis	1...99999	1	6
63	Active above / below SP value	0 = active below SP 1 = active above SP	1	6
64	Switch delay	0.0...10.0 sec.	0.0	6
65	Delay type	0 = none 1 = switch-on delay 2 = switch-off delay 3 = switch-on/off delay	1	6
<b>Setpoint 2</b>				
70	Reference for Setpoint 1	0 = deactivated 1 = ch1 2 = ch2 3 = arithmetic function	1	6
71	Threshold	-9999...99999	1000	6
72	Hysteresis	1...99999	1	6
73	Active above / below SP value	0 = active below SP 1 = active above SP	1	6
74	Switch delay	0.0...10.0 sec.	0.0	6

PN	Function	Range of values	Default	User level
75	Delay type	0 = none 1 = switch-on delay 2 = switch-off delay 3 = switch-on/off delay	1	6
<b>Setpoint 3</b>				
80	Reference for Setpoint 3	0 = deactivated 1 = ch1 2 = ch2 3 = arithmetic function	1	6
81	Threshold	-9999...99999	1000	6
82	Hysteresis	1...99999	1	6
83	Active above / below SP value	0 = active below SP 1 = active above SP	1	6
84	Switch delay	0.0...10.0 sec.	0.0	6
85	Delay type	0 = none 1 = switch-on delay 2 = switch-off delay 3 = switch-on/off delay	1	6
<b>Setpoint 4</b>				
90	Reference for Setpoint 4	0 = deactivated 1 = ch1 2 = ch2 3 = arithmetic function	1	6
91	Threshold	-9999...99999	1000	6
92	Hysteresis	1...99999	1	6
93	Active above / below SP value	0 = active below SP 1 = active above SP	1	6
94	Switch delay	0.0...10.0 sec.	0.0	6
95	Delay type	0 = none 1 = switch-on delay 2 = switch-off delay 3 = switch-on/off delay	1	6
<b>Linearisation channel 1</b>				
100	Number of additional calibration points	0...30	0	2
101	Calibration points 1...30	-9999...99999		2
...				
130				
<b>Linearisation channel 2</b>				
140	Number of additional calibration points	0...30	0	2
141	Calibration points 1...30	-9999...99999		2
...				
170				
<b>Information</b>				
200	Serial number	0...99999	0	8

## Technical data of the digital display

### Housing

Dimensions	96 x 48 x 134 mm (BxHxD) including screw terminal 96 x 48 x 148 mm (BxHxD) including plug-in terminal
Assembly cut-out	92,0 <sup>+0,8</sup> x 45,0 <sup>+0,6</sup> mm
Wall thickness	0...50 mm
Fixing	snap-in screw element
Material	PC/ABS-blend, black, UL94V-0
Protective system	Standard IP54 (front), IP00 (back)
Weight	approx. 450 g
Connection	Screw/plug-in terminal; line cross section up to 2.5 mm <sup>2</sup>
Mounting grid	horizontal 120 mm / vertical 96 mm (recommended)

### Display

Digit height	14 mm
Segment colour	red
Display range	-9999...99999
Setpoints	one LED per setpoint
Overflow	horizontal bars at top
Underflow	horizontal bars at the bottom
Display time	0,2...10 s

### Input

Measuring range	0...10 V and 0/4...20 mA
Input resistance	0...10 V $R_i = \sim 150 \text{ k}\Omega$ 0/4...20 mA $R_i = \sim 50 \Omega$
Measuring error at measuring time = 1 s	0,02% of Range $\pm 1$ Digit $T_U = 20...40^\circ\text{C}$
Temperature drift at $T_U < 20^\circ\text{C}$ or $> 40^\circ\text{C}$	all measuring inputs 50 ppm/K
Measuring time	single channel    0,1...10,00 s two channel        0,2...10,00 s
Measuring principle	Sigma/Delta
Resolution	24 bit

### Output

Relay	Switchover contact 230V/AC 5A or 30V/DC 2A ( $\cos \varphi = 1$ ) Separation as per DIN EN 50178 Characteristic data as per DIN EN 60255
Analogue output (galv. insulated)	0...10 V (12-bit) load $\geq 1 \text{ k}\Omega$ 0...20 mA (12-bit) load $\leq 500 \Omega$ 4...20 mA (12-bit) load $\leq 500 \Omega$
Error	0.1 % in the range $T_U = 20...40^\circ\text{C}$ , beyond 50 ppm/K
Internal resistance	100 $\Omega$
Sensor supply (galv. insulated)	24V/DC 50 mA

### **Interface**

Protocol	Manufacturer-specific ASCII
RS232 (optional galv. separated)	9600 Baud, no parity, 8 databits, 1 stopbit
Lead length	max. 3 m
RS485 (optional galv. separated)	9600 Baud, no parity, 8 databits, 1 stopbit
Lead length	max. 1000 m

### **Power supply**

Supply voltage (galv. insulated)	230 V/AC / 50/60 Hz / $\pm 10$ % 115 V/AC / 50/60 Hz / $\pm 10$ % 24 V/DC / $\pm 10$ %
Power consumption	max. 8 VA

### **Memory**

Data life	Parameter memory EEPROM >100 years
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### **Ambient conditions**

Working temperature	0...60 °C
Storage temperature	-20...80 °C
Climatic resistance	rel. humidity $\leq 75$ % on year average without dew

### **EMV**

<b>CE</b>	DIN 61326 Conformity to 89/336/EEC
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### **Safety standard**

	DIN 61010
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## Error elimination

The following list gives the recommended procedure for dealing with faults and locating their possible cause.

### 1.23. Questions and answers

- I. The unit permanently indicates overflow. „-----“
  - One of the inputs has a very high measurement, check the measuring circuit.
  - The arithmetic calculation yields an overflow, see 1.14.1.
- II. The unit permanently shows underflow. „-----“
  - One of the inputs has a very low measurement, check the measuring circuit.
  - The arithmetic calculation yields an underflow, see 1.14.1.
- III. The word " HELP " lights up in the 7-segment display.
  - The unit has found an error in the configuration memory. Perform a reset on the default values and reconfigure the unit according to your application, see 1.24.
- IV. The display values change by very large amounts.
  - When dividing, the value of the divisor is very small, check the measuring circuit.
- V. "Err1" lights up in the 7-segment display.
  - This error can only be eliminated by the manufacturer.

### 1.24. Reset to default values

To return the unit to a defined basic state, a reset can be carried out to the default values.

The following procedure should be used:

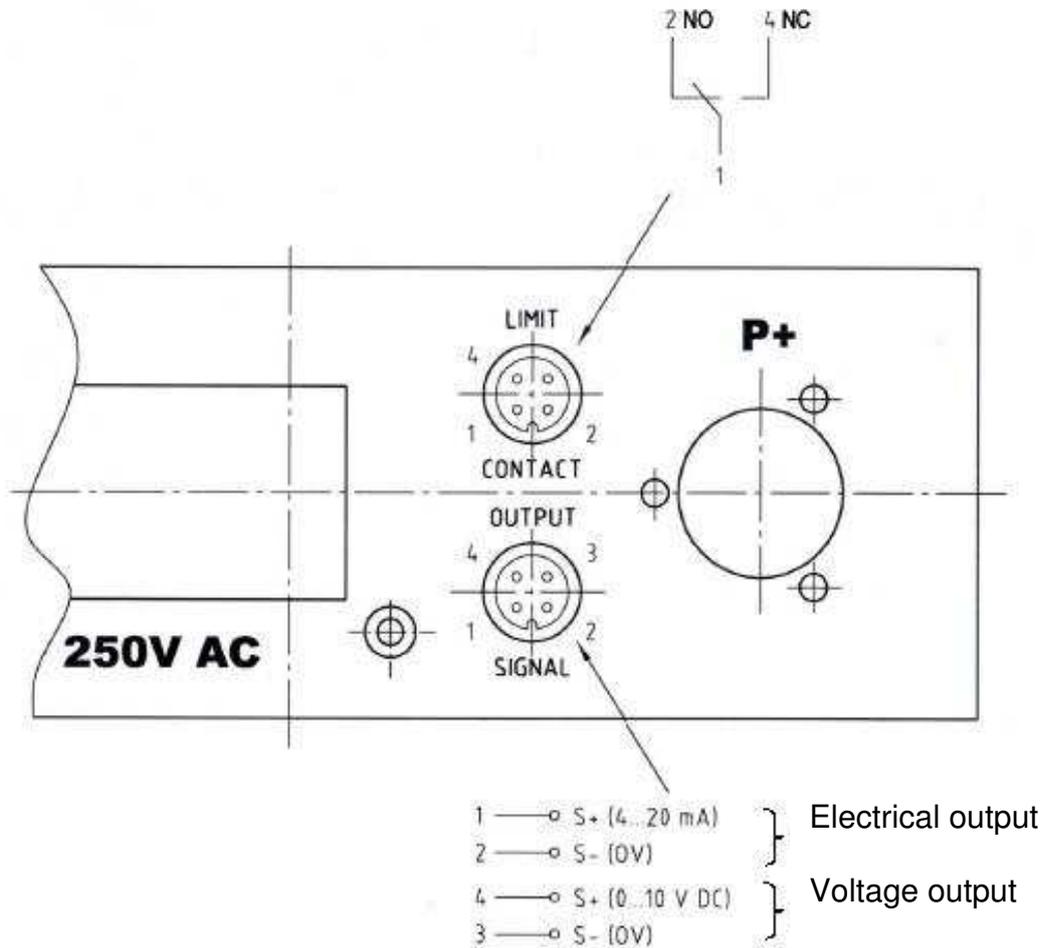
- ✓ Switch off the power supply.
- ✓ Press button [P]
- ✓ Switch on the power supply and press [P] for further approx. 2 s.

With **reset**, the **default values** of the program table **are loaded** and used for subsequent operation. This puts the unit back to the state in which it was supplied.

**Caution!** This is only possible when the programming lock PN 50 allows access to all PNs or "HELP" is shown in the display.

**Caution!** All application-related data are lost.

## Connection diagram



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