Operating Instructions

GOSSEN Müller & Weigert

# DINALOG A 96 x 24

## A1410 Light-Strip Indicator

3-349-120-02
3/5.01 - 11.02

## Contents

Page

Contents Page



## Notes and Warnings

This device has been shipped from the factory in flawless technical safety condition. In order to maintain this condition and to assure hazard-free operation, all notes and warnings which appear in the operating instructions must be observed by the user.

If, due to damage, it may be assumed that hazard-free operation of the device is no longer possible, it must be removed from service. This applies in any event if the device demonstrates visible damage.

Before placing the device into service, it must be assured that the measuring instrument has been configured correctly for the desired application (correct supply voltage, inputs and outputs). Specifications and any included options appear on the device's serial plate. Voltage conducting parts may be exposed if covers are opened, or if components are removed from the device.

Balancing, maintenance and repair of live, open devices may only be carried out by suitably trained personnel, who are aware of the dangers involved.

## 1 Applications

The programmable light-strip indicator is a precision panel meter with adjustable display range. The display range can be adapted for the 4 ... 20 mA and 0 ... 20 mA measuring ranges after installation without the use of a calibrator. The measuring instrument is thus suitable for applications which require frequent on-site display range adjustments.

The instrument can be optionally equipped with 2 limit values. Limit value violations are indicated optically with LEDs located within the scale. A relay is assigned to each limit value as well.

The measurement input is of modular design. Depending upon the measuring module which has been installed at the factory, the instrument can be used for the following measuring tasks.

Models without limit values:

- Direct current from ± 200 µA to ± 200 mA
- 0 ... 20 mA or 4 ... 20 mA direct current
- 4 ... 20 mA direct current with 24 V / 20 mA auxiliary power supply for 2-wire measuring transducer
- Direct voltage from ± 2 V to ± 300 V
- 0 ... 60 mV ... 300 mV, 0 ... 2 V ... 300 V direct voltage
- 0 ... 2 mA ... 200 mA alternating current
- 0 ... 2 mA ... 200 mA RMS alternating current
- 0 ... 1 A or 0 ... 5 A alternating current
- 0 ... 1 A or 0 ... 5 A RMS alternating current
- 0 ... 0.2 V ... 300 V, 0 ... 200 V, 0 ... 700 V alternating voltage
- 0 ... 0.2 V .... 300 V, 0 ... 200 V, 0 ... 700 V RMS alternating voltage
- Temperature with Pt 100: –200 ... 800 °C, –99.9 ... 99.9 °C, –328 ... 999 °F
- Resistance ranging from 0 ... 200 Ω, 0 ... 2 kΩ, 0 ... 20 kΩ
- Temperature with thermocouple
  Types J and K: –200 ... 999 °C, –328 ... 999 °F
  Types R and S: 0 ... 999 °C, 0 ... 999 °F

Models with limit values:

- Direct current from ± 200 µA to ± 200 mA
- 0 ... 20 mA or 4 ... 20 mA direct current
- Direct voltage from ± 2 V to ± 300 V
- 0 ... 2 V ... 300 V direct voltage

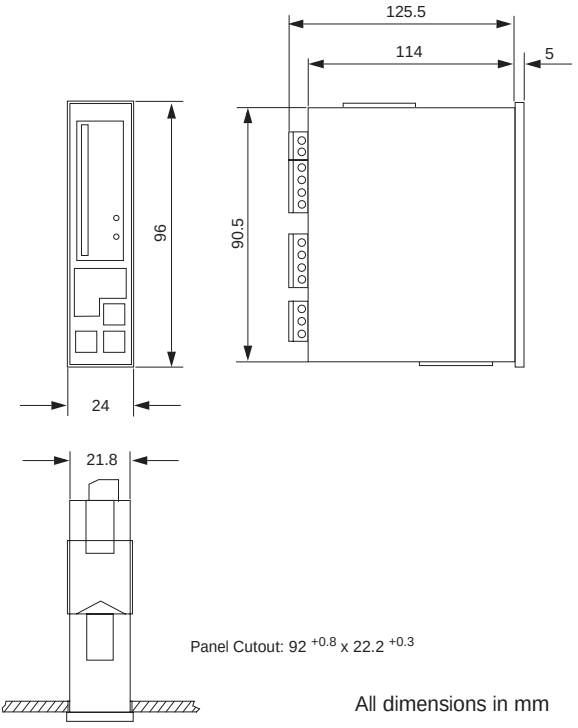
## 2 Installation

Insert the measuring instrument into the control panel cutout from the front without the mounting tabs. Then insert the mounting tabs from the rear into the slots at the device side panels and tighten them against the control panel.

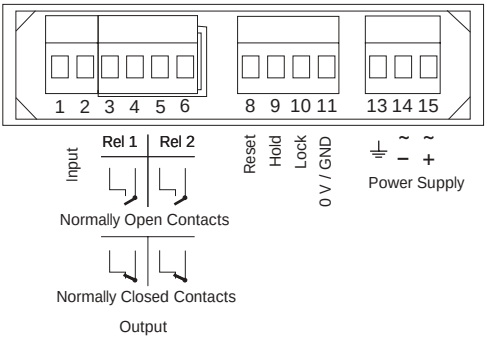
**Attention!**

**If several devices are installed at maximum component density it must be assured that the maximum allowable operating temperature of 50 °C is not exceeded despite self-heating.**

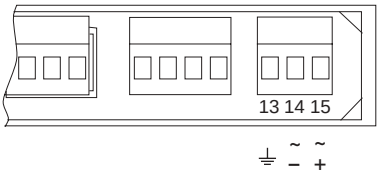
### 2.1 Dimensional Drawing



## 3 Terminal Assignments



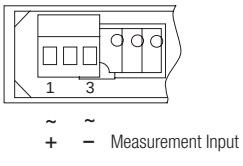

## 3.1 Power Supply

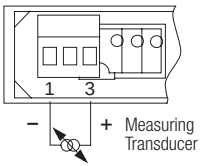
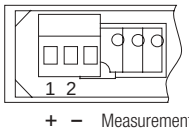
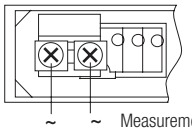
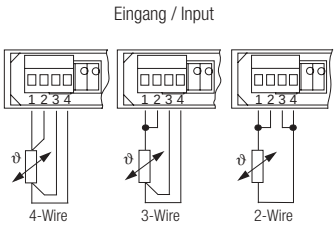
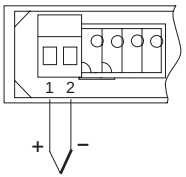


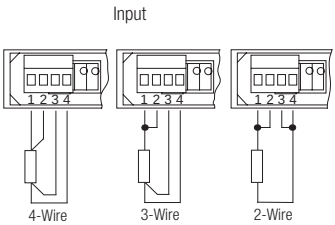
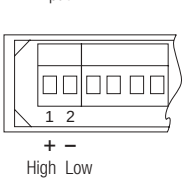

See specifications on the serial plate
regarding power supply and connected load.

## 3.2 Measurement Input

(depending upon device model and utilized measuring module)

| Device Model | Range | Terminal Assignments |
|---|---|---|
| DC | V, mV, mA, µA |  |
| AC | V, mV, mA | |
| AC, true RMS | V, mV, mA | |

| Device Model | Range | Terminal Assignments |
|---|---|---|
| DC with auxiliary power supply for 2-wire measuring transducer | mA |  |
| Alternative setup for direct read-in of current values | mA |  |
| AC | A |  |
| AC, true RMS | A | |
| Temperature measurement with PT100 | all |  |
| Temperature measurement with thermocouple | all |  |

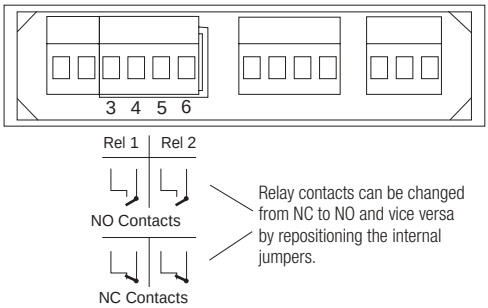
| Device Model | Range | Terminal Assignments |
|---|---|---|
| Resistance measurement | all |  |
| With limit values (for DC measuring ranges only) | V, mA |  |

## 3.3 Output

(depending upon device type and relay type)

| Device Type | Relay Type | Relay Terminal Assignments | |
|---|---|---|---|
| Single display | – | – | |
| Contacting instrument (MECO) | see serial plate | Relay 1 | Terminals 3 and 4 = NO for 1st limit value |
| | | Relay 2 | Terminals 5 and 6 = NO for 2nd limit value |

If the contacting instrument is equipped with two limit values, two relays with one normally open (normally closed) contact each are included. Each relay is assigned to one limit value. All relay contacts are electrically isolated from one another.

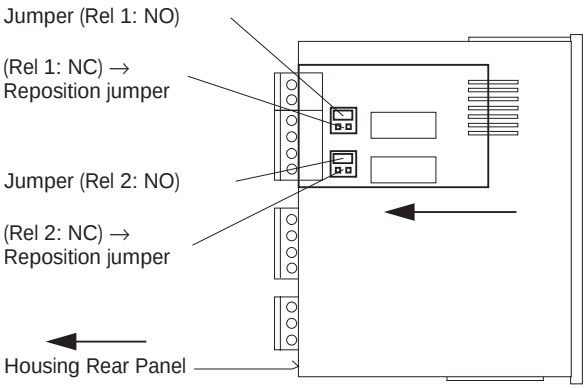



**Changing Relay Contacts from NO to NC (switching mode):**

Relays for devices with limit values are set at the factory for normally open operation. The relays can be changed from normally open to normally closed operation with the above mentioned jumpers.
The snap-in tabs at the housing rear panel must first be carefully released by lifting the housing shell, after which the housing rear panel can be removed along with the complete PCB. The jumpers at the limit value module must then be configured as shown below.

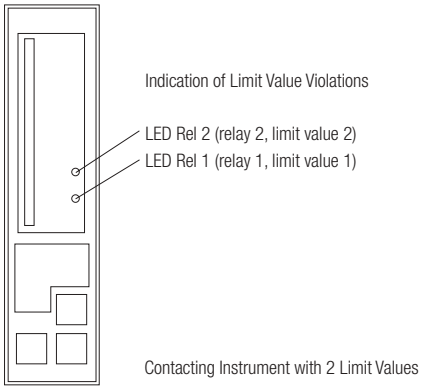
## Attention!

**This work may only be performed by trained personnel who are aware for the dangers involved.**
**Electrostatically sensitive devices are included in these instruments. The usual protective measures must be observed in order to prevent electrostatic charging of such components.**
**The guarantee is rendered null and void if the instrument is destroyed due to incorrectly implemented changes.**

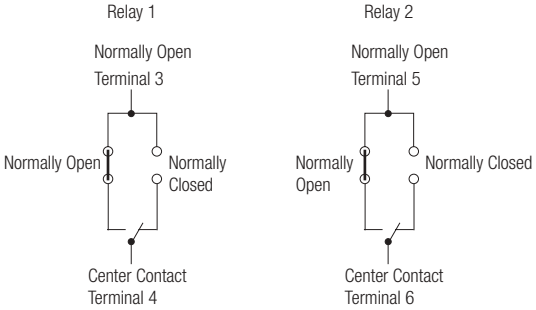



### Indication of Limit Value Violations

Two LEDs are included at the scale for the indication of limit value violations for devices with two limit values. The switching status of relay 1 is indicated at LED Rel 1, and the switching status of relay 2 is indicated at LED Rel 2.



## Switching Mode and Switching Status of Relays and Indicator LEDs



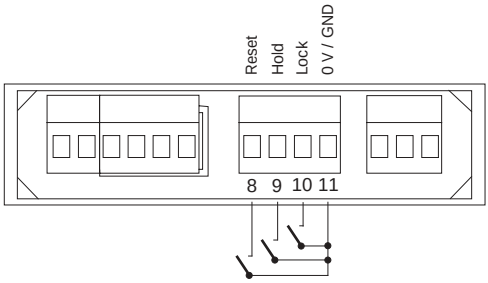

| Working Current Model (nOP) | | | | |
|---|---|---|---|---|
| Limit Value Switching Point | Measured Value (MV) > < Limit Value (LV) | NO Contact (factory setting) Terminals 3, 4 or 5, 6 | NC Contact (jumper repositioned) Terminals 3, 4 or 5, 6 | LED indication depending upon selected limit value |
| Lo1 ... 2 | MV > LV | open | closed | not illuminated |
| | MV < LV | closed | open | illuminated |
| Hi1 ... 2 | MV > LV | closed | open | illuminated |
| | MV < LV | open | closed | not illuminated |

| Closed-Circuit Current Model (nCL) | | | | |
|---|---|---|---|---|
| Limit Value Switching Point | Measured Value (MV) > < Limit Value (LV) | NO Contact (factory setting) Terminals 3, 4 or 5, 6 | NC Contact (jumper repositioned) Terminals 3, 4 or 5, 6 | LED indication depending upon selected limit value |
| Lo1 ... 2 | MV > LV | closed | open | not illuminated |
| | MV < LV | open | closed | illuminated |
| Hi1 ... 2 | MV > LV | open | closed | illuminated |
| | MV < LV | closed | open | not illuminated |

## 3.4 External Control Inputs

### Attention!

**Terminals 8, 9, 10 and 11 are electrically connected to the measurement input. Insulation at external switching elements must be grounded appropriately for prevailing measurement input potential.**




**Reset**

The entire display can be cleared by establishing a connection between terminals 8 and 11.

**Attention:**

This connection causes resetting of the microprocessor.
A segment test is performed for approximately 3 seconds after this connection has been interrupted. The device then resumes normal operation. Previous programming remains intact.

**Freezing the Display Value (hold function)**

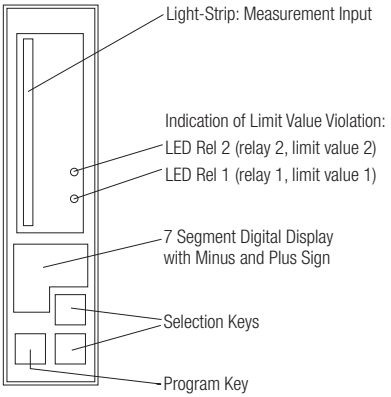
The currently displayed value can be frozen during normal operation by establishing a connection between terminals 9 and 11. This does not influence the measuring cycle.

**Disable Programming (lock function)**

Configured parameters can be protected against change by establishing a connection between terminals 10 and 11.

See chapter 7.1, page 24, for exceptions regarding limit value configuration.

# 4 Operation




## 4.1 Single Display (one measurement input)

The ⇓, P and ⇑ keys have no function in the operating mode. They are only used for programming.

## 4.2 Single Contacting Instrument (MECO), with One Measurement Input and Limit Values

After pressing the ⇑ key, limit value 1 appears at the display (as **Lo1** or **Hi1** depending upon how the switching function has been programmed). The device is returned to the normal operating mode by pressing the P key.
The same applies to the ⇓ key for limit value 2.

Landscape format devices display the current measurement value at the light-strip.

## 4.3 Display Test

If the ⇑, P and ⇓ keys are simultaneously pressed and held for approximately 1 second, the display is switched to the test mode. Alternately, Pro or the operating software revision level appears at the 7 segment display.

The display test is started by pressing the P key. The odd numbered segments (1, 3 ... 35) at the light-strips and the horizontal segments

at the 7 segment display are activated and light up for portrait format devices.

If the P key is pressed again, the even numbered segments (2, 4 ... 34) at the light-strips and the vertical segments at the 7 segment display are activated and light up for portrait format devices.
After pressing the P key a third time, all of the segments at the entire display are activated and light up.
The device can be returned to the normal display mode by once again pressing the P key.

## 5 Basic Device Settings

| Parameter | Function | Setting Range |
|---|---|---|
| bri | Display brightness (LEDs and light-strip) | 0 ... 7 [5 [1)]] |
| **4 ... 20** | Measuring range matching | |
| ASt | Display range lower limit (start) | –999 ... 999 |
| AEn | Display range upper limit (end) | –999 ... 999 |
| **0 ... 20** | Measuring range matching | |
| ASt | Display range lower limit (start) | –999 ... 999 |
| AEn | Display range upper limit (end) | –999 ... 999 |
| **± 20** | Measuring range matching | |
| ASt | Display range lower limit (start) | –999 ... 999 |
| AEn | Display range upper limit (end) | –999 ... 999 |
| **Pt** | Measuring range matching | |
| °C / °F | Display in degrees Celsius or Fahrenheit | |
| 2.4L / 3L | 2 / 4-wire connection or 3-wire connection | |
| **rES** | Measuring range matching | |
| 200 / 2k / 20k | Resistance range | 200 Ω / 2 kΩ / 20 kΩ |
| 2.4L / 3L | 2 / 4-wire connection or 3-wire connection | |
| **the** | Measuring range matching | |
| J / K / R / S | Thermocouple type selection | |
| °C / °F | Display in degrees Celsius or Fahrenheit | |
| **HCA** | Hardware calibration | |
| ZEr | Display range lower limit | –999 ... 999 |
| SPA | Display range upper limit | –999 ... 999 |

| Parameter | Function | Setting Range |
|---|---|---|
| **PCA** | Software calibration | |
| OFS | Offset adjustment | –999 ... 999 |
| SCA | Measured value scaling factor | –9.99 ... 9.99 |
| **dP / .dP / dP.** | Decimal point | |
| **FIL** | Mean value generation based upon 0 to max. 32 measured values | 0, 2, 4, 8, 16, 32 [2)] |
| SSt | Lower light-strip scale limit (start) with reference to the digital display | –999 ... 999 |
| SEn | Upper light-strip scale limit (end) with reference to the digital display | –999 ... 999 |
| SOr | Light-strip minimum scale value (origin) with reference to the digital display | SSt ≤ SOr ≤ SEn |
| **nCL / nOP** [3)] | Switching mode: closed-circuit current (normally closed) / working current (normally open), for all relays | |
| L–L [3)] | Switching function for relays 1 and 2 | L–L<br>L–H<br>H–H<br>H–L |
| Lo1 / Hi1 [3)] | Switching point for limit value 1 | –999 ... 999 |
| Lo2 / Hi2 [3)] | Switching point for limit value 2 | –999 ... 999 |
| HYS [3)] | Hysteresis | 0 ... 100 [0 [1)]] |
| Loc [3)] | Lock limit values | Loc, FrE [FrE [1)]] |
| diS / On | Switch digital display on or off | diS / On<br>diS / OFF |

[1)] Factory default setting
[2)] A setting of either 8, 16 or 32 must be used for Pt100 sensors and thermocouples.
[3)] Only for devices with limit value read-out

## 6 Programming

The following parameters can be configured in the indicated order:

– LED and light-strip brightness
– Measuring range matching
– Decimal point
– Sampling rate for mean value generation
– Scale ranges with light-strip minimum value
– Switch digital display on or off

The following additional parameters can be configured for devices with limit values:

– Relay switching mode
– Relay switching function
– Switching point values
– Relay hysteresis
– Lock limit values

### Enabling Programming

The lock function must be released in order to enable programming, i.e. contact between terminals 10 and 11 must be broken. If programming has not been enabled, **Loc** is displayed when the programming menu is opened. If this is the case, previously programmed values can be queried but not changed.

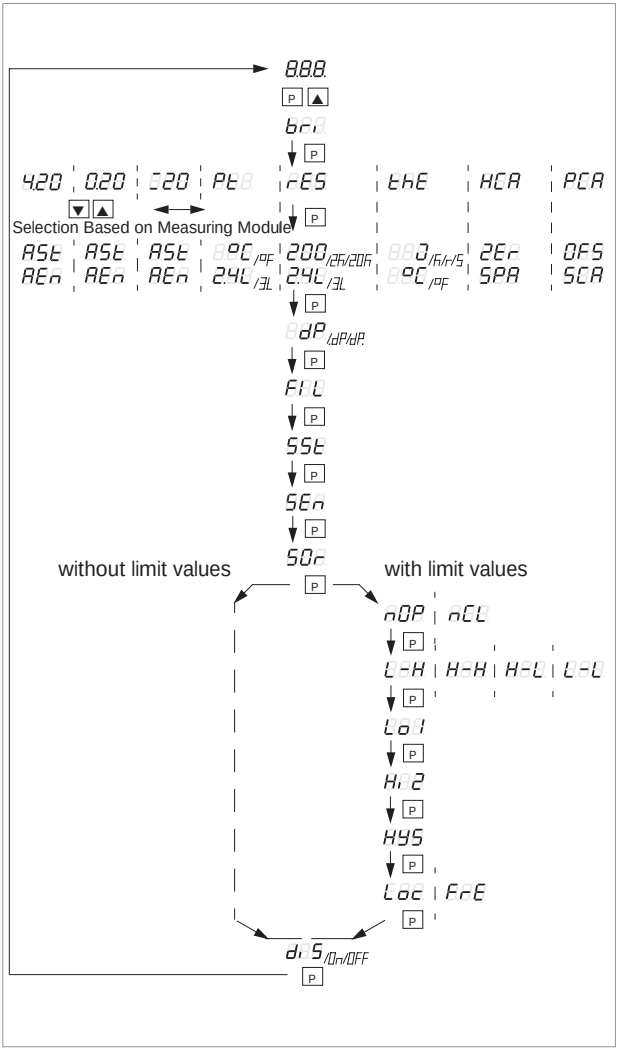
See chapter 7.1, page 24, for exceptions to this rule.

### Programming

The measuring instruments are programmed at the factory in accordance with customer specific requirements. If programming has been enabled, the basic device settings can be changed with the three keys at the front panel.

The **P** and ⇑ keys must be pressed simultaneously (first P and then ⇑) in order to enter the programming menu. The parameter designation and the corresponding value blink alternately in order to provide the user with orientation. Values can be changed with the ⇑ and ⇓ keys. The longer these keys are held depressed, the faster the value changes. The selected value is not saved to memory until the next parameter is queried by pressing the P key.

Various possibilities are provided for adapting the display to the input quantity. The various range matching options for 0 ... / 4 ... 20 mA, ± 20 mA, Pt100, Res and thermocouples are dependent upon the utilized measuring module and may only be selected if the device has been equipped with the corresponding measuring module (see designation on the serial plate). A measuring range type and the corresponding parameter settings can then be selected. Incorrect selection of measuring ranges results in malfunction!




*Programming Overview for Basic Device Settings*

## 6.1 Adjusting Display Brightness

Display brightness can be adjusted with the **bri** parameter. A setting can be selected within a range of 0 to 7. Brightness is adjusted to 5 at the factory.

## 6.2 Light-Strip Adjustment

The light-strip indicates measured values at the analog scale. The display range can be set anywhere within the measuring range.

The light-strip is preset at the factory. If the default settings need to be changed, this is accomplished in the program menu starting with the SSt parameter (see “Programming Overview for Basic Device Settings” on page 17).

## 6.3 Lower Scale Limit

**SSt** and a **numeric value** blink alternately at the 7 segment display. This number corresponds to the digital display value which represents the lower scale limit at the light-strip (minimum scale value is at the bottom for portrait format devices, and at the left for landscape format devices). This value can be changed with the ⇑ and ⇓ keys. The selected value is saved to memory by pressing the P key, and the upper scale limit then appears at the display.

## 6.4 Upper Scale Limit

**SEn** and a **numeric value** blink alternately at the 7 segment display. This number corresponds to the digital display value which represents the upper scale limit at the light-strip (maximum scale value is at the top for portrait format devices, and at the right for landscape format devices). This value can be changed with the ⇑ and ⇓ keys. The selected value is saved to memory by pressing the P key, and the minimum scale value then appears at the display.

## 6.5 Minimum Scale Value

**SOr** and a **numeric value** blink alternately at the 7 segment display.

This number corresponds to the digital display value which represents the minimum scale value, i.e. the point within the scale (SSt ... SEn) at which the light-strip starts.

This value can be changed with the ⇑ and ⇓ keys. A value which lies between SSt and SEn must be selected. Other values are not displayed. The selected value is saved to memory by pressing the P key, and the display is returned to the lower scale limit parameter.

**Example:**

| Light-Strip Indicator (with reference to the digital display) | SSt (lower scale limit) | SEn (upper scale limit) | SOr (minimum scale value) |
|---|---|---|---|
| 0 → 150 | 0 | 150 | 0 |
| 0 ← 150 | 0 | 150 | 150 |
| 100 → 0 | 100 | 0 | 100 |
| 100 ← 0 | 100 | 0 | 0 |
| –150 ← 0 → 150 | –150 | 150 | 0 |

The measuring instrument automatically calculates the corresponding parameters and returns to the normal operating mode.
If no programming keys are activated for a period of more than 3.5 minutes, the measuring instrument automatically returns to the normal operating mode.

## 6.6 Measuring Range Matching for 0 ... 20 mA, 4 ... 20 mA and ± 20 mA

The parameters **ASt** and **AEn** allow for the entry of a display range without necessitating any further balancing.

After selecting the measuring range, **ASt** and a **numeric value** blink alternately at the 7 segment display. Select the value which should be displayed as the measuring range lower limit with the ⇑ and ⇓ keys. Save the selected value to memory with the P key.

**AEn** and a **numeric value** then blink alternately at the 7 segment display. Select the value which should be displayed as the measuring range upper limit with the ⇑ and ⇓ keys. Save the selected value to memory with the P key. The measuring instrument automatically calculates the corresponding parameters, and then displays the decimal point configuration window.

## 6.7 Measuring Range Matching for Pt100 Temperature Sensor

This selection determines whether temperature will be displayed in **°C** or **°F**, and whether **3-wire** or **2 / 4-wire connection** will be used for the sensor. After selecting the **Pt** function, the 7 segment display alternates between **C** and **blank**. Display of temperature in **°C** or **°F** can be selected with the ⇑ and ⇓ keys. Save the selected value to memory with the P key.

Now the 7 segment display alternates between **2.4L** and **blank.** **2.4L** or **3L** can be selected with the ⇑ and ⇓ keys. Save the selected value to memory with the P key. The decimal point configuration window is then displayed.

## 6.8 Measuring Range Matching for Resistance

This selection determines the measuring range, and whether **3-wire** or **2 / 4-wire connection** will be used.

After selecting the **rES** function, the 7 segment display alternates between **200** and **blank**. One of the measuring ranges (**200**, **2k** or **20k**) can be selected with the ⇑ and ⇓ keys. Save the selected value to memory with the P key.

Now the 7 segment display alternates between **2.4L** and **blank.** **2.4L** or **3L** can be selected with the ⇑ and ⇓ keys. Save the selected value to memory with the P key.

The decimal point configuration window is then displayed.

## 6.9 Measuring Range Matching for Thermocouples

This selection determines the type of thermocouple to be used, and whether temperature will be displayed in **°C** or **°F**.

After selecting the **thE** function, the 7 segment display alternates between **J** and **blank**. A thermocouple type (**J, K, R** or **S**) can be selected with the ⇑ and ⇓ keys. Save the selected value with P.

Now the 7 segment display alternates between **°C** and **blank**. Display of temperature in **°C** or **°F** can be selected with the ⇑ and ⇓ keys. Save the selected value to memory with the P key.

The decimal point configuration window is then displayed.

## 6.10 Measuring Range Matching with HCA (hardware calibration)

This selection allows for balancing with a calibrator. During balancing, input quantities must be applied to the instrument which correspond to the measuring range lower and upper limits.

After selecting the **HCA** function, **ZEr** and a **numeric value** blink alternately at the 7 segment display. Apply the value which corresponds to the measuring range lower limit to the measurement input. Use the ⇑ and ⇓ keys to select the value to be displayed at the measuring range lower limit. Save the selected value with the P key.

**SPA** and a **numeric value** blink alternately at the 7 segment display. Apply the value which corresponds to the measuring range upper limit to the measurement input. Use the ⇑ and ⇓ keys to select the value to be displayed at the measuring range upper limit. Save the selected value to memory with the P key.

The instrument automatically calculates offset and scaling factor, saves these values and displays decimal point configuration.

**Attention:**

If the calculated values for offset or scaling factor are not within the setting range, Err / InP appears at the 7 segment display. Exit the programming function with the P key.

## 6.11 Measuring Range Matching with PCA (software calibration)

Balancing is accomplished without a calibrator during measuring range matching with **PCA** by calculating offset and scaling factor. Offset and scaling factor are then set digitally by the instrument.

After selecting the **PCA** function, **OFS** and a **numeric value** blink alternately at the 7 segment display. The offset value can be selected with the ⇑ and ⇓ keys. Save the selected value to memory with the P key. **SCA** and a **numeric value** then blink alternately at the 7 segment display.

### Calculating Offset (OFS)

The offset value is the number of digits the display is shifted from the “normal” zero point.

The offset value (OFS) is calculated with the following equation without taking the decimal point into consideration:

$$OFS = ASt - \frac{MSt \cdot (AEn - ASt)}{MEn - MSt}$$

| | |
|---|---|
| ASt = display range lower limit | MSt = bottom of scale |
| AEn = display range upper limit | MEn = top of scale |

### Calculating Scaling Factor (SCA)

The scaling factor is used to match the display range to the scale range of the input signal. The scaling factor value (SCA) is calculated with the following equation without taking the decimal point into consideration:

$$SCA = SCAold \cdot \frac{(MEn - MSt)old}{(AEn - ASt)(old)} \cdot \frac{(AEn - ASt)new}{(MEn - MSt)new}$$

| | |
|---|---|
| SCA old = scaling factor [1] | SCA = scaling factor[2] |
| ASt old = displ. range l. limit [1] | ASt new = display range l. limit[2] |
| AEn old = displ. range u. limit [1] | AEn new = display range u. limit[2] |
| MSt old = bottom of scale [1] | MSt new = bottom of scale[2] |
| MEn old = top of scale [1] | MEn new = top of scale[2] |

1) Which was selected at the measuring instrument before programming
2) Which is to be selected by means of reprogramming

**Example:**

A measuring instrument has been configured as follows:
0 ... 10 V scale range corresponds to 0.0 ... + 99.9 display range.
This configuration needs to be changed to the following:
2 ... 10 V scale range corresponds to – 10.0 ... + 99.9 display range.

ASt = –100 (without decimal point), MSt = 2 V

AEn = 999 (without decimal point), MEn = 10 V

This results in the following:

$$OFS = -100 - \frac{2 \cdot (999 - (-100))}{10 - 2} = -374{,}75 \quad \rightarrow \text{set to: } -375$$

$$SCA = 1 \cdot \frac{(10 - 0)}{(999 - 0)} \cdot \frac{(999 - (-100))}{(10 - 2)} = 1{,}375 \quad \rightarrow \text{set to: } 1.38$$

## 6.12 Setting the Decimal Point

**dP** is displayed at the 7 segment display with the selected decimal point configuration.

**Example:**

**dP.** is displayed for the following decimal point configuration: xx.X
**.dP** is displayed for the following decimal point configuration: x.XX
**dp** is displayed for no decimal point, i.e. XXX

The desired decimal point configuration can be selected with the ⇑ and ⇓ keys. Save the selected value to memory with the P key.

## 6.13 Mean Value Generation and Display

Mean value generation and display, using from 0 (no mean value generation) to 32 values in discrete steps of 2, 4, 8 and 16, is provided for with the **FIL** function. This allows for the stabilization of fluctuating display values. The sampling rate is approximately 8 measurements per second.
A setting of either 8, 16 or 32 must be used for Pt100 sensors and thermocouples.

## 6.14 Limit Value Function

The limit value function is selected immediately after light-strip settings have been completed. The selected limit value function appears at the 7 segment display. This setting is only available if the measuring instrument has been equipped with limit values

(see specifications on serial plate or scale (Rel 1, Rel 2)).
The following functions can be selected:

| Function | Parameter |
|---|---|
| Relay switching mode | nCL or nOP |
| Relay switching function | L–L, L–H, H–L or H–H |
| Relay switching hysteresis | HYS |
| Lock limit values | Loc or FrE |

## 6.15 Relay Switching Mode

After the light-strip settings have been completed, the selected relay switching mode appears at the 7 segment display.

The desired switching mode (**nCL** or **nOP**) can be selected with the ⇑ and ⇓ keys. Save the selected value to memory with the P key.

## 6.16 Relay Switching Function

Depending upon the selected relay switching mode (**nCL** or **nOP**), the selected switching function appears at the 7 segment display (**L–L, L–H, H–H** or **H–L**):

L–L = All limit value relays indicate limit value violation if the measured values are less than the selected limit values.

L–H = Relay 1 for limit value 1 indicates limit value violation, if the measured value is less than the selected limit value 1. Relay 2 for limit value 2 indicates limit value violation, if the measured value is greater than the selected limit value 2.

H–H = All limit value relays indicate limit value violation if the measured values are greater than the selected limit values.

H–L = Relay 1 for limit value 1 indicates limit value violation, if the measured value is greater than the selected limit value 1. Relay 2 for limit value 2 indicates limit value violation, if the measured value is less than the selected limit value 2.

The desired switching function can be selected with the ⇑ and ⇓ keys. Save the selected value to memory with the P key.

## 6.17 Setting Relay Switching Hysteresis

**HYS** and a **numeric value** blink alternately at the 7 segment display.

This value corresponds to the selected switching hysteresis in ± digits.

Select the desired number of digits with the ⇑ and ⇓ keys.
Save the selected value to memory with the P key.

## 7 Setting the Limit Values

The limit values can only be changed during operation if they haven't been locked in the programming mode. The limit values are accessed by simultaneously pressing the P and the ⇓ keys.
If **Loc** appears at the display, the instrument has been protected against limit value changes. No changes can be made in this case. The instrument is automatically returned to normal operation after approximately 3 minutes.
If the instrument has not been protected against limit value changes, the switching mode for the respective relay appears at the 7 segment display. The desired switching mode can be selected with the ⇑ and ⇓ keys, and the setting is saved to memory with the P key.
Depending upon the selected relay switching function (**nCL** or **nOP**), **Lo1** and a **numeric value**, or **Hi1** and a **numeric value** blink alternately at the 7 segment display. The displayed numeric value corresponds to limit value 1. The desired limit value can be selected at the 7 segment display with the ⇑ and ⇓ keys. Save the selected value to memory with the P key.
Depending upon the selected relay switching function, **Lo2** and a **numeric value**, or **Hi2** and a **numeric value** blink alternately at the 7 segment display. The displayed numeric value corresponds to limit value 2. The desired limit value can be selected with the ⇑ and ⇓ keys. Save the selected value to memory with the P key, and the instrument is returned to normal operation.

### 7.1 Locking the Selected Limit Values

Either **FrE** or **Loc** appears at the 7 segment display.

| | | |
|---|---|---|
| FrE | = | Limit values can be changed, even if programming has been disabled by establishing an external connection between terminals 10 and 11. |
| Loc | = | If programming is disabled, the limit values cannot be changed, i.e. the limit values are locked if a connection has been established between terminals 10 and 11. |

Select the desired value with the ⇑ and ⇓ keys. Save the selected value to memory with the P key.
The measuring instrument saves all settings to memory and the digital display on/off selection appears.

### 7.2 Switching the Digital Display On and Off

**diS** and **On**, or **diS** and **OFF** blink alternately at the 7 segment display. If diS / On is selected, the digital display remains active. If diS / OFF is selected, the digital display goes blank after the programming

menu has been exited. Selection is made with the ⇑ and ⇓ keys. Save the selected value to memory with the P key and the instrument returns to normal operation.
Even if the digital display has been deactivated (diS / OFF), it is activated briefly for the duration of the following operations:

- Programming
- Change or query selected limit values
- Display test

# 8 Technical Data

## Display

| | |
|---|---|
| Type: Analog | 35 segment light strip<br>2 limit value LEDs (contacting instruments only) |
| Digital | 7 segment LED, 3 digits with minus and plus sign (portrait format measuring instruments only) |
| Display Color | red |
| Light-Strip Height / Length | approx. 45 mm |
| Brightness | adjustable from 0 to 7 |
| Display Range | –999 to 999 |
| Character Height | approx. 8 mm |
| Polarity | displayed automatically |
| Decimal Point | programmable |
| Overload Display | ▯▯▯ |
| Underload Display | _ _ _ |

## Scale

| | |
|---|---|
| Format | portrait or landscape |
| Scale Height / Length | 45 mm |
| Scale Color | swan white |
| Graduation and Labelling | black, acc. to meas. range option: as requested |

## Input

| | |
|---|---|
| Specified Module | see designation on serial plate |
| **Voltage Module** | |
| Input Impedance | > 1 MΩ for measurements > 2 V<br>> 70 kΩ for measurements < 2 V |
| **Current Module** | |
| Voltage Drop | max. 2 V |
| **Temperature Module, Pt100 / Resistance** | |
| Sensor Current | 2 mA |
| **Thermocouples** | |
| Input | J, K, R, S |
| Broken Sensor | overload display |
| Colt Spot Compensation | within a range of 0 to 50 ˚C |

## Analog-Digital Conversion

| | |
|---|---|
| Measuring Method | dual-slope |
| Sampling Rate | approx. 8 measurements per second |
| Measuring Time | approx. 40 ms |

## Error Limits

| | |
|---|---|
| For Basic Device | |
| **Without Module** | ± (0.1% of reading + 2 digits) |
| **DC Module** | ± (0.1% of reading + 2 digits) |
| Temperature Coefficient | < 150 ppm / K |
| SMRR | > 30 dB at 50 Hz |
| CMRR | > 120 dB related to meas. range 200 mV at 50 Hz |
| **AC Module (arithmetic)** [1)] | |
| Intrinsic Error at | |
| 45 ... 65 Hz | ± (0.2% of reading + 3 digits) |
| 30 ... 1 kHz | ± (0.3% of reading + 5 digits) |
| Temperature Coefficient | < 150 ppm / K |
| Temperature Offset Drift | ± 0.1 digit / K |
| **True RMS Module** [1)] | |
| Intrinsic Error at | |
| 45 ... 65 Hz | ± (0.2% of reading + 3 digits) |
| 20 Hz ... 1 kHz | ± (0.3% of reading + 5 digits) |
| DC Measurement | ± (2 % of reading + 5 digits) |
| Crest Factor | 6 (additional 0.5% of reading) |
| Temperature Coefficient | < 150 ppm / K |
| Temperature Offset Drift | ± 0.1 digits / K |
| **Temperature Module, Pt100 / Resistance** [1)] | |
| Max. Error | ± (0.4% of reading + 3 digits) |
| Temperature Coefficient | < 150 ppm / K |
| Temperature Offset Drift | ± 0.1 digit / K |
| Max. Ri | 100 Ω |
| **Thermocouple Module** [1)] | |
| Max. Error | ± (0.4% of reading + 3 digits) |
| Linearization Error | < 1 K |
| Cold Spot | |
| Compensation Error | within a range of 10 to 50 °C < 2 K |
| Temperature Coefficient | < 150 ppm / K |
| Temperature Offset Drift | ± 0.1 digit / K |

In general, error limits are ± 3% of the measuring range for instruments without digital display.

[1)] does not apply to contacting instruments

## Control Inputs

| | |
|---|---|
| Device Test (Reset) | controlled via floating contact |
| Freeze Display (Hold) | controlled via floating contact |
| Disable Programming (Lock) | controlled via floating contact |

## Relays

| | |
|---|---|
| Contacts | 1 NO contact (or NC contact) |
| Switching Capacity | 5 A / 30 V AC / DC |
| Switching Time | max. 200 ms |
| Switching Hysteresis | adjustable from 0 to ± 100 digits |

## Power Supply

230 / 115 V AC ± 15% 50 / 60 Hz /
90 ... 260 V DC approx. 3 W
or
18 V ... 36 V DC /
24 V AC ± 15% 50 / 60 Hz approx. 2 W

## Electrical Safety

| | |
|---|---|
| **Types** | IEC 61010-1 / EN 61010-1 / VDE 0411 Part 1 |
| Safety Class | II |
| Overvoltage Category | II |
| Contamination Level | 2 |
| **Protection** | IEC 60529 / EN 60529 |
| Housing Front Panel | IP 65 |
| Terminals | IP 00 |
| **EMC** | |
| Interference Immunity | IEC 61326-1 / +A1 / EN 61326-1 / +A1 |
| Interference Emission | IEC 61326-1 / +A1 / EN 61326-1 / +A1 |
| **Operating Voltage** | |
| DC Voltage Module | 300 V |
| AC Voltage | |
| Module 100 / 700V | 600 V |
| DC / AC Current Module | 300 V |
| Temperature Module, Pt100 | 50 V |
| Resistance Module | 50V |
| Thermocouple Module | 50V |

## Ambient Conditions

| | |
|---|---|
| Operating Temperature | 0 ... 50 °C |
| Storage Temperature | –20 ... 70 °C |
| Relative Humidity | max. 85% |
| Vibration Resistance | IEC 61010-1/ EN 61010-1 |

## Housing

| | |
|---|---|
| Material | plastic, ABS |
| Front Dimensions | 96 x 24 mm |

| | |
|---|---|
| Panel Cutout | 92 $^{+0.8}$ x 22.2 $^{+0.3}$ mm |
| Panel Thickness | min. 1 to max. 45 mm |
| Bezel Height | 5 mm |
| Installation Depth | max. 126 mm plus wiring |
| Weight | approx. 0.2 kg |
| Terminals | screw terminal blocks for wire with cross section of up to 2.5 square mm |
| Mounting | plastic mounting tabs |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