Transducers for Humidity and Temperature
for industrial applications

B 90.7023.1
Operating Instructions
PUBLISHED BY

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CHAPTER 1  
GENERAL INFORMATION

This chapter provides general notes for the manual and the product.

About This Manual

This manual provides information for installing, operating, and maintaining JUMO Humidity and Temperature Transmitter Series 907023.

Contents of This Manual

This manual consists of the following chapters:

- Chapter 1, General Information, provides general notes for the manual and the product.
- Chapter 2, Product Overview, introduces the features, advantages, and the product nomenclature of Transmitter.
- Chapter 3, Installation, provides you with information that is intended to help you install the product.
- Chapter 4, Operation, contains information that is needed to operate this product.
- Chapter 5, Maintenance, contains information that is needed in basic maintenance of the product.
- Chapter 6, Calibration and Adjustment, provides information and instructions concerning calibration and adjustment of Transmitter.
- Chapter 7, Technical Data, provides the technical data of the product.
- Appendix A, Probe Installation Kits and Installation Examples, presents the installation kits available for Transmitter and provides some installation examples.
- Appendix B, Calculation Formulas, presents the equations used in Transmitter to calculate values of dewpoint, mixing ratio, absolute humidity and enthalpy in normal pressure.

## General Safety Considerations

Throughout the manual, important safety considerations are highlighted as follows:

| WARNING | Warning alerts you to a serious hazard. If you do not read and follow instructions very carefully at this point, there is a risk of injury or even death. |
| CAUTION | Caution warns you of a potential hazard. If you do not read and follow instructions carefully at this point, the product could be damaged or important data could be lost. |
| NOTE | Note highlights important information on using the product. |

## Feedback

JUMO Customer Documentation Team welcomes your comments and suggestions on the quality and usefulness of this publication. If you find errors or have other suggestions for improvement, please indicate the chapter, section, and page number. You can send comments to us by e-mail: mail@jumo.net
Product Related Safety Precautions

The JUMO Humidity and Temperature Transmitter Series 907023 delivered to you has been tested for safety and approved as shipped from the factory. Note the following precautions:

**WARNING**  
Ground the product, and verify outdoor installation grounding periodically to minimize shock hazard.

**CAUTION**  
Do not modify the unit. Improper modification can damage the product, lead to malfunction, or make the product noncompliant with applicable legislation.

**ESD Protection**

Electrostatic Discharge (ESD) can cause immediate or latent damage to electronic circuits. JUMO products are adequately protected against ESD for their intended use. However, it is possible to damage the product by delivering electrostatic discharges when touching, removing, or inserting any objects inside the equipment housing.

To make sure you are not delivering high static voltages yourself:

- Handle ESD sensitive components on a properly grounded and protected ESD workbench. When this is not possible, ground yourself to the equipment chassis before touching the boards. Ground yourself with a wrist strap and a resistive connection cord. When neither of the above is possible, touch a conductive part of the equipment chassis with your other hand before touching the boards.

- Always hold the boards by the edges and avoid touching the component contacts.

**Regulatory Compliances**

**Transmitters with LAN or WLAN Interface**

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules.
These limits are designed to provide reasonable protection against harmful interference in a residential installation. Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Transmitters with WLAN Interface

This device has been designed to operate with a 2 dBi half-wave antenna. Antennas with a gain greater than 2 dB are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.

This Class [B] digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe [B] est conforme à la norme NMB-003 du Canada.
Recycling

Recycle all applicable material.

Dispose of batteries and the unit according to statutory regulations. Do not dispose of with regular household refuse.

Trademarks

HUMICAP® is a registered trademark of Vaisala. Microsoft®, Windows®, Windows® 2000, Windows Server® 2003, Windows® XP, and Windows® Vista are registered trademarks of Microsoft Corporation in the United States and/or other countries.

License Agreement

All rights to any software are held by JUMO or third parties. The customer is allowed to use the software only to the extent that is provided by the applicable supply contract or Software License Agreement.
Warranty

JUMO hereby represents and warrants all Products manufactured by JUMO and sold hereunder to be free from defects in workmanship or material during a period of twelve (12) months from the date of delivery save for products for which a special warranty is given. If any Product proves however to be defective in workmanship or material within the period herein provided JUMO undertakes to the exclusion of any other remedy to repair or at its own option replace the defective Product or part thereof free of charge and otherwise on the same conditions as for the original Product or part without extension to original warranty time. Defective parts replaced in accordance with this clause shall be placed at the disposal of JUMO.

JUMO also warrants the quality of all repair and service works performed by its employees to products sold by it. In case the repair or service works should appear inadequate or faulty and should this cause malfunction or nonfunction of the product to which the service was performed JUMO shall at its free option either repair or have repaired or replace the product in question. The working hours used by employees of JUMO for such repair or replacement shall be free of charge to the client. This service warranty shall be valid for a period of six (6) months from the date the service measures were completed.

This warranty is however subject to following conditions:

a) A substantiated written claim as to any alleged defects shall have been received by JUMO within thirty (30) days after the defect or fault became known or occurred, and

b) The allegedly defective Product or part shall, should JUMO so require, be sent to the works of JUMO or to such other place as JUMO may indicate in writing, freight and insurance prepaid and properly packed and labelled, unless JUMO agrees to inspect and repair the Product or replace it on site.

This warranty does not however apply when the defect has been caused through

a) normal wear and tear or accident;

b) misuse or other unsuitable or unauthorized use of the Product or negligence or error in storing, maintaining or in handling the Product or any equipment thereof;

c) wrong installation or assembly or failure to service the Product or otherwise follow JUMO's service instructions including any repairs or installation or assembly or service made by unauthorized personnel not approved by JUMO or replacements with parts not manufactured or supplied by JUMO;

d) modifications or changes of the Product as well as any adding to it without JUMO's prior authorization;

e) other factors depending on the Customer or a third party.

Notwithstanding the aforesaid JUMO's liability under this clause shall not apply to any defects arising out of materials, designs or instructions provided by the Customer.

This warranty is expressly in lieu of and excludes all other conditions, warranties and liabilities, express or implied, whether under law, statute or otherwise, including without limitation any implied warranties of merchantability or fitness for a particular purpose and all other obligations and liabilities of JUMO or its representatives with respect to any defect or deficiency applicable to or resulting directly or indirectly from the Products supplied hereunder, which obligations and liabilities are hereby expressly cancelled and waived. JUMO's liability shall under no circumstances exceed the invoice price of any Product for which a warranty claim is made, nor shall JUMO in any circumstances be liable for lost profits or other consequential loss whether direct or indirect or for special damages.
CHAPTER 2
PRODUCT OVERVIEW

This chapter introduces the features, advantages, and the product nomenclature of the JUMO Humidity and Temperature Transmitter Series 907023.

Introduction to TRANSMITTER

The transmitter provides reliable humidity measurement in a wide range of applications. Analog outputs can be chosen between current and voltage signals. Alternatively, digital outputs RS-232 (standard) or RS-422/485 (optional) can be selected.

The quantities measured and calculated by transmitter are presented in Table 1 unterhalb. The quantities available as an option are presented in Table 2 unterhalb.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Quantities Measured by TRANSMITTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td>Abbreviation</td>
</tr>
<tr>
<td>Relative humidity (RH)</td>
<td>RH</td>
</tr>
<tr>
<td>Temperature (T)</td>
<td>T</td>
</tr>
</tbody>
</table>
### Table 2  Optional Quantities Measured by TRANSMITTER

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Abbreviation</th>
<th>Metric Unit</th>
<th>Non Metric Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dewpoint / Frostpoint Temperature ($T_{d/f}$)</td>
<td>TDF</td>
<td>°C</td>
<td>°F</td>
</tr>
<tr>
<td>Dewpoint Temperature ($T_d$)</td>
<td>TD</td>
<td>°C</td>
<td>°F</td>
</tr>
<tr>
<td>Absolute humidity (a)</td>
<td>A</td>
<td>g/m$^3$</td>
<td>gr/ft$^3$</td>
</tr>
<tr>
<td>Mixing ratio (x)</td>
<td>X</td>
<td>g/kg</td>
<td>gr/lb</td>
</tr>
<tr>
<td>Wetbulb temperature ($T_w$)</td>
<td>TW</td>
<td>°C</td>
<td>°F</td>
</tr>
<tr>
<td>Humid air volume/ dry air volume (by volume or by weight) ($H_2O$)</td>
<td>H2O</td>
<td>ppmv/ppmw</td>
<td>ppmv/ppmw</td>
</tr>
<tr>
<td>Water vapor pressure ($P_w$)</td>
<td>PW</td>
<td>hPa</td>
<td>lb/in$^2$</td>
</tr>
<tr>
<td>Water vapor saturation pressure ($P_{ws}$)</td>
<td>PWS</td>
<td>hPa</td>
<td>lb/in$^2$</td>
</tr>
<tr>
<td>Enthalpy (h)</td>
<td>H</td>
<td>kJ/kg</td>
<td>Btu/lb</td>
</tr>
<tr>
<td>Difference of $T$ and $T_{d/f}$ ($\Delta T$)</td>
<td>DT</td>
<td>°C</td>
<td>°F</td>
</tr>
</tbody>
</table>

### Basic Features and Options

- Several probes for various applications
- User friendly display
- Calculated output quantities available
- Different probe mounting kits, sensor protection options and probe cable lengths
- Transmitter mounting kits for multiple installation purposes
- Chemical purge for applications where interfering chemicals in the measuring environment pose a risk
- Warmed probe and sensor heating for high humidity conditions (907023/337)
- Additional temperature sensor (907023/337)
- USB connectivity for service connections via the optional USB-RJ45 cable
- Optional modules:
  - isolated power supply
  - power supply module
  - RS-422/485-module
  - LAN and WLAN interfaces
  - data logger module with real time clock
  - additional analog output module
  - relay module
Structure of the Transmitter

The numbers refer to Figure 1:

1 = Signal + powering cable gland
2 = Cable gland for optional module, or WLAN antenna connector
3 = Cable gland for optional module
4 = Cover screw (4 pcs)
5 = Display with keypad (optional)
6 = Cover LED
Figure 2  Inside the Transmitter

The following numbers refer to Figure 2:

1 = Service port (RS-232)
2 = DIP switches for analog output settings
3 = Power supply and signal wiring screw terminals
4 = Relay, data logger, RS-422/485, LAN, or WLAN module (optional)
5 = Grounding connector
6 = Power supply module (optional)
7 = Relay, data logger, or analog output module (optional)
8 = Humidity probe cable
9 = Temperature probe cable (optional)
10 = Output isolation module (optional)
11 = Adjustment buttons (chemical purge buttons) with indicator LED
Figure 3  Probe Options

The following numbers refer to Figure 3:

1 = 907023/331 for demanding wall-mounted applications
2 = 907023/333 for ducts and tight spaces
3 = 907023/334 for high pressure and vacuum applications (up to 100 bars)
4 = 907023/335 for high temperatures (up to 180 °C, vapor tight)
   *) Flange available as an option
5 = 907023/337 for high humidity applications (optional warmed and vapor tight probe)
6 = 907023/338 for pressurized pipelines (up to 40 bar)

Probe cable lengths are 2 m, 5 m and 10 m.
Warmed Probe 907023/337

Temperature difference between the probe and external environment can cause a risk of condensation on the sensor. A wet probe cannot observe the actual humidity in the ambient air. If the condensed water is contaminated, the life span of the probe may shorten and calibration may change.

907023/337B probe shall be used in applications where condensation can occur due to high humidity and rapid humidity changes. The warmed probe is heated continuously so that its temperature is always higher than in environment. This prevents condensation on the probe. The power consumption of the warmed probe is slightly higher than other probes.
CHAPTER 3
INSTALLATION

This chapter provides you with information that is intended to help you install the product.

Mounting the Housing

The housing can be mounted either without the mounting plate or with optional mounting plates.

Standard Mounting without Mounting Plate

Mount the housing by attaching the transmitter to a wall with 4 screws, for example M6 (not provided).

![Figure 4 Standard Mounting](image-url)
Wall Mounting with Wall Mounting Kit

When mounting with wall mounting kit the mounting plate can be installed directly on wall or onto a standard wall box (also US junction box). When wiring through back wall, remove the plastic plug from the wiring hole in the transmitter before mounting.

![Figure 5 - Mounting with Wall Mounting Kit](image)

The following numbers refer to Figure 5:

1 = Plastic mounting plate  
2 = Mount the plate to wall with 4 screws M6 (not provided)  
3 = The arched side up  
4 = Attach the transmitter to the mounting plate with 4 fixing screws M3 (provided)  
5 = Holes for wall/junction box mounting

![Figure 6 - Dimensions of the Plastic Mounting Plate (mm/inch)](image)
Mounting with DIN Rail Installation Kit

DIN rail installation kit includes a wall mounting kit, 2 clip-fasteners and 2 screws M4 × 10 DIN 7985.

1. Attach two spring holders to the plastic mounting plate by using the screws provided in the installation kit.
2. Attach the transmitter to the plastic mounting plate with the 4 screws provided for that purpose.
3. Press the transmitter onto the DIN rail so that the clip-fasteners snap into the rail.

Figure 7 Mounting with the DIN Rail Installation Kit
Pole Installation with Installation Kit for Pole or Pipeline

Installation kit for pole or pipeline includes the metal mounting plate and 4 mounting nuts for pole mounting. When mounting, the arrow in the metal mounting plate must point upwards; see Figure 10 on page 26 unterhalb.

**Figure 8  Vertical Pole**

The following numbers refer to Figure 8:

1 = Fixing brackets (2 pcs) M8 (provided) for 30 ... 102 mm poles.
2 = Mounting nuts M8 (4 pcs)

**Figure 9  Horizontal Pole**

The following number refers to Figure 9:

1 = Mounting nuts M8 (4 pcs)
Metal mounting plate is included in rain shield with installation kit and installation kit for pole or pipeline.

Figure 10  Mounting with Metal Wall Mounting Plate

The following numbers refer to Figure 10:

1 = Mount the plate to wall with 4 screws M8 (not provided)
2 = Attach the transmitter to the mounting plate with 4 fixing screws M6 (provided)
3 = Note the position of the arrow when mounting. This side must be up when mounting.

Figure 11  Dimensions of the Metal Mounting Plate (mm/inch)
Mounting Rain Shield with Installation Kit

The following numbers refer to Figure 12:

1  =  Assemble the rain shield with the installation kit to the metal mounting plate with 2 (M6) mounting screws (provided).

2  =  Assemble the mounting plate with rain shield with installation kit to the wall or to the pole (see pole installation).

3  =  Assemble the transmitter to the mounting plate with 4 fixing screws (provided).

Panel Mounting Frame

To enable a neat and dirt free embedded installation of the transmitter, a panel mounting frame is available as an option. The frame is a thin, flexible plastic frame for the transmitter, with adhesive tape on one side.

The frame is used to hide any rough edges of the installation hole, and provide a more finished look. Note that the panel mounting frame is not intended to bear the weight of the transmitter, and does not include any mounting supports.

Use the panel mounting frame as follows:

1. Use the frame as a template to mark the required size for the installation hole in the panel.
2. Cut the hole in the panel.
3. Mount the transmitter through the panel with suitable supports.
4. Remove the paper protecting the adhesive tape on the frame, and attach the frame around the transmitter. Refer to Figure 13 unterhalb.

**Figure 13  Panel Mounting Frame**

The following numbers refer to Figure 13:

1  =  Panel (not included)

2  =  Panel mounting frame

**Figure 14  Panel Mounting Dimensions (mm/inch)**
Wiring

Cable Bushings

A single electrical cable with screen and three to ten wires is recommended for power and analog/serial connections. The cable diameter should be 8 ... 11 mm. The number of cable bushings depends on the transmitter options. See the following recommendations for the cable bushings:

![Figure 15 Cable Bushings](image)

The following numbers refer to Figure 15:

1  =  Cable for signal/powering Ø8 ... 11 mm
2  =  Cable for optional module Ø8 ... 11 mm
3  =  Cable for optional power supply module Ø8 ... 11 mm

**NOTE**

When there is high electric noise level (for example, near a powerful electric motor) in the operating environment it is recommended to use shielded cable or take care that the signal cables are separated from other cables.

---

Chapter 3  
JUMO 
Installation 

29
Grounding the Cables

Ground the screen of the electrical cable properly to achieve the best possible EMC performance.

Figure 16   Grounding the Screen of Electrical Cable
1. Cut back outer sheath to desired length.
2. Cut back screen braiding or screen foil to dimension X (see figure 3).
3. Push the domed cap nut (item 1) and the seal insert with contact socket of the gland (item 2+3) onto the cable as shown in the diagram.
4. Bend over the screen braiding or screen foil by about 90º (item 4).
5. Push the seal insert with the contact socket of the gland (item 2+3) up to the screen braiding or screen foil.
6. Mount lower part (item 5) on the housing.
7. Push the seal with the contact socket of the gland and (item 2+3) flush into the lower part (item 5).
8. Attach the domed cap nut (item 1) onto the lower part (item 5).

**Grounding the Transmitter Housing**

In case you need to ground the transmitter housing, the grounding connector is found inside the housing, see Figure 2 Seite 19. Note that the probe is connected to the same potential as the housing. Make sure that different groundings are made to the same potential. Otherwise harmful ground currents may be generated.

If it is needed to have galvanic isolation of the power supply line from the output signals, the transmitter can be ordered with an optional output isolation module. This module prevents harmful grounding loops.
Signal and Power Supply Wiring

When connecting the transmitter with 8-pin connector, see section 8-Pin Connector on page 60. When wiring the power supply module, see section Power Supply Module on page 44.

![Screw Terminal Block on Motherboard](image)

Figure 17  Screw Terminal Block on Motherboard

The following numbers refer to Figure 17:

1 = Power supply terminals 10 ... 35 VDC, 24 VAC  
2 = User port (RS-232 terminals)  
3 = Analog signal terminals

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make sure that you connect only de-energized wires.</td>
</tr>
</tbody>
</table>

1. Unfasten the four cover screws and open the transmitter cover.  
2. Insert the power supply wires and signal wires through the cable bushing in the bottom of the transmitter; see the grounding instructions in the previous sections.  
3. Connect the analog output cables to terminals: Ch1 +, Ch1-, Ch2+, Ch2-. Connect the RS-232 user port cables to terminals RxD, GND and TxD. For more information about the RS-232 connection refer to section Serial Line Communication on page 70.
4. When wiring the optional modules, see the corresponding section for instructions:
   - RS-422/485 Interface on page 53
   - Relays on page 51
   - Third Analog Output on page 49
   - LAN Interface on page 55
   - WLAN Interface on page 56

5. Connect the power supply wires to the connectors: **POWER 10 ... 35V+ 24V~ (+) and (-) terminals.** If you are using 24 VAC power supply, see the note below before connecting the supply wires.

6. Turn on the power. The indicator led on the cover lit continuously during normal operation.

7. Close the cover and fasten the cover screws. The transmitter is ready for use.

**Connections to a 24 VAC Power Supply**

Separate floating supply for each transmitter is recommended (see the upper part of Figure 18 Seite 34). If you have to connect several transmitters or other instruments to one AC supply, the phase (~) must always be connected to the (+) connector of each transmitter (see the lower part of Figure 18).

<table>
<thead>
<tr>
<th>CAUTION</th>
<th>24 VAC POWER SUPPLY USE</th>
</tr>
</thead>
<tbody>
<tr>
<td>To prevent fire and/or damage, if either 24 VAC wire is grounded or connected to a &quot;-&quot;, &quot;0&quot;, or &quot;GND&quot; terminal of any other device, you must connect the same wire on the &quot;-&quot; terminal also on this instrument.</td>
<td></td>
</tr>
</tbody>
</table>
Figure 18 Connections to 24 VAC Power Supply
Probe Mounting

In humidity measurement and especially in calibration it is essential that temperature of the probe and measuring environment is the same. Even a small difference in temperature between the environment and the probe causes an error. As the curve below shows, if the temperature is +20 °C and the relative humidity 100 %RH, a difference of ±1 °C between the environment and the probe causes an error of ±6 %RH.

The graph below illustrates the measurement error at 100 %RH when the difference between the ambient and sensor temperature is 1 °C.

Figure 19  Measurement Error at 100 %RH
General Instructions for Probes with a Cable

Mount the probes with a cable horizontally; this way, any water condensing on the tube cannot flow onto the sensor.

Figure 20  Horizontal Mounting of Probe

The following numbers refer to Figure 20:

1 = To be sealed.
2 = To be insulated.
3 = Insulate the cable.
4 = Let the cable hang loosely. This prevents condensed water running to the probe along the cable.
When there is no alternative but to install the probe in the process **vertically**, the point of entry must be carefully insulated. The cable must also be allowed to hang loosely as this prevents any condensed water from running onto the probe along the cable.

![Diagram of vertical mounting of probe](image)

**Figure 21  Vertical Mounting of Probe**

The following numbers refer to Figure 21:

1 = To be sealed.
2 = Insulate the cable.
3 = To be insulated.
4 = Let the cable hang loosely. This prevents condensed water running to the sensor along the cable.

**NOTE**

Please do not attach a heated probe (907023/337B) to metal structures to avoid condensation problems caused by heat conduction along the metal.

If the process temperature is much higher than that of the environment, the whole probe and preferably plenty of cable must be inside the process. This prevents measuring inaccuracy caused by heat conduction along the cable.

When mounted on the side of a duct or channel, the probe must be inserted from the side of the duct. If this is not possible and the probe must be inserted from the top, the point of entry must be carefully insulated.

For JUMO probe installation kits and some installation examples, see Appendix A on page 163.
907023/333 for Ducts and Tight Spaces

The 907023/333 is a small size (ø = 12mm) general-purpose probe suitable for ducts and channels with the installation kit available from JUMO.

The 907023/333 provides for two measuring range options. The first probe version is equipped with a flexible cable and can be used when measuring in environments up to 80 °C. The second version is suitable for measuring in environments up to 120 °C.

See Appendix A on page 163 for the following probe installation kits for 907023/333 and installation examples.

- Duct mounting kit
- Cable gland.

907023/334 for High Pressure and Vacuum Applications

The 907023/334 probe is for the dewpoint measurements in pressurized rooms and industrial processes. The probe is provided with a nut, a fitting screw and a sealing washer. Keep the fitting screw and the nut in place on the body of the probe during handling to prevent damage to the highly polished surface of the probe. Follow the instructions below to achieve a leak-tight assembly:

1. Remove the fitting screw from the nut and the probe.
2. Attach the fitting screw to the chamber wall with a sealing washer. Tighten the fitting screw into the threaded sleeve with a torque spanner. The tightening torque is 150 ± 10 Nm (110 ± 7 ft-lbs).
3. Insert the body of the probe into the fitting screw and attach the nut manually to the fitting screw so that the connection feels tight.
4. Mark both the fitting screw and the nut hex.
The following numbers refer to Figure 22:

1 = Tightening cone
2 = Nut
3 = Fitting screw, M22x1.5 or NPT 1/2"
4 = Sealing washer
5 = Probe; Ø12 mm.

5. Tighten the nut a further 30° (1/12) turn or if you have a torque spanner tighten it with a torque of 80 ± 10 Nm (60 ± 7 ft-lbs).

**NOTE**
When re-tightening the nut after detachment the nut must be tightened without increased effort.

6. Clean and grease the tightening cone of the fitting screw after every tenth detachment. Change the sealing washer every time the fitting screw is detached. Use high-vacuum grease (for example Dow Corning) or similar grease.
Figure 24   Cleaning of Tightening Cone

The following numbers refer to Figure 24:

1 = Fitting screw
2 = Sealing washer
3 = Tightening cone
4 = Clean cotton stick

---

**CAUTION**

In pressurized processes it is essential to tighten the supporting nuts and screws very carefully to prevent loosening of the probe by the action of pressure.

---

**NOTE**

When installed in a process with a pressure differing from normal atmospheric pressure, please enter the pressure value of the process (in hPa or mbar) into the transmitter memory via the serial line (see command PRES and XPRES on page 94) or by using display/keypad.

---

**907023/335 for High Temperatures**

907023/335 is installed similarly than the 907023/333 probe but without the supporting bar. Refer to Appendix A on page 163 for more information on the duct installation kit for 907023/335.

To avoid incorrect humidity readings, the temperature differences between inside and outside of the duct must not be remarkable.
907023/337 for High Humidity Applications

The 907023/337 is for environment where relative humidity is very high, near saturation. The warmed probe prevents the saturation of the sensor. An additional temperature probe is also available.

See Appendix A on page 163 for a presentation of the following probe installation kits for 907023/337 with installation examples:

- Duct mounting kit
- Cable gland
- Pressure tight Swagelok connector
- Meteorological Installation kit

The installation kits are available for both humidity and temperature probe.

Temperature Probe (Optional)

An additional temperature probe is available to measure the ambient temperature when the 907023/337B (with probe warming) is used. The additional temperature probe allows you to measure other humidity quantities apart from dewpoint and mixing ratio. The temperature probe must be connected to the transmitter at the factory. Do not cut and re-connect the cable yourself.

You must install the additional temperature probe in the same measurement environment as the 907023/337B probe. Make sure that heat does not transfer from the warmed probe to the temperature probe. For an example installation, refer to section Example of Installation Through Roof on page 169.

907023/338 for Pressurized Pipelines

Due to the sliding fit the 907023/338 is easy to install into and remove from the pressurized process. The probe is especially suitable for the measurements in pipelines. See section Ball Valve Installation Kit for 907023/338 on page 170.
The following numbers refer to Figure 25:

1 = Clasp nut, 24 mm hex nut
2 = Fitting body, 27 mm hex head

The following two fitting body options are available:

- Fitting Body ISO1/2 solid structure
- Fitting Body NPT1/2 solid structure

**Table 3 907023/338 Probe Dimensions**

<table>
<thead>
<tr>
<th>Probe type</th>
<th>Probe Dimension</th>
<th>Adjustment Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>178 mm</td>
<td>120 mm</td>
</tr>
<tr>
<td>Optional</td>
<td>400 mm</td>
<td>340 mm</td>
</tr>
</tbody>
</table>

**Figure 26  Sealing of Fitting Body into Process**

Sealing with:
1. LOCTITE® No 542 + activ. No 7649 (t=-55...+150 °C)
2. MEGA-PIPE EXTRA No 7188 (t=-55...+170 °C)
3. PTFE tape (t=-60...+210 °C) NOTE: the tape does not lock the parts together. Therefore, use two fork spanners (hex 24 and 27 mm) for tightening and opening the clasp nut of the probe.
Chapter 3  __________________________________________________________ Installation

**Tightening the Clasp Nut**

1. Adjust the probe to a suitable depth according to the type of installation.
2. Tighten the clasp nut first manually.
3. Mark the fitting screw and the clasp nut.
4. Tighten the nut a further 50 -60º (ca. 1/6 turn) with a wrench. If you have suitable torque spanner, tighten the nut to max 45 ± 5 Nm (33 ± 4 ft-lbs).

![Figure 27  Tightening the Clasp Nut](image)

The following numbers refer to Figure 27 on page 43:

1 = Probe  
2 = Clasp nut  
3 = Fitting screw  
4 = Pen

**NOTE**

Take care not to over tighten the clasp nut to avoid difficulties when opening it.

**CAUTION**

Take care not to damage the probe body. A damaged body makes the probe less tight and may prevent it from going through the clasp nut.

**CAUTION**

In pressurized processes it is essential to tighten the supporting nuts and screws very carefully to prevent loosening of the probe by the action of pressure.
NOTE
When installed in a process with a pressure differing from normal atmospheric pressure, please enter the pressure value of the process (in hPa or mbar) into the transmitter memory via the serial line (see command PRES and XPRES on page 94) or by using display/keypad.

Optional Modules

Power Supply Module

The AC (mains) power connection may be connected to the power supply module only by an authorized electrician. A readily accessible disconnect device shall be incorporated in the fixed wiring.

The following numbers refer to Figure 28:

1 = Connect AC (mains) voltage wires to these terminals
2 = Grounding terminal
3 = In case the module is not installed in the factory: Connect wires from these terminals to the POWER 10...36V 24V terminals of the mother board.
4 = +
5 = -

Figure 28  Power Supply Module
Installation

1. Disconnect the power and open the transmitter cover.
2. Remove the protective plug from the cable gland and thread the wires. In case the power supply module is installed in the factory, continue with the step 5.
3. Attach the power module to the bottom of the housing with four screws. See the position Figure 2 Seite 19.
4. Connect the wires from the terminals of the power supply module marked with + and - to the terminals POWER 10 ... 35 V 24V on the motherboard of the transmitter.
5. Connect the AC mains voltage wires to the power supply module terminals marked with N and L.
6. Attach the grounding wire to the grounding terminal on the right-hand side of the transmitter.
7. Connect the power. The LED on the cover of the transmitter is lit continuously during normal operation.

**WARNING** Do not detach the power supply module from the transmitter when the power is on.

**WARNING** Do not connect the mains power to power supply module when it is not installed in the transmitter.

**WARNING** Always connect the protective ground terminal.
Warnings

Dieses Produkt entspricht der Niederspannungsrichtlinie (73/23 EWG).

- Das Netzmodul darf nur von einem dazu befugten Elektriker angeschlossen werden.
- Trennen Sie das Netzmodul nicht vom Messwertgeber, wenn der Strom eingeschaltet ist.
- Verbinden Sie das Netzmodul nur mit der Spannungsquelle, wenn es im Messwertgeber 907023 montiert ist.
- Das Erdungskabel muss zum Schutz immer angeschlossen sein.

Ce produit est conforme à la Directive relative à la Basse Tension (73/23 EEC).

- Seul un électricien compétent est habilité à raccorder le module d’alimentation au secteur.
- Ne pas détacher le module d’alimentation du transmetteur lorsqu’il est en service.
- Ne pas raccorder le secteur au module d’alimentation lorsque celui-ci n’est pas installé dans le transmetteur 907023.
- Toujours raccorder un bornier de protection à la terre.

Tämä tuote on pienjännitedirektiivin (73/23 EEC) mukainen.

- Vaihtovirtaliitännän saa kytkeä tehonsyöttömoduuliin ainoastaan valtuutettu sähköasentaja
- Älä irrota tehonsyöttömoduulia lähetystästä, kun virta on kytkettyä.
- Älä kytke verkkovirtaa tehonsyöttömoduuliin, jos kyseistä moduulia ei ole asennettu 907023 lähetimeen.
- Kytke aina maadoitusliitimet.

Denna produkt uppfyller kraven i direktivet om lågspänning (73/23 EEC).

- Nätanslutningen (växelströmsanslutningen) får bara anslutas till strömförsörjningsmodulen av en behörig elektriker.
- Ta inte loss strömförsörjningsmodulen från mätaren när strömmen är på.
- Anslut inte strömförsörjningsmodulen till nätet när den inte är installerad i 907023-mätaren
- Anslut alltid en skyddande jordningsplint.
Questo prodotto é conforme alla Direttiva sul basso voltaggio (73/23 CEE).

- La conduttura elettrica puó essere collegata al modulo di alimentazione elettrica soltanto da un elettricista autorizzato.
- Non staccare l’alimentazione elettrica dal trasmettitore quando é acceso.
- Non collegare la corrente elettrica al modulo di alimentazione elettrica se non é installato nel trasmettitore 907023.
- Collegare sempre il morsetto protettivo a terra!

Dette produkt er i overensstemmelse med direktivet om lavspænding (73/23 EØS).

- Netstrømsskoblingen til må kun tilsluttes strømforsyningsmodulet af en autoriseret elinstallatør
- Strømforsyningsmodulet må ikke løsgøres fra senderen, mens spændingen er sluttet til.
- Slut ikke netspændingen til strømforsyningsmodulet, når det ikke er installeret i 907023-senderen
- Forbind altid den beskyttende jordklemme!

Dit product voldoet aan de eisen van de richtlijn 73/23 EEG (Laagspanningsrichtlijn).

- De stroom kan aan de stroomtoevoer module aangesloten worden alleen door een bevoegde monteur.
- Het is niet toegestaan de stroomtoevoer module van de transmitter los te koppelen wanneer de stroom aan is.
- Het is niet toegestaan de stroom aan de stroomtoevoer module aan te sluiten als deze niet in een 907023-transmitter is gemonteerd.
- Altijd beschermend aardcontact aansluiten!

Este producto cumple con la directiva de bajo voltaje (73/23 EEC).

- La conexión de la alimentación principal al módulo de alimentación sólo puede realizarla un electricista autorizado.
- No desenchufe el módulo de alimentación del transmisor cuando esté encendido.
- No conecte la alimentación principal al módulo de alimentación cuando no esté instalado en el transmisor 907023.
- Conecte siempre el terminal de protección de conexión a tierra.

See toode vastab madalpinge direktiivile (73/23 EEC).

- Voolukaabli võib vooluallika mooduli külge ühendada ainult volitatud elektrik.
- Ärge ühendage vooluallika moodulit saatja küljest lahti, kui vool on sisse lülitatud.
- Ärge ühendage voolukaablit vooluallika mooduli külge, kui seda pole 907023-tüüpi saatjasse paigaldatud.
- Ühendage alati kaitsev maandusklemm!
Ez a termék megfelel a Kisfeszültségű villamos termékek irányelvnek (73/23/EGK).

- A hálózati feszültséget csak feljogosított elektrotechnikus csatlakoztathatja a tápegysémodulra.
- A bekapcsolt távadóról ne csatolja le a tápegysémodult.
- Ne csatlakoztassa a hálózati feszültséget a tápegysémodulhoz, ha az nincs beépítve a 907023 távadóba.
- Feltétlenül csatlakoztasson földelő védőkapcsot!

Šis produktas atitinka direktyvą dėl žemos įtampos prietaisų (73/23/EB).

- Elektros tinklą su energijos tiekimo moduli sujungti gali tik igaliotas elektrikas.
- Niekada neišminkite energijos tiekimo modulo iš siųstuvo, kai maitinimas yra įjungtas.
- Jei energijos tiekimo modulis néra įmontuotas 907023 siųstuve, nejunkite jo į elektros tinklą.
- Visada prijunkite prie apsauginės įžeminimo jungties!

Šis produkts atbilst Zemsprieguma direktīvai (73/23 EEC).

- Strāvas pieslēgumu var pieslēgt pie barošanas avota modula tikai autorizēts elektrikis.
- Neatvienot barošanas avota moduli no raidītāja, kad pieslēgta strāva.
- Nepievienot strāvu barošanas avota modulim, ja tas nav uzstādēts 907023 raidītājā
- Vienmēr pievienot aizsargājošu iezemētu terminālu!

Ten produkt speļnia wymogi Dyrektywy niskonapięciowej (73/23 EEC).

- Napięcie zasilające powinno zostać podłączone do modułu zasilacza tylko przez wykwalifikowanego elektryka.
- Nie wolno odłączać modułu zasilacza od nadajnika, kiedy zasilanie jest włączone.
- Nie wolno podłączać napięcia zasilającego do modułu zasilacza, kiedy nie jest on zamontowany w nadajniku 907023.
- Zawsze należy podłączać zabezpieczający zacisk uziemiający!

Tento výrobek vyhovuje Směrnici pro nízké napětí (73/23 EEC).

- Připojení síťového napájení k napájecímu modulu smí provádět pouze oprávněný elektrikář.
- Neodpojujte napájecí modul od snímače při zapnutém napájení.
- Nepřipojujte síťové napájení k napájecímu modulu, pokud není instalován ve snímači 907023.
- Vždy zapojte ochrannou zemnici svorku!
Galvanic Isolation for Output

If galvanic isolation of the power supply line from the output signals is needed, transmitter can be ordered with optional output isolation module. This module prevents harmful grounding loops.

**NOTE**
Output isolation module is not needed when using the power supply module.

![Figure 29: Galvanic Output Isolation Module](image1)

The following number refers to Figure 29:

1️⃣ Output isolation module

---

Third Analog Output

![Figure 30: Third Analog Output](image2)

The following numbers refer to Figure 30:

1️⃣ Flat cable pins
2️⃣ Screw terminals for signal line
3️⃣ DIP switches to select the output mode and range
Installation and Wiring

1. Disconnect the power. In case the analog output module is installed in the factory, continue with the step 4.

2. Open the transmitter cover and fasten the analog output module to the position for MODULE 2 with four screws. Refer to Figure 2 on page 19.

3. Connect the flat cable between the analog output module and the motherboard's connector for MODULE 2.

4. Take out the protective plug from the cable gland and thread the wires.

5. Connect the wires to the screw terminals marked with Ch+ and Ch-.

6. Select the current/voltage output by setting ON either of the switches 1 or 2.

7. Select the range by setting ON one of the switches 3 ... 7.

NOTE

Only one of the switches 1 and 2 can be ON at a time.

Only one of the switches 3 ... 7 can be ON at a time.

<table>
<thead>
<tr>
<th>OFF</th>
<th>ON</th>
<th>Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Current output selection, ON=Current output selected</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>Voltage output selection, ON=Voltage output selected</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>0...20 mA selection, ON= 0...20 mA selected</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>4... 20 mA selection, ON= 4...20 mA selected</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>0..1 V selection, ON=0...1 V selected</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>0...5 V selection, ON=0...5 V selected</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>0...10 V selection, ON= 0...10 V selected</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>For service use only, keep always in OFF position.</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>Channel 3</td>
</tr>
</tbody>
</table>

Figure 31 Third analog output selection

8. Connect the power.

9. Select the quantity and scale the channel via the serial line or display/keypad, see section Analog Output Quantities on page 109. For testing the analog output, see section Analog Output Tests on page 111. For fault indication setting, see section Analog Output Fault Indication Setting on page 112.
Relays

Transmitter can be equipped with one or two configurable relay modules. Each module contains two configurable relays. See the contact ratings in section Technical Specifications of Optional Modules on page 153.

Installation and Wiring

1. Disconnect the power and open the transmitter cover. In case the relay-module is installed in the factory, continue with step 5.
2. Attach the relay module to the bottom of the housing with four screws. See the position in Figure 2 Seite 19.
3. When the mains power is in use attach the grounding wire to the grounding terminal.
4. Connect the flat cable between the relay module and the MODULE 1 or MODULE 2 pins of the motherboard.
5. Take out the protective plug from the cable gland and thread the relay wires.
6. Connect the wires to the screw terminals: NO, C, NC. Refer to section Selecting the Activation State of the Relay unterhalb.
7. Connect the power and close the cover.

Selecting the Activation State of the Relay

The middlemost C terminal and either one of the terminals NO/NC must be connected. The polarity can be freely selected.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NO</td>
<td>Normally open</td>
</tr>
<tr>
<td>C</td>
<td>Common relay</td>
</tr>
<tr>
<td>NC</td>
<td>Normally closed</td>
</tr>
</tbody>
</table>

Relay NOT activated: C and NC outputs are closed, NO is open
Relay IS activated: C and NO outputs are closed, NC is open.

NOTE

For instructions on how to operate the relay (for example, select quantity for the relay output and set the relay setpoints) see section Operation of Relays on page 113.
Figure 32  Relay Module

The following numbers refer to Figure 32:

1 = Indication led for the relay 1 or 3  
2 = Relay test buttons  
3 = Flat cable pins  
4 = Indication led for relay 2 or 4

**WARNING**  
The relay module may contain dangerous voltages even if the transmitter power has been disconnected. Before opening the transmitter you must switch off both the transmitter and the voltage connected to the relay terminals.

**WARNING**  
Do not connect the mains power to relay unit without grounding the transmitter.
RS-422/485 Interface

Figure 33   RS-485 Module

The following numbers refer to Figure 33:
1  =  Flat cable pins
2  =  Selection switches
3  =  Screw terminals for wiring

Installation and Wiring

1. Disconnect the power. In case the RS-485-module is installed in the factory, continue with the item 4.
2. Open the transmitter cover and attach the RS-485 module to the bottom of the housing with four screws.
3. Connect the flat cable between the RS-485 module and the motherboard's pins MODULE1 (Communications).
4. Pull the network wirings through the cable gland.
5. Connect the twisted pair wires (1 or 2 pairs) to the screw terminals as presented in Table 4 unterhalb:

<table>
<thead>
<tr>
<th>Screw terminal</th>
<th>Data line (2-wire RS-485)</th>
<th>Data line (4-wire RS-485/422)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(not connected)</td>
<td>RxB</td>
</tr>
<tr>
<td>2</td>
<td>(not connected)</td>
<td>RxA</td>
</tr>
<tr>
<td>3</td>
<td>Data pair shield</td>
<td>Data pair shield</td>
</tr>
<tr>
<td>4</td>
<td>B</td>
<td>TxB</td>
</tr>
<tr>
<td>5</td>
<td>A</td>
<td>TxA</td>
</tr>
</tbody>
</table>
6. If you use RS-485 (or RS-422) to connect just one transmitter to a master computer, enable the internal termination of transmitter by switching switches 1 and 2 ON. Make sure that the master's end of the line is also terminated (by using master's internal termination or with a separate terminator).

If you are connecting many transmitters to the same RS-485 bus, make sure that switches 1 and 2 are OFF and terminate the bus with separate terminators at both ends. This allows removing any transmitter without blocking the bus operation.

**NOTE**

If you use the internal termination of the transmitter at the end of the RS-485 bus (instead of using separate terminators) removing that transmitter will block the bus operation.

7. Use the bus type (4-wire/2-wire) to select the selection switch 3.

In 4-wire mode RS-485 master sends data to the transmitter through terminals RxA and RxB and receives data from transmitter through terminals TxA and TxB.

![4-Wire RS-485 Bus Diagram](image)

**Figure 34** 4-Wire RS-485 Bus

**Table 5** 4-Wire (Switch 3: On)

<table>
<thead>
<tr>
<th>RS-485 master</th>
<th>Data</th>
<th>TRANSMITTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>TxA</td>
<td>→</td>
<td>RxA</td>
</tr>
<tr>
<td>TxB</td>
<td>→</td>
<td>RxB</td>
</tr>
<tr>
<td>RxA</td>
<td>←</td>
<td>TxA</td>
</tr>
<tr>
<td>RxB</td>
<td>←</td>
<td>TxB</td>
</tr>
</tbody>
</table>
Table 6  2-Wire (Switch 3: Off)

<table>
<thead>
<tr>
<th>RS-485 master</th>
<th>Data</th>
<th>TRANSMITTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>↔</td>
<td>A</td>
</tr>
<tr>
<td>B</td>
<td>↔</td>
<td>B</td>
</tr>
</tbody>
</table>

8. When operating in communication mode RS-422, set both switches 3 and 4 to ON position (4-wire wiring is required for RS-422 mode).

9. Connect the power and close the cover.

**LAN Interface**

The optional LAN interface enables an Ethernet connection to the transmitter. The LAN interface provides the same capabilities as the serial connection. The user can connect to the transmitter using the MI70 Link software, or by using a telnet client program such as Hyperterminal. When the LAN Interface is in use, serial communication using the User Port is disabled.

The LAN interface module must be installed at the factory (when ordering the transmitter). Once installed, the module is automatically used by the transmitter. The physical connection to the network is made to the RJ45 connector on the LAN interface module, using a standard twisted pair Ethernet cable (10/100Base-T). Transmitters with the optional LAN interface are delivered pre-installed with a suitable cable and cable gland.
The LAN interface can use both static and dynamic network settings. If the interface is configured to use dynamic settings, the network where the LAN interface is connected must have a DHCP server that provides the settings.

The network configuration can be done using the optional display and keypad, or by using the service port. For instructions, see section LAN Communication on page 74. The LAN interface also provides a web configuration interface, which you can access by entering the IP address of the LAN interface in the address field of a web browser. For instructions on how to verify the current settings and status of the LAN interface, see section Device Information on page 99.

![Image of LAN Interface Module]

**Figure 35**  LAN Interface Module

The following numbers refer to Figure 35 above:

1 = Flat cable connector
2 = RJ45 connector with indicator LEDs for link and activity

**WLAN Interface**

The optional WLAN interface enables a wireless Ethernet connection (IEEE 802.11b) to the transmitter. The interface supports Wired Equivalent Privacy (WEP) and Wi-Fi Protected Access (WPA). For WEP, 64 and 128 bit encryption is supported, with open system or shared key authentication. WPA is used in the Pre-Shared Key (PSK) mode, with either TKIP or CCMP protocol.

The WLAN interface provides the same capabilities as the serial connection. The user can connect to the transmitter using the MI70 Link software, or by using a telnet client program such as
Hyperterminal. When the WLAN Interface is in use, serial communication using the User Port is disabled.

Similarly to the LAN Interface, the WLAN interface can use both static and dynamic network settings. If the interface is configured to use dynamic settings, the network where the WLAN interface is connected must have a DHCP server that provides the settings.

The WLAN interface also provides a web configuration interface, which you can access by entering the IP address of the WLAN interface in the address field of a web browser.

![WLAN Interface Module](image)

**Figure 36   WLAN Interface Module**

The following numbers refer to Figure 36 above:

1 = Flat cable connector
2 = Connector for antenna cable (connected to transmitter cover)

**Attaching the WLAN Antenna**

The LAN interface module must be installed at the factory (when ordering the transmitter. Before taking the transmitter into use, the user must attach the antenna of the WLAN interface into the RP-SMA connector on the transmitter cover. The location of the antenna is shown in Figure 74 on page 159.

**Data Logger Module**

The optional data logger module extends the data storage for the measurement data. When the data logger is present, this storage is automatically used by the transmitter. The stored data can be browsed...
using the optional display module, and accessed through the serial connections. See sections Graphic History on page 62 and Data Recording on page 103.

The data logger module contains non-volatile flash memory providing 4 years 5 months of storage for 3 parameters at a 10 second sampling interval. When the memory is full, the data recording will not stop. Instead, the oldest data is overwritten. For each parameter and observation period, the module stores the minimum and maximum values during the interval, as well a data trend value that is averaged from samples taken during the interval (see Table 7 on page 58).

### Table 7 Observation Periods and Resolution

<table>
<thead>
<tr>
<th>Observation Period</th>
<th>Period for Trend/Max/Min Calculations (Resolution)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 minutes</td>
<td>10 seconds</td>
</tr>
<tr>
<td>3 hours</td>
<td>90 seconds</td>
</tr>
<tr>
<td>1 day</td>
<td>12 minutes</td>
</tr>
<tr>
<td>10 days</td>
<td>2 hours</td>
</tr>
<tr>
<td>2 months</td>
<td>12 hours</td>
</tr>
<tr>
<td>1 year</td>
<td>3 days</td>
</tr>
<tr>
<td>4 years</td>
<td>12 days</td>
</tr>
</tbody>
</table>

The quantities that are logged are the same that have been selected for measurement using the display/keypad or the serial line. When taking the transmitter into use, verify that the desired quantities are selected. If you change the quantities later, the transmitter will start logging the new quantities, and stop logging the quantities that are no longer selected. Changing the quantities does not delete any measurement data that is already in memory.

The data logger module has a real time clock with a battery back-up. The clock has been set to the Coordinated Universal Time (UTC) at the factory, and its time cannot be set by the user. The data that is stored in the logger's memory is timestamped using the logger's clock.

When date and time are set on the transmitter, they are stored to the transmitter's memory as an offset from the time on the logger's clock. When browsing the stored data, the time offset is applied to the timestamps shown in the graphical history, and data outputted from the serial port. The timestamps in the data logger's memory remain as they were originally stored.

You can compensate for the clock drift (less than ±2 min/year) by setting the time on the transmitter. This updates the time offset used on the display and the serial port. You can set the time by using the keypad/display or the serial commands.
Figure 37  Data Logger Module

The following numbers refer to Figure 37 above:
1 = Flat cable pins
2 = Battery

After a reset or a power up, it will usually take at least 10 seconds before the data logger module is initialized. The real time clock and the data logging and reading functions are not available before the initialization is complete.

The indicator LED on the module will blink green during normal operation. If the LED is lit in red color, there is a problem with the module. The transmitter will also indicate the problem by activating the "Add-on module connection failure" error. If the module is not operating correctly, the transmitter must be sent to JUMO for maintenance.

The data logger module must be installed at the factory (when ordering the transmitter. Once installed, the module is automatically used by the transmitter. When the module requires a new battery, the transmitter must be sent to JUMO for maintenance.
8-Pin Connector

![Diagram of 8-Pin Connector](image)

**Figure 38**  Wiring of Optional 8-Pin Connector

**Table 8**  Wiring of 8-Pin Connector

<table>
<thead>
<tr>
<th>PIN/Terminal</th>
<th>Wire</th>
<th>Serial Signal</th>
<th>Analog Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>RS-232 (EIA-232)</td>
<td>RS-485 (EIA-485)</td>
</tr>
<tr>
<td>1</td>
<td>White</td>
<td>Data out TX</td>
<td>A</td>
</tr>
<tr>
<td>2</td>
<td>Brown</td>
<td>(serial GND)</td>
<td>(serial GND) Signal GND (for both channels)</td>
</tr>
<tr>
<td>3</td>
<td>Green</td>
<td>-</td>
<td>Ch 2+</td>
</tr>
<tr>
<td>4</td>
<td>Yellow</td>
<td>-</td>
<td>Ch 1 +</td>
</tr>
<tr>
<td>5</td>
<td>Grey</td>
<td>Supply -</td>
<td>Supply -</td>
</tr>
<tr>
<td>6</td>
<td>Pink</td>
<td>Supply +</td>
<td>Supply +</td>
</tr>
<tr>
<td>7</td>
<td>Blue</td>
<td>Data in RX</td>
<td>B</td>
</tr>
<tr>
<td>8</td>
<td>Shield/Red</td>
<td>Cable shield</td>
<td>Cable shield</td>
</tr>
</tbody>
</table>

60
CHAPTER 4
OPERATION

This chapter contains information that is needed to operate this product.

Getting Started

Within a few seconds after power-up the LED on the cover of the transmitter is lit continuously indicating normal operation. When using the optional display and turning the transmitter on the first time, the language selection menu window opens. Select the language with ▼▲ arrow buttons and press the SELECT button (the left-hand button).

The pressure has an effect on humidity calculations and accuracy. Therefore, accurate calculations can be achieved only when the ambient pressure is taken into consideration. For instructions on how to set the pressure, see section Pressure Compensation Setting on page 93.

Display/Keypad (Optional)

Basic Display

Display shows you the measurement values of the selected quantities in the selected units. You can select 1 ... 3 quantities for the numerical basic display (see section Changing Quantities and Units on page 90.)
Figure 39 Basic Display

The following numbers refer to Figure 39 oben:

1 = The Info shortcut button, see section Device Information on page 99
2 = The Graph shortcut button, see section Graphic History on page 62
3 = Quantities selected for display

NOTE From any view, a four-second press on the right-hand function button takes you directly to the basic display.

Graphic History

The graphical display shows the data trend or min/max graph of the selected quantities, one at a time. The graph is updated automatically while measuring.

Trend graph: Shows you a curve of average values. Each value is a calculated average over a period. See Table 9 on page 63 unterhalb.
**Max/min graph:** Shows you the minimum and maximum values in a form of curve. Each value is max/min over a time period. See Table 9 unterhalb.

### Table 9  Periods for Trend and Max/Min Calculations

<table>
<thead>
<tr>
<th>Observation Period</th>
<th>Period for Trend/Max/Min Calculations (Resolution)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 minutes</td>
<td>10 seconds</td>
</tr>
<tr>
<td>3 hours</td>
<td>90 seconds</td>
</tr>
<tr>
<td>1 day</td>
<td>12 minutes</td>
</tr>
<tr>
<td>10 days</td>
<td>2 hours</td>
</tr>
<tr>
<td>2 months</td>
<td>12 minutes</td>
</tr>
<tr>
<td>1 year</td>
<td>3 days</td>
</tr>
<tr>
<td>4 year*</td>
<td>12 days</td>
</tr>
</tbody>
</table>

* Shows the maximum logging period of the data logger module (available when data logger module is installed)

Use the following functions in the graphical display:

- Press the NEXT button to change between the trend graph and max/min graph for the quantities selected for display.
- Press the EXIT button to return to the basic display.
- Press the ▼▲ arrow buttons to zoom in and out in the graph window.
- Press the ◀► arrow buttons move the cursor (vertical bar) along the time axis. The cursor mode allows you to observe individual measuring points. The numerical value at the cursor position is shown at the left upper corner. The right upper corner shows the time from the present to the chosen moment (without the logger module), or the date and time at the cursor position (when the logger module is installed).
- If the optional data logger module is installed, you can scroll the cursor off the screen to move to a new point on the time axis. The new date will be displayed, and the cursor will be centered at the date where the cursor scrolled off the screen.

![Figure 41 Graphical Display with Data Logger](image-url)
The time that is shown below the graph is adjusted with the current time offset of the transmitter. If you change the transmitter’s date and time setting, the displayed timestamps in the history graph change accordingly. For an explanation of the effect of changing the date and time manually, see section Data Logger Module on page 57.

Table 10  Graph Information Messages in Cursor Mode

<table>
<thead>
<tr>
<th>Message</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power outage</td>
<td>Power failure (marked also with dashed vertical line)</td>
</tr>
<tr>
<td>No data</td>
<td>Quantity has not been selected for the display</td>
</tr>
<tr>
<td>Device failure</td>
<td>General device failure</td>
</tr>
<tr>
<td>T meas. failure</td>
<td>Temperature measurement/sensor failure</td>
</tr>
<tr>
<td>RH meas. failure</td>
<td>Humidity measurement/sensor failure</td>
</tr>
<tr>
<td>Adj. mode active</td>
<td>Adjustment mode active (data recorded in the adjustment mode is not displayed)</td>
</tr>
</tbody>
</table>

A question mark after time tells you that at least one power failure (dashed vertical line) has occurred after the chosen moment. In this case, the exact time difference between the present and the cursor position is not exactly known.

**Menus and Navigation**

You can change settings and select functions in the menus.

1. Open the MAIN MENU by pressing any of the ▼▲◄► arrow buttons in the basic (numeric) display mode.
2. Move in the menus by using the ▲▼ arrow buttons.
3. Open a submenu with ► button.
4. Press ◀ to return to the previous level.
5. Function button EXIT returns you back to the basic display.
Some menu items, such as Purge in the Measuring menu, are only shown if supported by the transmitter and the installed options.

Changing the Language

1. Go back to the basic display by keeping the right-hand \( \text{button pressed for four seconds.} \)

2. Open the Main menu by pressing any of the \( \text{\textup{▼ ▲◄►}} \) buttons.

3. Scroll to the System menu option, and press the \( \text{►} \) button. The menu option is indicated with the wrench \( \text{symbol.} \)

4. Scroll to the Language menu option, and the left-hand \( \text{button. The menu option is indicated with the flag \( \text{symbol.} \)

5. Select the language with the \( \text{\textup{▼ ▲}} \) buttons, and confirm the selection by pressing the left-hand \( \text{button.} \)

6. Press the right-hand \( \text{button to exit to the basic display.} \)

Figure 42   Main Menus
Rounding Setting

Round off one decimal by using the Rounding function. The default setting is rounding on. Rounding has no effect on quantities without decimals.

1. Open the MAIN MENU by pressing any of the ▼▲◄► arrow buttons.
2. Select Display and confirm by pressing the ► arrow button.
3. Select Rounding and press ON/OFF button.
4. Press EXIT to return to the basic display.

Display Backlight Setting

As a default the display backlight is always on. In the automatic mode the backlight stays on for 30 seconds from the last press of any button. When pressing any button, the light turns on again.

1. Open the MAIN MENU by pressing any of the ▼▲◄► arrow buttons.
2. Select Display, press the ► arrow button.
3. Select Backlight, press the CHANGE button.
4. Select On/Off/Automatic, press the SELECT button.
5. Press EXIT to return to the basic display.

Display Contrast Setting

1. Open the MAIN MENU by pressing any of the ▼▲◄► arrow buttons.
2. Select Display, press the ► arrow button.
3. Select Contrast, press the ADJUST button.
4. Adjust the contrast by pressing the◄► arrow buttons.
5. Press OK and EXIT to return to the basic display.

Keypad Lock (Key guard)

This function locks the keypad and prevents unintentional key presses.

1. Keep pressing the left-hand function button for 4 seconds to lock the keypad (at any display).
2. To unlock the keypad, press the OPEN button for 4 seconds.
Menu PIN Lock

You can prevent unauthorized changes of the device settings by activating the menu PIN lock. When this function is activated, the basic display and graphical view are available but access to the menus is locked. The key symbol indicates the activation of this feature.

1. Open the MAIN MENU by pressing any of the ▼▲◄► arrow buttons.
2. Select System, press the ► arrow button.
3. Select Menu PIN, press the ON button.
4. Enter a PIN code by using the ▼▲ arrow buttons. Press OK to confirm the setting. Now the PIN lock is on and a key symbol is shown in a display.
5. Press EXIT to return to the basic display. Returning to the menu is possible only by entering the correct PIN code.

When you want to turn off the PIN lock, go to the menu by giving the PIN code and select System, Menu PIN, press OFF button.

In case you have forgotten the PIN code, open the transmitter cover and press the ADJ button once. Wait for a few seconds and the adjustment menu opens. Select Clear menu PIN, press CLEAR.

NOTE  You can also disable the keypad completely with serial command LOCK.

Factory Settings

Use the display/keypad to restore the factory settings. This operation does not affect the adjustments. Only settings available in the menus are restored.

1. Press any of the arrow buttons to open the MAIN MENU.
2. Select System by pressing the ► arrow button.
3. Select Factory settings and press the REVERT button to confirm your selection. Press the YES button to reset all settings to the factory defaults.

See section General Settings on page 90 for a description of the other menu options.
Display Alarms

The Display Alarm feature provides two independently configurable alarms for transmitters with the display/keypad option. Each alarm tracks a selected quantity, with a freely configurable low and high limit. Each alarm also has a configurable hysteresis value to prevent unnecessary triggering when the measurement fluctuates around an alarm limit. The alarms can be configured for any quantity supported by the transmitter. The configuration of the Display Alarms can only be done using the display/keypad option.

An alarm is activated when the selected quantity goes higher than the high limit, or lower than the low limit, much in the same way as the relays. When an alarm is activated, an alarm note is displayed on the display, and the lights of the display will blink.

![Display Alarm Active](image)

**Figure 43** Display Alarm Active

Multiple alarms can be active at the same time; the alarm that was triggered first will be shown on the display. The next active alarm is revealed when the currently shown alarm is acknowledged by pressing the OK button.

Note that activated alarms are only shown on the screen. There are no alarm messages output to the serial line, or markers placed in the graph data. After an alarm has been acknowledged, you must refer to the data graphs to see when the measured quantities have exceeded the limits.

Configuring a Display Alarm

1. Enter the Main Menu by pressing an arrow key on the keypad.
2. Use the arrow keys to select Display, followed by Alarms, to open the Display Alarms menu. The Display Alarms menu shows the currently enabled and disabled alarms.
3. Use the arrow keys to select an alarm to configure. The alarm editing page opens.

**NOTE**
Changes you do on the alarm editing page will take effect immediately, and may cause an alarm to appear on the screen.

4. To select a quantity for the alarm, press the **Change** button and select the quantity from the list.

5. To modify or remove the alarm limit values, move the selection over the **Act. above** or **Act. below** field and press the **Set** button. You will be prompted to **Modify** or **Remove** the value.

6. Set a suitable **Hysteresis** value to prevent the alarm from being triggered unnecessarily by small measurement changes that pass the alarm limit repeatedly.

7. Set or clear the **Alarm enable** checkbox to enable or disable the alarm.

8. Press the **Exit** button to leave the alarm configuration screen and return to the basic view.

**Figure 44** Display Alarms

**Figure 45** Modifying an Alarm Limit
MI70 Link Program for Data Handling

The recorded data can be transferred to a PC by using MI70 Link program. You can examine the recorded data easily in Windows environment and transfer it further to a spreadsheet program (such as Microsoft Excel) or virtually to any Windows program in numeric or graphical format. MI70 Link program allows you also to monitor transmitter readings directly with a PC (real-time window function).

Use a MI70 Link version 1.2, or a newer one, to be able to utilize all the functions of transmitter.

1. Connect your PC to the transmitter using the serial interface, LAN interface, or the WLAN interface. Refer to sections Serial Line Communication on page 70, and LAN Communication on page 74.

2. Check that the transmitter is powered.

3. Start the MI70 Link program.

4. If you are connecting through the LAN or WLAN interface, you must enter the IP address of the transmitter. You can check the IP address using the device information display; see section Device Information on page 99. If you do not have the display/keypad option, you can use the NET command on the serial line; see section IP Configuration on page 74.

   If you are connecting through the serial interface, the program detects the connection type automatically; there is usually no need to select a COM port manually.

The MI70 Link program, and the optional connection cables, are available from JUMO. See list of accessories in section Options and Accessories on page 156.

Serial Line Communication

Connect the serial interface by using either the user port or the service port.

For permanent interfacing to host system, use the user port. You can change the serial settings and operate in RUN, STOP and POLL modes.

For temporary connections, use the service port. The service port is always available with fixed serial settings.
Figure 46   Service Port Connector and User Port Terminal on Mother Board

The following numbers refer to Figure 46 oben:

1 = Service port connector
2 = User port terminals

User Port Connection

Use a suitable serial cable between the user port RxD, GND and TxD screw terminals and the PC serial port, see Figure 47 on page 72.

Table 11  Default Serial Communication Settings for the User Port

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bauds</td>
<td>4800</td>
</tr>
<tr>
<td>Parity</td>
<td>Even</td>
</tr>
<tr>
<td>Data bits</td>
<td>7</td>
</tr>
<tr>
<td>Stop bits</td>
<td>1</td>
</tr>
<tr>
<td>Flow control</td>
<td>None</td>
</tr>
</tbody>
</table>
Connections to pins 4, 6, 7 and 8 on PC serial port are required only if you are using software requiring hardware handshaking. After power-up the transmitter (in STOP-mode) outputs the software version and the command prompt.

```
TRANSMITTER/5.00
>
```

In RUN mode a measurement output starts immediately after power-up.

In POLL mode, the transmitter does not output anything after power-up (see section SMODE Seite 121).

**NOTE** User port cannot be used when the RS-485 module is connected.

### Service Port Connection

#### Connection Cables

To connect to the service port, you need a suitable cable with an RJ45 connector. Depending on the connections of your PC, you can either use the Serial Connection Cable or the USB-RJ45 Serial Connection Cable. The USB cable enables you to connect the transmitter to a PC via a standard type A USB port. Note that the USB cable does not enable high speed data transfer, since the bit rate is limited by the serial interface of the service port.
Installing the Driver for the USB Cable

Before taking the USB cable into use, you must install the provided USB driver on your PC. When installing the driver, you must acknowledge any security prompts that may appear. The driver is compatible with Windows 2000, Windows XP, Windows Server 2003, and Windows Vista.

1. Check that the USB cable is not connected. Disconnect the cable if you have already connected it.
2. Insert the media that came with the cable.
3. Execute the USB driver installation program (setup.exe), and accept the installation defaults. The installation of the driver may take several minutes.
4. After the driver has been installed, connect the USB cable to a USB port on your PC. Windows will detect the new device, and use the driver automatically.
5. The installation has reserved a COM port for the cable. Verify the port number, and the status of the cable, using the USB Instrument Finder program that has been installed in the Windows Start menu.

Windows will recognize each individual cable as a different device, and reserve a new COM port. Remember to use the correct port in the settings of your terminal program. If you are using the MI70 Link application, you do not need to check the COM port, as the MI70 Link detects the USB connection automatically.

There is no reason to uninstall the driver for normal use. However, if you wish to remove the driver files and all USB cable devices, you can do so by uninstalling the entry for USB Instrument Driver from the Add or Remove Programs (Programs and Features in Windows Vista) in the Windows Control Panel.

Using the Service Port

1. Unfasten the screws on the transmitter cover, and open the transmitter.
2. Connect the desired cable (serial interface cable or USB cable) to your PC and the service port connector on the transmitter. For the location of the service port, refer to Figure 46 Seite 71.
3. Open a terminal program and set the communication settings as follows:
Table 12  Communication Settings for the Service Port

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bauds</td>
<td>19200</td>
</tr>
<tr>
<td>Parity</td>
<td>None</td>
</tr>
<tr>
<td>Data bits</td>
<td>8</td>
</tr>
<tr>
<td>Stop bits</td>
<td>1</td>
</tr>
<tr>
<td>Flow control</td>
<td>None</td>
</tr>
</tbody>
</table>

For a detailed explanation of using a terminal program, see section Terminal Program Settings on page 76.

4. Power-up the transmitter.

LAN Communication

To enable LAN communication, a LAN or WLAN interface must be physically connected to the network, and the networking settings must be suitable for your network. For a description of interfaces, see sections LAN Interface on page 55 and WLAN Interface on page 56.

The LAN and WLAN interfaces both operate by accessing the serial interface (User Port) of the transmitter. All commands that are available using the serial interface are available through the LAN and WLAN interfaces; refer to section List of Serial Commands on page 85. For instructions on how to connect using a terminal program, see section Terminal Program Settings on page 76.

IP Configuration

The IP settings of the LAN and WLAN interfaces are described in Table 13. The current settings can be viewed on the serial line or using the device information display; see section Device Information on page 99.
Table 13  IP Settings for the LAN and WLAN Interfaces

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic configuration (DHCP)</td>
<td>If enabled, the transmitter will retrieve its network settings (including the IP Address) from a server in the network. If disabled, static network settings are used instead.</td>
</tr>
<tr>
<td>Web configuration</td>
<td>If enabled, the settings of the interface can be changed using a web browser. The configuration page can be accessed by browsing to the IP address of the transmitter.</td>
</tr>
<tr>
<td>IP Address</td>
<td>The four part network ID of the transmitter. Must be set manually if automatic configuration is not used. Example value: 192.168.0.222</td>
</tr>
<tr>
<td>Netmask</td>
<td>Used together with the IP address to determine which network the transmitter is a part of. Must be set manually if automatic configuration is not used. A common netmask is 255.255.255.0.</td>
</tr>
<tr>
<td>Gateway</td>
<td>IP address of the server that enables the transmitter to access other networks. Must be set manually if automatic configuration is not used. Example value: 192.168.0.1</td>
</tr>
<tr>
<td>MAC</td>
<td>The MAC address is the unique hardware address of the LAN or WLAN interface. Cannot be changed.</td>
</tr>
</tbody>
</table>

Using Display/Keypad

You can configure the IP settings of the LAN and WLAN interfaces using the display/keypad as follows:

1. Press any of the arrow buttons to open the MAIN MENU.
2. Press the ► arrow button to select Interfaces.
3. Press ► arrow button to select Network settings. There will be a delay as the transmitter refreshes the network information.
4. You are now in the Network Interface menu. Selecting the IP configuration option opens the IP configuration menu.
The Network Interface menu also allows you to enable or disable the Web configuration option, or Disconnect all users that are currently accessing the LAN or WLAN interface.

5. In the IP configuration menu, select Automatic configuration (DHCP), or enter the IP address, Netmask and Gateway manually. If automatic configuration is enabled, manual configuration cannot be done.

To enter a value manually, use the the ▲▼ arrow buttons to select the parameter to change, and press Change. A cursor will appear in the first digit. Move the cursor using the ◄► arrow buttons, and change the value under the cursor using the ▲▼ arrow buttons. Confirm the selection by pressing OK.

6. After configuring the desired parameters, press EXIT to return to the basic display.

Using Serial Line

Use the serial line command NET to view or set the network settings for the LAN and WLAN interfaces. You can also refresh the network information or disconnect all active connections.
NET [REFRESH] [DISCONNECT] [DHCP WEB] [DHCP IP SUBNET GATEWAY WEB]

where

REFRESH = Updates the network information and displays it
DISCONNECT = Disconnects all current sessions
DHCP = ON or OFF. Enables or disables the automatic IP configuration.
WEB = ON or OFF. Enables or disables the Web Configuration page.
IP = The four part network ID of the transmitter. Must be set manually if automatic configuration is not used.
SUBNET = Used together with the IP address to determine which network the transmitter is a part of. Must be set manually if automatic configuration is not used.
GATEWAY = IP address of the server that enables the transmitter to access other networks. Must be set manually if automatic configuration is not used.

Examples:

> net refresh
OK
DHCP : OFF
IP address : 192.168.0.101
Subnet mask : 255.255.255.0
Default gateway: 192.168.0.1
Web config. : OFF
MAC address : 00:40:9d:2c:d2:05
Telnet : Not connected
>

> net on off
OK
DHCP : ON
IP address : 192.168.0.104
Subnet mask : 255.255.255.0
Default gateway: 192.168.0.1
Web config. : OFF
MAC address : 00:40:9d:2c:d2:05
Telnet : Connected
OK
>
Wireless LAN Configuration

The settings of the WLAN interface are described in Table 14. The current settings can be viewed on the serial line or using the device information display; see section Device Information on page 99.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SSID</strong></td>
<td>The service set identifier (i.e. network name) of the wireless network to connect to. 1 ... 32 characters.</td>
</tr>
<tr>
<td><strong>Security type</strong></td>
<td>The security type of the wireless network. The options are:  &lt;br&gt; OPEN  &lt;br&gt; OPEN/WEP  &lt;br&gt; WPA-PSK/TKIP  &lt;br&gt; WPA-PSK/CCMP  &lt;br&gt; All other choices except OPEN require a security key; see below.</td>
</tr>
<tr>
<td><strong>Security key</strong></td>
<td>The encryption key or passphrase that is used with an encrypted network.</td>
</tr>
</tbody>
</table>

Using Display/Keypad

You can configure the Wireless LAN settings using the display/keypad as follows:

1. Press any of the arrow buttons to open the **MAIN MENU**.
2. Press the ► arrow button to select **Interfaces**.
3. Press the ► arrow button to select **Network settings**. There will be a delay as the transmitter refreshes the network information.
4. Press the ► arrow button to select **Wireless LAN settings**.
Figure 50  Wireless LAN Settings

5. The Name entry on the page shows the SSID of the currently selected wireless network. To change the SSID, press the SET button. Use the ▲▼ arrow buttons to change the character under the cursor, and ◄► arrow buttons to move the cursor. Press the OK button when done.

Figure 51  Entering Network SSID

6. To change the currently selected Network type, select the Type entry and press the Change button. Select the new type from the list and press the Select button.

Figure 52  Selecting the Wireless Network Type

7. If you have selected an encrypted network type (WEP or WPA), you must enter the security key to be used. Select the Key/passphrase entry and press the Set button. Enter the key in the same way as the SSID, and press the OK button. With the WEP encryption you must enter the encryption key in hexadecimal (10 hexdecimals for 64-bit encryption or 26 hexadecimals for 128-bit encryption). A WPA key must be 8 … 63 ASCII characters.
8. After setting the wireless network parameters, press the Exit button in the Wireless Network Settings menu. You will be asked to confirm the new settings. Note that when new settings are saved, all currently active WLAN connections are disconnected.

**Using Serial Line**

Use the serial line command **WLAN** to view or set the wireless network settings. If you set an encrypted network type, you will be asked to enter the security key. With the WEP encryption you must enter the encryption key in hexadecimal (10 hexadecimals for 64-bit encryption or 26 hexadecimals for 128-bit encryption) or with plain ASCII characters (5 characters for 64-bit encryption or 13 characters for 128-bit encryption). A WPA key must be 8 … 63 ASCII characters.

**WLAN [SSID TYPE]**

Where

<table>
<thead>
<tr>
<th>SSID</th>
<th>= The network name in 1 … 32 characters</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE</td>
<td>= The security type of the wireless network. The options are:</td>
</tr>
<tr>
<td></td>
<td>OPEN</td>
</tr>
<tr>
<td></td>
<td>OPEN/WEP</td>
</tr>
<tr>
<td></td>
<td>WPA-PSK/TKIP</td>
</tr>
<tr>
<td></td>
<td>WPA-PSK/CCMP</td>
</tr>
</tbody>
</table>

Examples:

```
>wlan ?
Network SSID : WLAN-AP
Type         : OPEN
>
>wlan accesspoint wpa-psk/tkip
Network SSID : accesspoint
Type         : WPA-PSK/TKIP
WPA-PSK phrase ? thequickbrownfox
Warning: Active connection will be disconnected.
Save changes (Y/N) ? y
OK
>```

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Telnet Settings

When a telnet connection is established via the LAN or WLAN interface, the session has the same communication mode, run interval, poll address and echo settings as the serial port (user port) session would have.

These settings can be changed using the display/keypad, using the serial line (user port or service port), or on-the-fly during the telnet session.

The display menu path to the telnet settings is:
Main menu ► Interfaces ► Network Interface ► Telnet settings.

The commands for changing the settings are SMODE, INTV, ADDR, and ECHO.

Web Configuration for LAN and WLAN

The LAN and WLAN interfaces both have a web configuration page that is accessible using a browser. If you have not disabled the page from the network settings, you can access it with a web browser at the IP address of the interface.

When accessing the web configuration page, you must first log in.

Username: user
Password: JUMO

The web configuration page provides similar network configuration options as the serial line and the display/keypad. It also has additional options for advanced users. For example, there are more options for securing the wireless network.

If these additional options are used, they will appear as custom configurations when viewed from the serial line or the display/keypad.
Figure 53   Web Configuration Interface for WLAN

Terminal Program Settings

The following instructions show a connection example with HyperTerminal program for the Microsoft Windows® operating system.

NOTE

HyperTerminal is not included with the Windows Vista operating system.

1. Start HyperTerminal. To get help for starting HyperTerminal, click Start, select Help to open Windows help, and search for "HyperTerminal".

2. In the New Connection window of the HyperTerminal, define a name for transmitter serial connection, for example "907023". Click OK.
3. Select the connection type using the **Connect using** pull down menu.

If you are connecting to the transmitter using the serial interface, select the PC communications port where the serial cable is connected and click **OK**. If you are using the USB-RJ45 cable to connect to the Service Port, check the communications port that the cable is using with the **USB Instrument Finder** program that has been installed in the Windows Start menu.

![Figure 54 Connecting Using Serial Interface](image1.png)

**Figure 54** Connecting Using Serial Interface

If you are connecting using the LAN or WLAN interface, select **TCP/IP (Winsock)**. Enter the IP address of the interface in the **Host address** field, and 23 as the **Port number**. Click **OK** to connect to the transmitter.

![Figure 55 Connecting Using a Network](image2.png)

**Figure 55** Connecting Using a Network
4. If you selected a serial port, you must match the port settings in the **Properties** window with the transmitter’s serial interface (user port or service port). If you are using the USB-RJ45 cable, you are connecting to the service port. Verify that **Flow control** is set to **None**. Click **OK** to start using the serial connection.

![Hyper Terminal Serial Port Settings](image)

**Figure 56** Hyper Terminal Serial Port Settings

5. Select **File → Save** in the HyperTerminal main window to save the connection settings. To use the saved settings later, start HyperTerminal, click cancel in the **New Connection** window, and select **File → Open**.
List of Serial Commands

The **bold** text in the brackets is the default setting. To issue a command, type it on your computer and press the Enter key.

### Table 15  Measurement Commands

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>Start the continuous outputting</td>
</tr>
<tr>
<td>S</td>
<td>Stop the continuous outputting</td>
</tr>
<tr>
<td>INTV [0 ... 255 S/MIN/H]</td>
<td>Set the continuous output interval (for RUN mode)</td>
</tr>
<tr>
<td>SEND [0 ... 99]</td>
<td>Output the reading once</td>
</tr>
<tr>
<td>SEND D</td>
<td>Outputting the reading with the raw data</td>
</tr>
<tr>
<td>SMODE [STOP/RUN/POLL]</td>
<td>Set the serial interface mode</td>
</tr>
<tr>
<td>SDELAY</td>
<td>View or set user port (RS232 or RS485) answer minimum delay</td>
</tr>
<tr>
<td>SERI [baud p d s]</td>
<td>User Port settings (Default: 4800 E 7 1) baud: 300 ... 115200</td>
</tr>
<tr>
<td>ADDR [0 ... 99]</td>
<td>Set the transmitter address (for POLL mode)</td>
</tr>
<tr>
<td>NET</td>
<td>View or set networking parameters for LAN and WLAN interfaces</td>
</tr>
<tr>
<td>WLAN</td>
<td>View or set wireless network parameters for WLAN interface</td>
</tr>
<tr>
<td>OPEN [0 ... 99]</td>
<td>Open a temporary connection to a POLL mode device</td>
</tr>
<tr>
<td>CLOSE</td>
<td>Close the temporary connection (Back to POLL mode)</td>
</tr>
</tbody>
</table>

### Table 16  Formatting Commands

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FORM</td>
<td>Set the output format of SEND and R commands</td>
</tr>
<tr>
<td>TIME</td>
<td>Set the time</td>
</tr>
<tr>
<td>DATE</td>
<td>Set the date</td>
</tr>
<tr>
<td>FTIME [ON/OFF]</td>
<td>Add time to SEND and R outputs</td>
</tr>
<tr>
<td>FDATE [ON/OFF]</td>
<td>Add date to SEND and R outputs</td>
</tr>
<tr>
<td>FST [ON/OFF]</td>
<td>Add the state of probe heating and chemical purge in connection with SEND and R commands</td>
</tr>
<tr>
<td>UNIT</td>
<td>Select the metric or non-metric output units</td>
</tr>
</tbody>
</table>

### Table 17  Data Recording Commands

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIR</td>
<td>Display recorded files</td>
</tr>
<tr>
<td>PLAY [0 ... 21] [START END]</td>
<td>Output recorded data file. Start and end times can only be specified if the data logger module is installed. The times must be given in the following format:</td>
</tr>
<tr>
<td>Command</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>DSEL</td>
<td>yyyy-mm-dd hh:mm:ss</td>
</tr>
<tr>
<td>DELETE</td>
<td>Select data recording and display quantities.</td>
</tr>
<tr>
<td>UNDELETE</td>
<td>Delete all data files, including the memory of the optional data logger module</td>
</tr>
<tr>
<td></td>
<td>Recover the deleted files that have not been overwritten</td>
</tr>
</tbody>
</table>

**Table 18 Chemical Purge Commands**

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUR</td>
<td>Set the automatic chemical purge</td>
</tr>
<tr>
<td>PURGE</td>
<td>Start the manual chemical purge</td>
</tr>
</tbody>
</table>

**Table 19 Calibration and Adjustment Commands**

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRH</td>
<td>Relative humidity calibration</td>
</tr>
<tr>
<td>CT</td>
<td>Temperature calibration</td>
</tr>
<tr>
<td>CTA</td>
<td>Additional temperature probe calibration</td>
</tr>
<tr>
<td>FCRH</td>
<td>Relative humidity calibration after sensor change</td>
</tr>
<tr>
<td>CTEXT</td>
<td>Give the text to calibration information field</td>
</tr>
<tr>
<td>CDATE</td>
<td>Set the calibration date</td>
</tr>
<tr>
<td>ACAL</td>
<td>Analog output calibration</td>
</tr>
</tbody>
</table>

**Table 20 Setting and Testing the Analog Outputs**

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMODE</td>
<td>View the analog output modes</td>
</tr>
<tr>
<td>ASEL</td>
<td>Select the parameters for the analog outputs</td>
</tr>
<tr>
<td>ITEST</td>
<td>Test the analog outputs</td>
</tr>
<tr>
<td>AERR</td>
<td>Change the analog error output values</td>
</tr>
</tbody>
</table>

**Table 21 Setting and Testing the Relays**

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RSEL</td>
<td>Set and view the relays</td>
</tr>
<tr>
<td>RTEST</td>
<td>Test the relays</td>
</tr>
</tbody>
</table>
Table 22 Other Commands

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>?</td>
<td>Output information about the device</td>
</tr>
<tr>
<td>??</td>
<td>Output information about the device in POLL mode</td>
</tr>
<tr>
<td>ECHO [ON/OFF]</td>
<td>Turn the serial interface echo ON/OFF</td>
</tr>
<tr>
<td>ERRS</td>
<td>List present transmitter errors</td>
</tr>
<tr>
<td>FILT</td>
<td>Set the result filtering</td>
</tr>
<tr>
<td>FIND</td>
<td>All devices in POLL mode send their addresses</td>
</tr>
<tr>
<td>HELP</td>
<td>List the most common commands</td>
</tr>
<tr>
<td>LOCK</td>
<td>Lock the menu and disable the keypad</td>
</tr>
<tr>
<td>PRES [hPa]</td>
<td>Set the value for pressure compensations</td>
</tr>
<tr>
<td>VERS</td>
<td>Display the software version information</td>
</tr>
<tr>
<td>XHEAT</td>
<td>Sensor heating</td>
</tr>
<tr>
<td>XPRES [hPa]</td>
<td>Set the value for pressure compensations, temporarily</td>
</tr>
</tbody>
</table>

Getting Measurement Message from Serial Line

Starting Continuous Outputting

R

Enter the R command to start the continuous output of measurements.

Example:

```
> r
RH= 60.5 %RH T= 23.7 'C Tdf= 15.6 'C Td= 15.6 'C a= 13.0 g/m3  x= 11.1 g/kg  Tw= 18.5 'C H2O= 17889 ppmV pw= 17.81 hPa pws= 29.43 hPa h= 52.3 kJ/kg  dT= 8.1 'C
```

If a value is too long to fit to the allocated space in the output, or if there is an error in outputting the quantity, the value is displayed with stars ‘*’.

Example:

```
RH=***.* %RH T= 31.0 'C
```

You can change the format of the output with the following commands:
- Outputting interval can be changed with the **INTV** command.
- Output message format can be changed with the **FORM** command.
- Status of chemical purge and probe heating can be added with the **FST** command.
- Date and time information can be added with commands **FDATE** and **FTIME**

**Stopping Continuous Outputting**

**S**

Use the **S** command to end the RUN mode. After this command all other commands can be used. You can also press the Esc button or reset the transmitter to stop the outputting.

See command **SMODE** to change the default (power-up) operation mode.

**Outputting Reading Once**

**SEND**

Use the **SEND** command to output the reading once in STOP mode. The output format depends on which parameters the transmitter can output.

**Examples:**

```
RH= 98.4 %RH T= 31.1 'C

RH= 98.4 %RH T= 31.1 'C Td= 36.0 'C Tdf= 36.0 'C a= 42.4 g/m3 x= 38.8 g/kg Tw= 30.8 'C ppm= 62414 pw= 59.53 hPa pws= 60.52 hPa h= 130.7 kJ/kg
```

**Outputting Reading with Raw Data**

**SEND D**

**Example:**

```
>send d
24.1720 15.0399 -3.5743 189.2324 15.0709 15.0399
23.9765
```
Where the readings (from the left) are:

24.1720 = Temperature of the humidity probe (°C)
15.0399 = RH (%RH)
-3.5743 = Tdf (°C)
189.2324 = Capacitance (pF)
15.0709 = RH raw: calculated from scaled capacitance (%RH)
15.0399 = Enhancement factor corrected RH (%RH)
23.9765 = Temperature of the additional temperature probe (optional) (°C)

Formatting Serial Line Message

FTIME and FDATE

FTIME and FDATE commands will enable/disable output of time and date to the serial line. To add time to R and SEND outputs enter:

FTIME [x]
To add date to R and SEND outputs enter:

FDATE [x]

where

x = ON or OFF

Example:

>send
RH= 98.4 %RH T= 31.0 'C
>ftime on
Form. time : ON
>send
03:47:59 RH= 98.4 %RH T= 31.0 'C
>fdate on
Form. date : ON
>send
2004-07-05 03:48:03 RH= 98.4 %RH T= 31.0 'C
>

FST

To output the state of optional probe heating and chemical purge in connection with SEND and R commands enter:

FST [x]
Where

\[ x = \text{ON or OFF (default)} \]

**Example:**

```
> fst on
Form. status : ON
> send
N  0 RH= 40.1 %RH T= 24.0 'C Td= 9.7 'C Tdf= 9.7 'C
a= 8.7 g/m3  x= 7.5
g/kg  Tw= 15.6 'C ppm= 11980 pw= 12.00 hPa pws= 29.91
hPa  h= 43.2 kJ/kg
> purge
Purge started, press any key to abort.
> send
S 134 RH= 40.2 %RH T= 24.1 'C Td= 9.8 'C Tdf= 9.8 'C
a= 8.8 g/m3  x= 7.5
g/kg  Tw= 15.7 'C ppm= 12084 pw= 12.10 hPa pws= 30.11
hPa  h= 43.5 kJ/kg
> 
```

For more information on chemical purge, see section Chemical Purge (Optional) on page 124.

Where the state of the probe is indicated by the following letters and values:

<table>
<thead>
<tr>
<th>N...xxx</th>
<th>Normal operation where hxxx=</th>
<th>Probe heat power</th>
</tr>
</thead>
<tbody>
<tr>
<td>X...xxx</td>
<td>Sensor heating where xxx=</td>
<td>Sensor temperature (°C)</td>
</tr>
<tr>
<td>H...xxx</td>
<td>Chemical purge where xxx=</td>
<td>Sensor temperature (°C)</td>
</tr>
<tr>
<td>S...xxx</td>
<td>Sensor cooling after purge</td>
<td>Sensor temperature (°C)</td>
</tr>
</tbody>
</table>

**General Settings**

**Changing Quantities and Units**

To change quantities and units use serial commands or the optional display/keypad. See Table 1 on page 16 for available quantities and Table 2 on page 17 for optional quantities.

| NOTE | Only the quantities selected when ordering the device can be selected as a display output quantity. |

**Using Display/Keypad**

Use display/keypad to select the display output quantities.

1. Press any of the arrow buttons to open the **MAIN MENU**.
2. Press the ► arrow button to select **Display**.
3. Press ► arrow button to select **Quantities**.
4. Select the quantity by using the ▲▼ arrow buttons. Confirm the selection by pressing **SELECT**. You can select 1 ... 3 display quantities at a time.
5. Press **EXIT** to return to the basic display.

To select display units:

1. Press any of the arrow buttons to open the MAIN MENU.
2. Press the ► arrow button to select **Display**.
3. Use the ▲▼ arrow buttons to select **Units**. Confirm the selection by pressing the right-hand arrow button.
4. Use the ▲▼ arrow buttons to select display units. Confirm the selection by pressing **CHANGE**. The unit changes from metric to non-metric or the other way round.
5. Press **EXIT** to return to the basic display.

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changing the display quantities/units (by using the display/keypad) has no effect on the serial output data.</td>
</tr>
</tbody>
</table>

**Using Serial Line**

Use the serial line command **FORM** to change the format or select a certain quantities for the output commands **SEND** and **R**. Use the serial line command **UNIT** to select metric or non-metric output units.

**FORM**

Use the serial line command **FORM** to change the format or select a certain quantities for the output commands **SEND** and **R**.

**FORM** [x]

where

\[ x = \text{Formatter string} \]

Formatter string consists of quantities and modifiers.

When entering the command, use the abbreviations of the quantities. For more information on quantities, see Table 1 and Table 2 Seite 16.
The modifiers are presented in Table 23 unterhalb.

### Table 23  FORM Command Modifiers

<table>
<thead>
<tr>
<th>Modifier</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>x.y</td>
<td>Length modifier (number of digits and decimal places)</td>
</tr>
<tr>
<td>#t</td>
<td>Tabulator</td>
</tr>
<tr>
<td>#r</td>
<td>Carriage-return</td>
</tr>
<tr>
<td>#n</td>
<td>Line feed</td>
</tr>
<tr>
<td>&quot;&quot;</td>
<td>String constant</td>
</tr>
<tr>
<td>#xxx</td>
<td>Special character, code &quot;xxx&quot; (decimal), for example #027 for ESC</td>
</tr>
<tr>
<td>U5</td>
<td>Unit field and length</td>
</tr>
<tr>
<td>ADDR</td>
<td>Transmitter address with two characters [00...99]</td>
</tr>
<tr>
<td>ERR</td>
<td>Error flags for P, T, Ta, RH [0000 ... 1111], 0 = no error</td>
</tr>
<tr>
<td>STAT</td>
<td>Transmitter status in 7 character field, for example:</td>
</tr>
<tr>
<td></td>
<td>N 0 no heating</td>
</tr>
<tr>
<td></td>
<td>h 115 probe heating active, power 115/255</td>
</tr>
<tr>
<td></td>
<td>H 159.0 purge heating active, temperature 159°C</td>
</tr>
<tr>
<td></td>
<td>S 115.0 purge cooling active, temperature 115°C</td>
</tr>
<tr>
<td></td>
<td>X 95.0 sensor heating active, temperature 95°C</td>
</tr>
<tr>
<td>SN</td>
<td>Transmitter serial number</td>
</tr>
<tr>
<td>TIME</td>
<td>Time [hh:mm:ss]</td>
</tr>
<tr>
<td>DATE</td>
<td>Date [yyyy-mm-dd]</td>
</tr>
<tr>
<td>OK</td>
<td>Pressure stability indicator, two characters [OK or &quot; &quot;]</td>
</tr>
<tr>
<td>CS2</td>
<td>Modulus-256 checksum of message sent so far, ascii encoded hexadecimal notation</td>
</tr>
<tr>
<td>CS4</td>
<td>Modulus-65536 checksum of message sent so far, ascii encoded hexadecimal notation</td>
</tr>
<tr>
<td>CSX</td>
<td>NMEA xor-checksum of message sent so far, ascii encoded hexadecimal notation</td>
</tr>
<tr>
<td>A3H</td>
<td>Pressure tendency [* or 0...8]</td>
</tr>
</tbody>
</table>

#### Example:

>form "RH=" 4.2 rh U5 #t "T=" t U3 #r #n

RH= 14.98%RH  T=  74.68'F

>send

RH= 16.03%RH  T=  74.66'F

>form "Tfrost=" tdf U3 #t "Temp=" t U3 #r #n

Tfrost= 36.0'C  Temp=  31.0'C

Command ‘FORM /’ will return the default output format. The default output format depends on the device configuration.

>form /  >send

RH= 98.4 %RH T= 31.1 'C  >
UNIT
Use the UNIT command to select metric or non-metric output units:

UNIT [x]

where

x = M or N

where

M = Metric units
N = Non-metric units

NOTE
This command changes both the serial output and display units to either metric or non-metric units. When you want to output both metric and non-metric units simultaneously on the display, select the display units later by using the display/keypad.

Pressure Compensation Setting

The pressure has an effect on humidity calculations and accuracy. Therefore, accurate calculations can be achieved only when the process pressure is taken into consideration.

Note that conversions from mmHg and inHg are defined at 0°C and for mmH₂O and inH₂O at 4°C.

NOTE
Pressure compensation is intended to be used in normal air only. When measuring in other gases.

Using Display/Keypad

Use display/keypad to set the pressure compensation. To select the pressure unit using display/keypad, see section Changing Quantities and Units on page 90.
1. Press any of the arrow buttons to open the MAIN MENU.
2. Select Measuring and press the ►arrow button to confirm your selection.
3. Select Pressure compensation and press the ►arrow button to confirm you selection.
4. Press SET and enter the pressure value in the chosen unit by using the arrow buttons.
5. Press OK and EXIT to return to the basic display.

Using Serial Line

PRES and XPRES

Command XPRES should be used if the value is changed frequently. Its value is not retained at reset, and when set to 0; last value set with PRES is used instead. Use the serial line and do the following:

PRES [aaaa.a]

XPRES [aaaa.a]

where

aaaa.a = Absolute process pressure (hPa)

Example:

>pres
Pressure : 1013.00 hPa ?
>pres 2000
Pressure : 2000.00 hPa
>

<table>
<thead>
<tr>
<th>From</th>
<th>To: hPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>mbar</td>
<td>1</td>
</tr>
<tr>
<td>Pa N/m2</td>
<td>0.01</td>
</tr>
<tr>
<td>mmHg torr</td>
<td>1.333224</td>
</tr>
<tr>
<td>inHg</td>
<td>33.86388</td>
</tr>
<tr>
<td>mmH₂O</td>
<td>0.09806650</td>
</tr>
<tr>
<td>inH₂O</td>
<td>2.490889</td>
</tr>
<tr>
<td>atm</td>
<td>1013.25</td>
</tr>
<tr>
<td>at</td>
<td>980.665</td>
</tr>
<tr>
<td>bar</td>
<td>1000</td>
</tr>
<tr>
<td>psia (^1)</td>
<td>68.94757</td>
</tr>
</tbody>
</table>

\(^1\) psia = psi absolute.

Example:

29.9213 inHg = 29.9213 × 33.86388 = 1013.25 hPa
Date and Time

Using Display/Keypad

If the optional Data Logger Module is installed, you can change the time and date using the display/keypad.

1. Press any of the arrow buttons to open the MAIN MENU.
2. Select **System** and press the ► arrow button to confirm your selection.
3. Select **Date and time** and press the ► arrow button.
4. Press the **SET** button to enter the adjustment mode, and use the arrow buttons to select and change the values.
5. You can also change the date and time formats that are shown in the graphs. The selected formats are only used in graphical display, they do not change the formats that are used in the serial communication.
6. Press **EXIT** to return to the basic display.

Using Serial Line

To set time enter the **TIME** command. To set date enter the **DATE** command.

**TIME**

**DATE**

These time and date settings are shown on the timestamps of **PLAY** command. When you want to include time and date in the **R** and **SEND** commands, use the **FTIME** and **FDATE** commands.

**Example:**

```
>TIME  
Time    : 13:42:49 ?

>DATE  
Date    : 2007-05-31 ?
```

**NOTE**

If the optional Data Logger Module is not installed, time and date are cleared to 2000-01-01 00:00:00 at reset or at power failure.
User Port Serial Settings

Using Display/Keypad

The communication settings for the user port can be changed via the serial line or by using the optional display/keypad. The communication settings for the service port are fixed and not changeable.

1. Press any of the arrow buttons to open the MAIN MENU.
2. Select Interfaces and press the ► arrow button to confirm your selection.
3. Select Serial interface and press the ► arrow button to confirm your selection.
4. Select Bit rate/Serial format/Comm. mode by pressing the CHANGE button. Use the ▲ ▼ arrow buttons to select and press SELECT to confirm your selection.
5. If you selected RUN communication mode, select RUN interval for and press SET to confirm your selection.
6. Use the arrow buttons to set the measuring interval and the unit. Press OK to confirm your settings.
7. If you selected POLL communication mode, select POLL address and press SET to confirm your selection.
8. Use the arrow buttons to set the transmitter address. Press OK to confirm the setting.
9. Use the arrow buttons to select ECHO. Press ON to turn it on. Press OFF to turn it off.
10. Press EXIT to return to the basic display.

The new user port settings set using the display/keypad are effective immediately.
Using Serial Line

SERI

Use the serial line command **SERI** \([b\ p\ d\ s]\) to set communication settings for the user port.

**SERI** \([b\ p\ d\ s]\)

where

\[b = \text{Bit rate (110, 150, 300, 600, 1200, 2400, 4800, 9600,19200, 38400, 57600, 115200)}\]

\[p = \text{Parity (n = none, e = even, o = odd)}\]

\[d = \text{Data bits (7 or 8)}\]

\[s = \text{Stop bits (1 or 2)}\]

**Example:**

\[>\text{SERI 600 N 8 1} \]
\[600 N 8 1 \]
\[>\]

You need to reset the transmitter to activate the new communication settings set with command **SERI**.

The settings can be changed one parameter at a time or all parameters at once:

\[>\text{SERI O} \quad \text{changing parity only} \]
\[4800 O 7 1 \]
\[>\text{SERI 600 N 8 1} \quad \text{changing all parameters} \]
\[600 N 8 1 \]
\[>\]

SMODE

Use the command **SMODE** to set the user port start-up operating mode.

**SMODE** \([xxxx]\)

where

\[xxx = \text{STOP, RUN or POLL}\]
Table 25  Selection of Output Modes

<table>
<thead>
<tr>
<th>Mode</th>
<th>Output</th>
<th>Available Commands</th>
</tr>
</thead>
<tbody>
<tr>
<td>STOP</td>
<td>Only with the SEND command</td>
<td>All (default mode)</td>
</tr>
<tr>
<td>RUN</td>
<td>Automatic output</td>
<td>Only command S</td>
</tr>
<tr>
<td>POLL</td>
<td>Only with the SEND [addr] command</td>
<td>Use with RS-485 buses, see Operation of the RS-485 Module on page 119.</td>
</tr>
</tbody>
</table>

Selected output mode will be activated after power outages.

**INTV**

Use the command **INTV** to set the outputting interval for the RUN mode.

**INTV** [xxx yyy]

where

xxx = Output interval (0 ... 255). 0: the fastest possible output rate.
yyy = Unit (s, min or h)

**Example:**

>INTV 10 min
Output intrv. : 10 min
>

**ECHO**

Use the command **ECHO** to set the user port echo. The command either enables or disables echo of characters received.

**ECHO** [x]

where

x = ON (default) or
    = OFF

**NOTE**

You can use the SERI, SMODE, INTV and ECHO commands to change/view the user port settings even if you are currently connected to the service port.
**Data Filtering**

The averaging data filter calculates an average over a certain period of time. The lowest measurement noise is achieved with the extended filtering. There are three filtering levels available.

<table>
<thead>
<tr>
<th>Table 26 Filtering Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting</td>
</tr>
<tr>
<td>OFF</td>
</tr>
<tr>
<td>ON (default)</td>
</tr>
<tr>
<td>EXTENDED</td>
</tr>
</tbody>
</table>

Use display/keypad to set the filtering level.

1. Press any of the arrow buttons to open the MAIN MENU.
2. Select Measuring by pressing the ► arrow button.
3. Select Filtering and press CHANGE to confirm your selection.
5. Press EXIT to return to the basic display.

**FILT**

Use the serial line command **FILT [xxx]** to set the filtering level.

**FILT [xxx]**

where

xxx = OFF, ON or EXT (default = OFF)

**Device Information**

Use the display/keypad or the serial line to display the device information.

Press the INFO button in the basic display to see the following information:
- Current sensor operation (for example, chemical purge), if any, in progress
- Present or past unacknowledged errors, if any
- Device information
- Adjustment information fed by the user
- Measuring settings
- Information on chemical purge settings (when applicable)
- Display Alarm settings
- Serial interface information
- Network settings and status of the LAN and WLAN interfaces
- Analog output information
- Relay output information (when applicable)

![Device Information on Display](image)

**Figure 57  Device Information on Display**

Proceed in the information views by pressing the MORE button as many times as you get the desired information. You can browse through the information displays also with arrow buttons. Press **OK** to return to the basic display.

?  
Use the serial line command ? to check the current transmitter configuration. Command ?? is similar but can also be used if the transmitter is in POLL mode.

**Example:**

```
>?
TRANSMITTER / 4.03
Serial number : B2930015
Batch number  : B2350091
Adjust. date  : 2008-07-19
Adjust. info  : Fulda / GER
Date          : 2009-03-30
Time          : 13:41:55
Serial mode   : STOP
Baud P D S    : 4800 E 7 1
```
Output interval: 0 s  
Address : 0  
Echo : ON  
Pressure : 1013.25 hPa  
Filter : OFF  
Ch1 output : 4...20mA  
Ch2 output : 4...20mA  
Ch1 RH low : 0.00 %RH  
Ch1 RH high : 100.00 %RH  
Ch2 T low : -40.00 °C  
Ch2 T high : 60.00 °C  
Module 1 : LOGGER-1  
Module 2 : not installed

HELP

Use the command HELP to list the commands.

Example:

>help

? ACAL ADDR AERR ALSEL
ASCL ASEL CDATE CLOSE CODE
CRH CTA CTEXT DATE
DELETE DIR DSEL DSEND ECHO
ERRS FCRH FDATE FILT FORM
FST FTIME HELP INTV ITEST
MODS NET OPEN PLAY PRES
R RESET SEND SERI SMODE
TEST TIME UNDELETE UNIT VERS
WLAN XPRES

ERRS

Use the command ERRS to display transmitter error messages, see Table 27 on page 134.

Example:

>ERRS

NO ERRORS

Example:

>ERRS

FAIL

Error: Temperature measurement malfunction
Error: Humidity sensor open circuit

>
VERS

Use the command VERS to display software version information.

Example:

> vers
TRANSMITTER / 5.00
>

Resetting Transmitter Using Serial Line

RESET

This command resets the device. The user port switches to start-up output mode selected with command SMODE.

Locking Menu/Keypad by Using Serial Line

LOCK

Use the LOCK command to prevent the user from entering the menu using the keypad, or to lock the keypad completely. You can optionally set a 4-digit PIN code, for example 4444.

If a PIN code has been set, the user will be prompted to enter the code when trying to access the menu. Entering the code correctly will disable the lock until the user returns back to the basic view.

LOCK [x] [yyyy]

where

x = Keypad locking level, range 0...2. The options are:
   0 - No lock (enables full access)
   1 - Menu locked, but graphs are accessible
   2 - Keypad completely disabled

yyyy = 4-digit PIN code. The code can only be set when keypad locking level is 1.
Examples:

>lock 1 4444
Keyboard lock : 1 [4444]
>
>lock 1
Keyboard lock : 1
>

Data Recording

Data recording function is always on and collects data automatically into the memory of the device. If the optional data logger module is installed, the transmitter uses it automatically. Recorded data does not disappear from the memory when the power is switched off. Collected data can be observed in a form of a graph in the graphical view of the display or it can be listed out by using the serial line or MI70 Link program.

Selecting Data Recording Quantities

If the device is provided with the optional display, the recorded quantities are always those selected for the display. Up to three quantities can be recorded at a time. For instructions on how to select the display quantities with the keypad, see section Changing Quantities and Units on page 90.

DSEL

Use the serial line command DSEL to select the quantities to be recorded if the transmitter is not equipped with display/keypad.

DSEL [xxx]

where

xxx = Data recording quantity. See Table 1 on page 16 and Table 2 on page 17 for the quantities.

Example:

>dsel rh t tdf
 RH T Tdf
>

Enter the command without parameters and press ENTER to display the current recording parameters.
View Recorded Data

If the device is provided with the optional display, the graphical display shows the data of the selected quantities, one at a time. See section Graphic History on page 62 for details about graphical display.

You may also dump the logged data to the serial line in numeric form with the following commands.

**DIR**

Use the serial line and enter the **DIR** command to check the available files.

Without the data logger module, the device records six files (six observation periods) for each selected quantity. The data logger raises the number of recorded files to seven for each quantity. Thus, the total amount of the files varies between 6 and 21. See Table 9 on page 63.

Select, for example, three quantities (RH, T, and Tdf). The last column illustrates the number of data points that has been stored in the file.

**Example (data logger module installed):**

```
>dir
    File description              Oldest data available  No. of points
 1  RH  (10 s intervals)   2007-05-30 08:26:50     13996800
 2  RH  (90 s intervals)   2007-05-30 05:25:30     1555200
 3  RH  (12 min intervals) 2007-05-29 05:48:00     194400
 4  RH  (2 h intervals)    2007-05-19 02:00:00     19440
 5  RH  (12 h intervals)   2007-03-23 12:00:00     3240
 6  RH  (3 d intervals)    2006-04-20 00:00:00     540
 7  RH  (12 d intervals)   2002-12-16 00:00:00     135
 8  T   (10 s intervals)   2007-05-30 08:26:50     13996800
 9  T   (90 s intervals)   2007-05-30 05:25:30     1555200
10 T  (12 min intervals)  2007-05-29 05:48:00     194400
11 T  (2 h intervals)     2007-05-19 02:00:00     19440
12 T  (12 h intervals)   2007-03-23 12:00:00     3240
13 T  (3 d intervals)     2006-04-20 00:00:00     540
14 T  (12 d intervals)    2002-12-16 00:00:00     135
15 Tdf(10 s intervals)   2007-05-30 08:26:50     13996800
16 Tdf(90 s intervals)   2007-05-30 05:25:30     1555200
17 Tdf(12 min intervals) 2007-05-29 05:48:00     194400
18 Tdf(2 h intervals)    2007-05-19 02:00:00     19440
19 Tdf(12 h intervals)   2007-03-23 12:00:00     3240
20 Tdf(3 d intervals)    2006-04-20 00:00:00     540
21 Tdf(12 d intervals)   2002-12-16 00:00:00     135
>```
Example (without data logger module):

```
> dir
    File description        Oldest data available       No. of points
 1  RH  (10 s intervals)  2008-04-11 23:41:10       135
 2  RH  (90 s intervals)  2008-04-11 20:41:11       135
 3  RH  (12 min intervals) 2008-04-10 21:03:41       135
 4  RH  (2 h intervals)  2008-03-31 18:03:41       135
 5  RH  (12 h intervals)  2008-02-04 12:03:41       135
 6  RH  (3 d intervals)  2007-03-04 00:03:41       135
 7  T   (10 s intervals)  2008-04-11 23:41:11       135
 8  T   (90 s intervals)  2008-04-11 20:41:11       135
 9  T   (12 min intervals) 2008-04-10 21:03:41       135
10  T   (2 h intervals)  2008-03-31 18:03:41       135
11  T   (12 h intervals) 2008-02-04 12:03:41       135
12  T   (3 d intervals)  2007-03-04 00:03:41       135
13  Tdf (10 s intervals) 2008-04-11 23:41:11       135
14  Tdf (90 s intervals) 2008-04-11 20:41:11       135
15  Tdf (12 min intervals) 2008-04-10 21:03:41       135
16  Tdf (2 h intervals)  2008-03-31 18:03:41       135
17  Tdf (12 h intervals) 2008-02-04 12:03:41       135
18  Tdf (3 d intervals)  2007-03-04 00:03:41       135
> 
```

**PLAY**

Use the PLAY command to output the selected file to the serial line. If the data logger module is installed, you can specify an interval to be outputted.

Data in the output is <TAB> delimited. This is compatible with most spreadsheet programs. Before giving the command, set the local date and time with TIME and DATE commands, if needed.

```
PLAY [x] [start_date start_time end_date end_time]
```

where

- **x** = Number of the data file that will be outputted, range 0...21. The numbers correspond to the output of the DIR command; refer to the example on page 104. Selecting number 0 will output all data files.
- **start_date** = Starting date of the interval to be outputted. Must be given in the following format: yyyy-mm-dd
- **start_time** = Starting time of the interval to be outputted. Must be given in the following format: hh:mm:ss
- **end_date** = Ending date of the interval to be outputted. Must be given in the following format: yyyy-mm-dd
- **end_time** = Ending time of the interval to be outputted. Must be given in the following format: hh:mm:ss
Example:

```
>play 3 2007-05-05 00:00:00 2007-05-06 00:00:00
RH (12 min intervals) 2007-05-05 00:00:00 121
```

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>trend</th>
<th>min</th>
<th>max</th>
</tr>
</thead>
<tbody>
<tr>
<td>yyyy-mm-dd</td>
<td>hh:mm:ss</td>
<td>%RH</td>
<td>%RH</td>
<td>%RH</td>
</tr>
<tr>
<td>2007-05-05</td>
<td>00:00:00</td>
<td>19.16</td>
<td>18.99</td>
<td>19.33</td>
</tr>
<tr>
<td>2007-05-05</td>
<td>00:12:00</td>
<td>19.30</td>
<td>19.09</td>
<td>19.55</td>
</tr>
<tr>
<td>2007-05-05</td>
<td>00:24:00</td>
<td>20.01</td>
<td>19.28</td>
<td>21.17</td>
</tr>
<tr>
<td>2007-05-05</td>
<td>00:36:00</td>
<td>21.21</td>
<td>20.98</td>
<td>21.44</td>
</tr>
<tr>
<td>2007-05-05</td>
<td>00:48:00</td>
<td>19.57</td>
<td>17.72</td>
<td>21.11</td>
</tr>
<tr>
<td>2007-05-05</td>
<td>01:00:00</td>
<td>19.09</td>
<td>18.62</td>
<td>19.84</td>
</tr>
</tbody>
</table>

The <ESC> key can be used to interrupt the output listing.

**NOTE**

Output of large amounts of recorded data can result in huge data files and take a long time, up to several days for the entire memory of the data logger at 10 second resolution. To make it easier to process the data it is recommended to select the largest suitable data interval, and to specify the start and end times carefully.
Deleting the Recorded Files

You can delete the recorded data files using the keypad/display, or the DELETE command on the serial line. The deletion is always done for all data; you cannot delete individual files.

Note that the transmitter automatically overwrites the old data when the memory is full, so manual deletion of the recorded files is not necessary in normal use.

To delete the data files using the keypad/display:

1. Press any of the arrow buttons to open the MAIN MENU.
2. Select System by pressing the ► arrow button.
3. Select Clear graph memories by pressing the CLEAR button. Press the YES button to confirm the selection.

**CAUTION**

This function clears the entire data history of the transmitter, including all graphs and the content of the optional data logger module.

**UNDELETE**

Similarly to the DELETE command, the UNDELETE command is used without any arguments. It will recover all deleted data that has not been overwritten yet.

Analog Output Settings

The analog outputs are set in the factory according to the order form. In case you want to change the settings, follow these instructions. See section Third Analog Output on page 49.

Changing Output Mode and Range

Both output channels have their own DIP switch module with 8 switches; see the position in Figure 2 Seite 19 (DIP switches for analog output settings).
1. Select the current/voltage output; switch ON either of the switches, 1 or 2.

2. Select the range; switch ON one of the switches from 3 to 7.

**Figure 58  Current/Voltage Switches of Output Modules**

The following numbers refer to Figure 58 oben:

1  =  Current/voltage selection output switches (from 1 to 2)
2  =  Current/voltage range selection switches (from 3 to 7) in analog output 1 and 2.
3  =  Switches for service use only. Keep in OFF position always.

**NOTE**

Only one of the switches 1 or 2 must be ON at a time.

Only one of the switches 3 to 7 must be ON at a time.
Example: 0 ... 5 V voltage output selected for channel 1 and 4 ... 20 mA selected for channel 2.

<table>
<thead>
<tr>
<th></th>
<th>OFF</th>
<th>ON</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Selection**

Voltage output selected

0 ... 5 V selected

Current output selected

4 ... 20 mA selected

NOTE

If you have customized the error output setting (AERR), check that the set error values are still valid after changing the output mode/range, see section Analog Output Fault Indication Setting on page 112.

**Analog Output Quantities**

Use the display/keypad to change and scale the analog output quantities.

1. Press any of the arrow buttons to open the MAIN MENU.
2. Select Interfaces by pressing the ► arrow button.
3. Select Analog outputs by pressing the ► arrow button.
4. Select Output 1/2/3 by pressing the ► arrow button.
5. Select Quantity by pressing the ▲ ▼ arrow buttons. Confirm your selection by pressing CHANGE.
6. Select the quantity by using the arrow buttons. Press SELECT to confirm your selection.
7. Select Scale, lower limit, by pressing the ▲▼arrow buttons. Press SET to confirm your selection. Press OK to confirm your setting.

8. Select the upper limit by pressing the ▲▼arrow buttons. Use the arrow buttons to set the upper limit value. Press SET to confirm your selection. Press OK to confirm your setting.

9. Press EXIT to return to the basic display.

**AMODE/ASEL**

Use the serial line to select and scale the analog output quantities. Connect the transmitter to the PC. Open the terminal connection between your PC and the transmitter.

1. Check the analog output modes with the AMODE command.

**Example:**

```
>amode
Ch1 output : 0...1V
Ch2 output : 0...1V
>
```

2. Select and scale the quantities for the analog outputs with the command ASEL. Note that the optional quantities can be selected only if they have been selected when ordering the device.

**ASEL [xxx yyy zzz]**

where

- **xxx** = Quantity of channel 1
- **yyy** = Quantity of channel 2
- **zzz** = Quantity of the optional analog output channel 3

Enter always all the quantities for all outputs. For quantities and their abbreviations see Table 1 on page 16 and Table 2 on page 17.

Use the command ASEL [xxx yyy] as shown in the example below when using a device with two analog outputs.

**Example:**

```
>asel rh t
Ch1 (RH ) low : 0.00 %RH ? 0
Ch1 (RH ) high : 100.00 %RH ? 100
Ch2 (T ) low : -40.00 'C ? -50
Ch2 (T ) high : 60.00 'C ? 80
>
```
Analog Output Tests

Use the display/keypad for testing to test the operation of the analog by forcing the outputs to known values. Measure then the outputs with a current/voltage meter.

1. Press any of the arrow buttons to open the **MAIN MENU**.
2. Select System by pressing the ► arrow button.
3. Select **Diagnostics** by pressing the ► arrow button.
4. Select **Analog output tests** by pressing the ► arrow button.
5. Select one of the testing options **Force 0%/50%/100% of scale**. Press **TEST** to confirm your selection. All outputs are tested simultaneously. The actual output value depends on the selected range.
6. Press **OK** to stop testing. Press **EXIT** to return to the basic display.

**ITEST**

Use the serial line to test the operation of the analog outputs. Use the command **ITEST** to force the analog outputs to entered values. The set values remain valid until you enter the command **ITEST** without parameters or **RESET** the transmitter.

**ITEST** [[aa.aaa bb.bbb]]

where

\[ aa.aaa = \text{Current or voltage value to be set for channel 1 (mA or V)} \]
\[ bb.bbb = \text{Current or voltage value to be set for channel 2 (mA or V)} \]

**Example:**

```
>itest 20 5
Ch1 (Td ) : * 20.000 mA H'672A
Ch2 (T )  : * 5.000 mA H'34F9
>itest
Ch1 (Td ) : -23.204 'C 16.238 mA H'FFFFE
Ch2 (T )  : 22.889 'C 8.573 mA H'5950
>```

JUMO 111
Analog Output Fault Indication Setting

Factory default state for analog outputs during error condition is 0 V/0 mA. Please be careful when selecting the new error value. The error state of the transmitter should not cause unexpected problems in process monitoring.

Use the display/keypad to set the analog output fault indication.

1. Press any of the arrow buttons to open the MAIN MENU.
2. Select Interfaces by pressing the ► arrow button.
3. Select Analog Outputs by pressing the ► arrow button.
4. Select Output 1/2/3 by pressing the ► arrow button.
5. Select Fault indication. Press SET to confirm your selection. Enter the fault indication value by using the arrow buttons. Press OK to confirm your setting. This value is outputted if a transmitter error occurs.
6. Press EXIT to return to the basic display.

AERR

Use the serial line AERR command to change the error output.

AERR

Example:

>`aerr
Ch1 error out : 0.000V ? 5.0
Ch2 error out : 0.000V ? 5.0
>`

**NOTE**
The error output value must be within a valid range of the output mode.

**NOTE**
The error output value is displayed only when there are minor electrical faults such as humidity sensor damage. When there is a severe device malfunction, the error output value is not necessarily shown.
Operation of Relays

Quantity for Relay Output

A relay monitors the quantity chosen for the relay output. Any of the quantities available can be chosen.

Measurement-Based Relay Output Modes

Relay Setpoints

When the measured value is in between the "above" and "below" values, the relay is passive. When choosing lower value as "above" value and higher value as "below" value, the relay is passive when the measured value is not between the setpoints. You can also set only one setpoint. See Figure 59 unterhalb for illustrative examples of the different measurement-based relay output modes.

![Diagrams showing different relay output modes](image-url)
Mode 4 is usually used if an alarm needs to be triggered when the measured value exceeds a safe range. The relay is active when measurement is in range, and is released if the value goes out of range or the measurement fails.

**NOTE**

If the measurement of the selected quantity fails or the transmitter loses its power, the relay is released.

**Hysteresis**

Hysteresis function is to prevent the relay switching back and forth when the measured value is near to the setpoint values.

Relay is activated when the measured value passes the exact value of the setpoint. When returning and passing the setpoint again relay is not released before the value reaches the setpoint increased/decreased by the hysteresis value.

Hysteresis should be smaller than difference of the setpoints.

**Example:** When the 'active above' value is 60 %RH and the hysteresis value is 5 %RH, relay activates when the relative humidity reaches 60 %RH. As the humidity decreases, relay releases at 55 %RH.

**NOTE**

If both setpoints are specified and "above" setpoint is lower than "below" setpoint, the hysteresis works in the opposite direction, that is, relay is **released** when the measured value passes the exact value of the setpoint.

### Relay Indicating Transmitter Error Status

You can set a relay to follow the operation status of the device. By selecting FAULT/ONLINE STATUS for output quantity a relay changes state on the basis of the operation status as follows:

**FAULT STATUS**

Normal operation: relay active (C and NO outputs are closed)

Not measuring state (error state or power off): relay released (C and NC outputs are closed)
ONLINE STATUS

Live measurement (data available): relay active (C and NO outputs are closed)

No live data (for example: error state, chemical purge or adjustment mode): relay released (C and NC outputs are closed)

See Figure 60 unterhalb for illustrative examples of the FAULT/ONLINE STATUS relay output modes.

Figure 60  FAULT/ONLINE STATUS Relay Output Modes

FAULT/ONLINE STATUS relays are usually used in conjunction with an analog output to obtain validity information for the output value.

NOTE  If transmitter loses its power, all status-based relays are released similarly to the case of an instrument failure.
Enabling/Disabling Relays

You can deactivate the relay outputs for example for service purposes of your system.

Setting Relay Outputs

**NOTE**

When having only one relay module installed, its relays are called 'relay 1' and 'relay 2'.

When having two relay modules, the relays of the module connected to slot **MODULE 1** are called 'relay 1' and relay 2' and relays connected to slot **MODULE 2** are called 'relay 3' and 'relay 4'.

---

![Image of display showing relay indicators](image)

**Figure 61   Relay Indicators on Display**

The following number refers to Figure 61 oben:

1 = Lists enabled relays. Activation state shown in black. Disabled relays are not shown.

Use the display/keypad to set the relay outputs.

1. Press any of the arrow buttons to open the **MAIN MENU**.
2. Select **Interfaces**, confirm by pressing the ► arrow button.
3. Select **Relay outputs**, confirm by pressing the ► arrow button.
4. Select **Relay 1/2/3/4**, confirm by pressing the ► arrow button.
5. Select the **Quantity**, confirm by pressing **Change**. Select the Quantity by using the arrow buttons. Confirm your selection by pressing **Select**.
6. Select **Act. above / Act. below**. Press SET to confirm your selection. (If asked, select **MODIFY** if you want to set the setpoint by using the arrow buttons. Select **REMOVE** if you want to remove the setpoint.)
7. Select **Hysteresis** by using the arrow buttons. Press **SET** to set the hysteresis. Press **OK**.

8. Select **Relay enable** by using the arrow buttons, press **ON/OFF** to enable/disable the relay.

**RSEL**

Use the serial line to select the quantity, setpoints and hysteresis or enable/disable the relay outputs. Enter the **RSEL** command.

**RSEL** [q1 q2 q3 q4]

where

- q1 = quantity for the relay 1 or Fault/Online
- q2 = quantity for the relay 2 or Fault/Online
- q3 = quantity for the relay 3 or Fault/Online
- q4 = quantity for the relay 4 or Fault/Online

Factory setting: all relays disabled.

Use the quantity abbreviations presented above. See Table 1 on page 16 and Table 2 on page 17.

**Example of window limit switch:** Selecting relay 1 to follow dewpoint/frost point temperature measurement and relay 2 to follow temperature measurement. Two relay setpoints are set for both relays.

```
>rsel rh t
Rel1 RH above: 0.00 %RH ? 30
Rel1 RH below: 0.00 %RH ? 40
Rel1 RH hyst: 0.00 %RH ? 2
Rel1 RH enabl: OFF ? ON
Rel2 T above: 0.00 'C ? 30
Rel2 T below: 0.00 'C ? 40
Rel2 T hyst: 0.00 'C ? 3
Rel2 T enabl: OFF ? ON
>
```
**Example of normal limit switch:** Selecting relay 1 to follow relative humidity, relay 2 to follow temperature, relay 3 to follow dewpoint and relay 4 to follow dewpoint. One setpoint is chosen for all the outputs.

```bash
>rsel rh t td td
Rel1 RH above: 60.00 %RH ? 70
Rel1 RH below: 70.00 %RH ? -
Rel1 RH hyst : 2.00 %RH ? 2
Rel1 RH enabl: ON ? on
Rel2 T above: 50.00 'C ? 60
Rel2 T below: 40.00 'C ? -
Rel2 T hyst : 2.00 'C ? 2
Rel2 T enabl: ON ? on
Rel3 Td above: 5.00 'C ? 10
Rel3 Td below: 0.00 'C ? -
Rel3 Td hyst : 1.00 'C ? 1
Rel3 Td enabl: OFF ? on
Rel4 Td above: 0.00 'C ? 20
Rel4 Td below: 0.00 'C ? -
Rel4 Td hyst : 0.00 'C ? 2
Rel4 Td enabl: OFF ? on
>
```

**Example of using relay 1 as fault alarm:** selecting relay 1 to follow the fault status and relay 2 to follow the temperature measurement.

```bash
>rsel fault t
Rel1 FAUL above: -
Rel1 FAUL below: -
Rel1 FAUL hyst : -
Rel1 FAUL enabl: ON ?
Rel2 T above: 0.00 'C ? 30
Rel2 T below: 0.00 'C ? -
Rel2 T hyst : 0.00 'C ? 2
Rel2 T enabl: OFF ? ON
>
```

**Testing Operation of Relays**

Testing activates relays even if they are disabled.

Use the module push buttons to activate the relays. Press the REL 1 or REL 2 button to activate the corresponding relay.

<table>
<thead>
<tr>
<th>Relay is activated:</th>
<th>led is lit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relay is not activated:</td>
<td>led is not lit</td>
</tr>
</tbody>
</table>
Use the display/keypad to test the operation of relays.

1. Open the **MAIN MENU** by pressing any of the arrow buttons.
2. Select **System**, press the ► arrow button.
3. Select **Diagnostics**, press the ► arrow button.
4. Select **Relay tests**, press the ► arrow button.
5. Select **Invert relay 1...**, press **TEST**. Now the selected relay output is forced to opposite state. Press **OK** to return to normal operation.
6. Press **EXIT** to return to the basic display.

**RTEST**

Use the serial line command **RTEST** to test the operation of the relays.

**RTEST** \[x1 \ x2 \ x3 \ x4\]

where

\[x = \text{ON/OFF}\]

**Example:** Activate and then release all four relays.

```
> rtest on on on on
ON ON ON ON
>
> rtest off off off off
OFF OFF OFF OFF
>
```

Enter the command **RTEST** without parameters to stop testing.

**Operation of the RS-485 Module**

The RS-485 interface enables communication between RS-485 network and 907023 transmitter. The RS-485 interface is isolated and offers a maximum communications rate of 115 200 bits/s. (For maximum bus length of 1 km, use bit rate 19200 b/s or less.)
When selecting an RS-232-RS-485 converter for the network, avoid self powered converters as they don't necessarily support the needed power consumption.

Echo function shall be always disabled (OFF) when using the 2-wire connection. When using the 4-wire connection you can disable/enable the echo setting.

**NOTE**

User port on transmitter main board cannot be used and connected when RS-485 module is connected. Service port is operating normally.

**Networking Commands**

Set the RS-422/485 interface by using the following commands. The other serial line commands are presented in section List of Serial Commands on page 85.

RS-485 configuration commands **SERI; ECHO; SMODE; INTV** and **ADDR** may be entered by using either the service port or RS-422/485 port. Also the optional display/keypad can be used, see section User Port Serial Settings on page 96.

**SDELAY**

With the **SDELAY** command you can set delay (response time) for user port (RS232 or RS485), or view currently set delay value. Value corresponds to tens of milliseconds (eg. 5 = 0.050s minimum answer delay). The value can be set between 0...254.

**Example:**

```
>sdelay
Serial delay : 0 ? 10

>sdelay
Serial delay : 10 ?
```

**SERI**

Use the **SERI** command to input RS-485 bus settings.

**SERI** [b p d s]

where
where

\[ b = \text{bit rate (300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200)} \]
\[ p = \text{parity (n = none, e = even, o = odd)} \]
\[ d = \text{data bits (7 or 8)} \]
\[ s = \text{stop bits (1 or 2)} \]

**ECHO**

Use the ECHO command to enable/disable echo of characters received over the serial line.

**ECHO** [\(x\)]

where

\[ x = \text{ON/OFF (default = OFF)} \]

When using 2-wire connection, echo must be always disabled.

**SMODE**

Use the SMODE command to set the default serial interface mode.

**SMODE** [\(xxxx\)]

where

\[ xxxx = \text{STOP, RUN or POLL} \]

In STOP mode: measurements output only by command SEND, all commands can be used

In RUN mode: outputting automatically, only command S can be used to stop.

In POLL mode: measurements output only with command SEND [\(addr\)].

When several transmitters are connected to the same line, each transmitter must be entered an own address in the initial configuration, and POLL mode must be used.
INTV

Use the **INTV** command to set the RUN mode output interval.

**INTV** \([n \ xxx]\)

where

- \(n = \ 1 \ - \ 255\)
- \(xxx = \ S, \ MIN \ or \ H\)

This command sets the RUN mode output interval. The time interval is used only when the RUN mode is active. For example, the output interval is set to 10 minutes.

```plaintext
>INTV 10 min
Output intrvl. : 10 min
>
```

Setting RUN output interval to zero enables the fastest possible output rate.

**ADDR**

Addresses are required only for POLL mode (see serial line command **SMODE** on page 97). Use the **ADDR** command to input the RS-485 transmitter address.

**OPEN** \([aa]\)

where

- \(aa = \ address \ (0 \ ... \ 99) \ (default = 0)\)

**Example:** the transmitter is configured to address 99.

```plaintext
>ADDR
Address : 2 ? 99
>
```
SEND

Use the SEND command to output the reading once in POLL mode:

SEND [aa]

where

aa = address of the transmitter

OPEN

When all transmitters on the RS-485 bus are in POLL mode the OPEN command sets one transmitter temporarily to STOP mode so that other commands can be entered.

OPEN [aa]

where

aa = address of the transmitter (0 ... 99)

CLOSE

The CLOSE command switches the transmitter back to the POLL mode.

Example:

>OPEN 2  (opens the line to transmitter 2, other transmitters stay in POLL mode)
>CRH      (for example, calibration performed)
...      
>CLOSE    (line closed)
Sensor Functions

Chemical Purge (Optional)

In some specific applications the sensor gain may decrease gradually due to an interference caused by a particular chemical present in the measured gas, for example. The decrease of sensor gain due to an interfering chemical and the effect of the chemical purge process are illustrated below, see Figure 62 unterhalb. The sensor polymer absorbs the interfering chemical; and this reduces the ability of the polymer to absorb water molecules and consequently the sensor gain decreases. In chemical purge, heating the humidity sensor to a temperature level of approximately +160 °C for several minutes evaporates the interfering chemical.

The purge function starts with heating stage, continues with settling and when the temperature of the sensor is decreased the transmitter returns to normal mode. The whole cycle takes about 6 minutes.

**NOTE**

Chemical purge function locks the output values for about 6 minutes.

![Decrease of Sensor Gain](image)

Figure 62  Decrease of Sensor Gain
Before starting the chemical purge note the following:

- The sensor is protected with a PPS grid with stainless steel netting, a stainless steel sintered filter or with membrane SST filter.
- The sensor temperature must be below 100 °C. At higher temperatures the chemicals evaporate spontaneously from the sensor and the chemical purge is not necessary.

**Automatic Chemical Purge (Interval Purge)**

When transmitter leaves the factory the automatic chemical purge (if chosen) takes place repeatedly with the time intervals set in the factory. User can change the interval in which the purge takes place by using serial commands or with the optional display/keypad. This can be needed if the measuring environment contains high concentrations of interfering chemicals. The automatic chemical purge can also be turned off if necessary.

**Manual Chemical Purge**

The chemical purge should be performed always before calibration (see section Calibration and Adjustment Seite 137) or when there is a reason to believe that a sensor has become exposed to an interfering chemical. Make sure that the temperature of the sensor has come down to normal temperature before starting a calibration.

**Chemical Purge in Power Up**

Chemical purge (start-up purge) can be set to start within 10 seconds from the power-up of the device.
Starting and Configuring Chemical Purge

Using Buttons on Motherboard

Start manual chemical purge by pressing simultaneously two PURGE buttons on the motherboard inside the transmitter for a few seconds. Indicator led flashes until purge is complete (up to 6 minutes).

![Purge Buttons on Motherboard](image)

**Figure 63** Purge Buttons on Motherboard

Using Display/Keypad (Optional)

Set the automatic and manual chemical purge by using the display/keypad.

1. Open the **MAIN MENU** by pressing any of the ▼▲◄► arrow buttons.
2. Select ► **Measuring**, press ► button.
3. Select ► **Chemical purge**, press ► button.

![Chemical Purge Settings](image)

**Figure 64** Chemical Purge Settings
- Turn on/off the automatic purge by selecting **Automatic purge**, press ►ON/OFF button.
- Set the automatic purge interval by selecting **Interval**: ..., press SET. Set the purge interval and the unit (hour/day) by using the arrow buttons. The interval must be 1 hour ... 10 days. Press **OK**.
- Select **Start-up purge** by using the arrow buttons. Press On/Off to turn the start-up purge on/off.
- Start manual purge by selecting **Manual purge** and pressing START.

4. Press **EXIT** to return to the basic display.

**Figure 65**   Performing Chemical Purge

**Using Serial Line**

**PURGE**

Enter the **PURGE** command to start chemical purge immediately.

```plaintext
>purge
Purge started, press any key to abort.
> 
```

The prompt '>' appears when the heating period is over. However, the transmitter outputs are locked to the values measured before performing chemical purge until the settling time is over.

With **PUR** command you can enable or disable automatic and power-up chemical purge and set the interval for automatic purge. If the sensor is exposed to chemicals it is recommended to have the chemical purge done at least once in 720 min (=12 hours). In applications where the chemical exposure is not likely, the interval can be longer.

It is not recommended to change duration, settling, temperature or temperature difference.
PUR

Type **PUR** and press ENTER to proceed. The maximum interval is 14400 minutes (=10 days).

**Example:**

```plaintext
> pur
Interval Purge : OFF ?
Interval       : 720 min ?
Power-up Purge : OFF ?
Duration       : 120 s ?
Settling       : 240 s ?
Temperature    : 160 'C ?
Temp. diff.    : 0.5 'C ?
>
```

**NOTE**

To activate the new interval settings immediately, reset the transmitter.

**NOTE**

When chemical purge in power-up is enabled, wait about 6 min after power-up before taking measurements. The output channels are locked for the first operation minutes to the initial measured values.
Sensor Heating

This function is optionally available only in transmitters with HUMICAP®180C or HUMICAP®180RC sensor. It should be used only with the warmed probe.

The sensor heating is recommended for the high humidity environments where even a small temperature differences can cause water to condense on the sensor. The sensor heating speeds up the recovery of the humidity sensor from condensation.

Sensor heating starts-up when the relative humidity of the measuring environment reaches the RH-value set by a user (RH-limit). The user can define the RH-sensor heating temperature as well as the duration of the heating.

After the heating cycle the humidity conditions are checked and new sensor heating is performed if the predefined conditions are reached again.

**NOTE**

During the sensor heating the outputs are locked to the values measured before the heating cycle.

Setting Humidity Sensor Heating

When the transmitter leaves the factory the sensor heating follows the factory default values. You can enable/disable the function, change the RH-limit and define the heating temperature and duration of this function.

**XHEAT**

Enables/disables the sensor heating.

**XHEAT [xx]**

where:

**xx** = ON / OFF

```shell
> xheat on
Extra heat : ON
> xheat off
Extra heat : OFF
> 
```
To configure the sensor heating use the XHEAT command without parameters. Enter the values after question mark. The available ranges include the following:

- **Extra heat RH** - limit (heating function starts-up above the setpoint)  
  0 ... 100 %RH (default: 95 %RH)

- **Extra heating temperature**  
  0 ... 200 ºC (default: 100 ºC)

- **Extra heating time**  
  0 ... 255 s (default: 30 s)

**Example:**

```
>xheat
Extra heat     : OFF
Extra heat RH  : 95 ? 90
Extra heat temp: 100 ? 85
Extra heat time: 30 ? 10
>xheat on
Extra heat     : ON
>
```
This chapter contains information that is needed in basic maintenance of the product.

**Periodic Maintenance**

**Cleaning**

Clean the transmitter enclosure with a soft, lint-free cloth moistened with mild detergent.

**Changing the Probe Filter**

1. Turn the filter counter-clockwise to loosen it.
2. Remove the filter from the probe. Be careful not to touch the sensor with the filter. Without the filter in place, the sensor is easily damaged – handle the probe carefully.
3. Install a new filter on the probe. When using the stainless steel filter (for oil and fuel cell), take care to tighten the filter properly (recommended force 5 Nm).

New filters can be ordered from JUMO, see section Options and Accessories on page 156.
Changing the Sensor

The user can change the HUMICAP180, HUMICAP180L2, and HUMICAP180R sensors. If the transmitter has the chemical purge and/or warmed probe option (which utilize the HUMICAP180C or HUMICAP180RC sensor), the sensor cannot be changed by the user.

Changing the sensor should be considered corrective maintenance, and it is not necessary in normal operation. If the accuracy of the transmitter does not seem to be within specification, it is more likely that the transmitter is in need of calibration and adjustment, and not sensor replacement. Refer to chapter Calibration and Adjustment on page 137.

NOTE

When replacing the sensor, the new sensor must be of the same type as the old sensor (for example, HUMICAP180R). The sensor type can only be changed at a JUMO Service Center.

1. Remove the filter from the probe. See the instructions in section Changing the Probe Filter on page 131.
2. Remove the damaged sensor and insert a new one. Handle the new sensor by the plastic socket. DO NOT TOUCH THE SENSOR PLATE.
3. Perform a calibration and adjustment as instructed in section Relative Humidity Adjustment after Sensor Change on page 142.
4. Attach a new filter on the probe. When using the stainless steel filter, take care to tighten the filter properly (recommended force 5 Nm).

Figure 66 Changing the Sensor

The following numbers refer to Figure 66 oben:

1 = Pull out the sensor
2 = Plastic socket
Error States

In error state the quantity is not measured and the output is shown as follows:

- Analog channel outputs 0 mA or 0 V (you can use the serial line command \texttt{AERR} or display/keypad to change this fault indication value, see section Analog Output Fault Indication Setting on page 112.)

- The serial port outputs stars (***)

- The cover LED is blinking

- Optional display: error indicator is lit.

![Error Indicator and Error Message](image)

Figure 67 Error Indicator and Error Message

The following number refers to Figure 67 oben:

\[1 = \text{Error Indicator}\]

- The error indicator disappears when the error state is over and you have checked the error message. Press the \texttt{INFO} button to display the error message.

You can also check the error message via the serial interface by using the command \texttt{ERRS}. In case of constant error, please contact JUMO.
<table>
<thead>
<tr>
<th>Error Code</th>
<th>Error Message</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Humidity sensor measurement malfunction.</td>
<td>Check the integrity of the humidity probe and the probe cable. Clean the probe from dirt, water, ice or other contaminants.</td>
</tr>
<tr>
<td>1</td>
<td>Humidity sensor short circuit</td>
<td>Check the integrity of the humidity probe and the probe cable. Clean the probe from dirt, water, ice or other contaminants.</td>
</tr>
<tr>
<td>2</td>
<td>Humidity sensor open circuit</td>
<td>Check the integrity of the humidity probe and the probe cable.</td>
</tr>
<tr>
<td>3</td>
<td>Temperature sensor open circuit.</td>
<td>Check the integrity of the humidity probe and the probe cable.</td>
</tr>
<tr>
<td>4</td>
<td>Temperature sensor short circuit.</td>
<td>Check the integrity of the humidity probe and the probe cable. Clean the probe from dirt water, ice or other contaminants.</td>
</tr>
<tr>
<td>5</td>
<td>Temperature measurement malfunction</td>
<td>Check the integrity of the humidity probe and the probe cable. Clean the probe from dirt water, ice or other contaminants.</td>
</tr>
<tr>
<td>6</td>
<td>Temperature sensor current leak.</td>
<td>Check the integrity of the humidity probe and the probe cables. Clean the probes from dirt, water, ice or other contaminants.</td>
</tr>
<tr>
<td>7</td>
<td>Internal ADC read error</td>
<td>Internal transmitter failure. Remove the transmitter and return the faulty unit to JUMO Service.</td>
</tr>
<tr>
<td>8</td>
<td>Additional temperature sensor short circuit</td>
<td>Check the integrity of the temperature probe and the probe cable. Clean the probe cable from dirt, water, ice or other contaminants.</td>
</tr>
<tr>
<td>9</td>
<td>Checksum error in the internal configuration memory</td>
<td>Internal transmitter failure. Remove the transmitter and return the faulty unit to JUMO Service.</td>
</tr>
<tr>
<td>10</td>
<td>Internal EEPROM read error</td>
<td>Internal transmitter failure. Remove the transmitter and return the faulty unit to JUMO Service.</td>
</tr>
<tr>
<td>11</td>
<td>Internal EEPROM write error</td>
<td>Internal transmitter failure. Remove the transmitter and return the faulty unit to JUMO Service.</td>
</tr>
<tr>
<td>12 … 13</td>
<td>Add-on module 1 (or 2) connection failure</td>
<td>Turn off the power and check the module connection. Turn on the power.</td>
</tr>
<tr>
<td>14</td>
<td>Device internal temperature out of range</td>
<td>Ensure that the operating temperature is within the valid range.</td>
</tr>
<tr>
<td>15</td>
<td>Operating voltage out of range</td>
<td>Ensure that the operating voltage is within the valid range.</td>
</tr>
<tr>
<td>18</td>
<td>Internal ADC reference voltage out of range</td>
<td>Internal transmitter failure. Remove the transmitter and return the faulty unit to JUMO Service.</td>
</tr>
<tr>
<td>19</td>
<td>Internal analog output reference voltage out of range</td>
<td>Internal transmitter failure. Remove the transmitter and return the faulty unit to JUMO Service.</td>
</tr>
<tr>
<td>20 … 23</td>
<td>Configuration switches for analog output 1/2/3 set incorrectly</td>
<td>Check and re-set the switches, see page 55.</td>
</tr>
<tr>
<td>24 … 25</td>
<td>EEPROM failure on add-on module 1 (or 2)</td>
<td>Disconnect the power and check the analog output module connection.</td>
</tr>
<tr>
<td>Error Code</td>
<td>Error Message</td>
<td>Action</td>
</tr>
<tr>
<td>------------</td>
<td>------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>26</td>
<td>Communication module installed in incorrect add-on module slot</td>
<td>Disconnect the power and change the communication module to another module slot.</td>
</tr>
<tr>
<td>28 … 29</td>
<td>Unknown/incompatible module installed in add-on module slot 1 (or 2)</td>
<td>Ensure that the module is compatible with the TRANSMITTER.</td>
</tr>
<tr>
<td>30</td>
<td>Internal analog voltage out of range</td>
<td>Internal transmitter failure. Remove the transmitter and return the faulty unit to JUMO Service.</td>
</tr>
<tr>
<td>31</td>
<td>Internal system voltage out of range</td>
<td>Internal transmitter failure. Remove the transmitter and return the faulty unit to JUMO Service.</td>
</tr>
</tbody>
</table>

**Technical Support**

For technical questions, contact the JUMO technical support:

**JUMO GmbH & Co. KG**  
Hermann Muth Str. 2 / Werk 3  
36039 Fulda, Germany

E-Mail: mail@jumo.net  
Fax: +49 661 6003-601  
Internet: www.jumo.net

**Return Instructions**

If the product needs repair, please follow the instructions below to speed up the process and to avoid extra costs to you.

1. Read the section Warranty on page 15.
2. Contact a JUMO Service. The latest contact information and instructions are available from www.JUMO.com.

Please have the following information on hand:
- serial number of the unit
- date and place of purchase or last calibration
- description of the fault
- circumstances in which the fault occurs/occurred
- name and contact information of a technically competent person who can provide further information on the problem

3. Pack the faulty product in a strong box of adequate size, with proper cushioning material to avoid damage.

4. Include the information specified in step 2 in the box with the faulty product. Also include a detailed return address.

5. Ship the box to the address specified by your JUMO contact.
CHAPTER 6
CALIBRATION AND ADJUSTMENT

The transmitter is fully calibrated and adjusted as shipped from factory. Typical calibration interval is one year. Depending on the application it may be good to make more frequent checks. Calibration must be done always when there is a reason to believe that the device is not within the accuracy specifications.

It is recommended that calibration and adjustment should be carried out by JUMO.

Calibration and adjustment is carried out either by using the push-keys on the motherboard, through the serial port or with the optional display/keypad.

Opening and Closing the Adjustment Mode

1. Open the transmitter cover. The buttons needed in adjustment are on the left-hand side of the motherboard.
2. If the chemical purge option is available, it should be carried out always before calibration. To start chemical purge press simultaneously two PURGE push-keys (on the motherboard) for a few seconds. Red indicator led flashes with short pulses until purge is complete (up to 6 minutes).
3. Press the ADJ key to open the adjustment mode.
4. Press the ADJ key again to close the adjustment mode.
Figure 68  Adjustment and Purge Buttons

The following numbers refer to Figure 68 oben:

1 = Indicator led  
2 = Adjustment button  
3 = Press the purge buttons simultaneously to start chemical purge (if available)

Adjustment menu is displayed only when ADJ button (on the motherboard inside the transmitter) is pressed.

![Adjustment Menu](image)

Figure 69  Adjustment Menu

Table 28  Indicator Led Functions

<table>
<thead>
<tr>
<th>Indicator Led Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED off</td>
<td>adjustment locked</td>
</tr>
<tr>
<td>LED on</td>
<td>adjustment available</td>
</tr>
<tr>
<td>LED blinking evenly</td>
<td>measurement not stabilized</td>
</tr>
<tr>
<td>LED blinking with short pulses</td>
<td>performing chemical purge</td>
</tr>
</tbody>
</table>

NOTE

If using a warmed probe (907023/337B option), probe heating will be interrupted when ADJ key is pressed. Allow sufficient time for the probe to reach ambient temperature before starting the adjustment procedure.
Relative Humidity Adjustment

Using Push-Buttons

A simple push-button adjustment is carried out by using two relative humidity references: 11 % RH (LiCl) and 75 % RH (NaCl).

1. Carry out the chemical purge (if available).

LiCl reference

2. Press the ADJ button (see Figure 68 Seite 138) on the motherboard to open the adjustment mode. The indicator led starts flashing.

3. Remove the filter from the probe and insert the probe into a measurement hole of the 11 % RH (LiCl) in the humidity calibrator.

4. Wait at least 30 minutes for the sensor to stabilize (the indicator led is lit continuously). Adjustment cannot be done if the conditions are not stabilized (indicator led is flashing).

5. When the indicator led is lit continuously, press the button LiCl-11% to adjust the 11 % RH condition. After adjustment transmitter returns to normal operation mode (indicator LED is unlit).

NaCl reference

6. When adjusting in the second reference 75 % RH, press the ADJ button to open the adjustment mode. The indicator led starts flashing.

7. Insert the probe into a measurement hole of the 75 % RH (NaCl) reference chamber of the humidity calibrator.

8. Wait at least 30 minutes for the sensor to stabilize (the indicator led is lit continuously). Adjustment cannot be done if the conditions are not stabilized (indicator led is flashing).
9. Press the button **NaCl 75 %** to adjust the 75 % RH condition. After adjustment transmitter returns to normal operation mode (indicator led is unlit).

**Using Display/Keypad**

Note that the difference between the two humidity references must be at least 50% RH.

1. Carry out the chemical purge (if available).
2. Press the **ADJ** button (opens the **ADJUSTMENT MENU**).
3. Select **Adjust RH measurement**, press ► button.
4. Select **1-point/ 2-point adjustment**, press. Press **START**.
5. Select the reference as guided by the display, press **SELECT**.

![Figure 70 Selecting Point 1 Reference Type](image)

6. Remove the filter from the probe and insert the probe into a measurement hole of the dry end reference chamber (for example, LiCl: 11 % RH in the humidity calibrator).

7. Wait at least 30 minutes for the sensor to stabilize. Follow the stabilization from the **GRAPH** display.

8. Press **READY** when stabilized. If you have chosen the **Other** reference value, enter now the reference value by using the arrow buttons.

When carrying out the 2-point adjustment proceed to the next adjustment point and carry out the procedure as described in the previous items.

9. Answer **YES** to confirm the adjustment. Press **OK** to return to the adjustment menu.

10. Press **EXIT** to close the adjustment mode and return to the basic display. Before closing the adjustment mode, feed the adjustment information into the device, see section **Feeding Adjustment Information** on page 146.
Using Serial Line

Note that the difference between the two humidity references must be at least 50% RH.

1. Connect the transmitter to a PC. See section Serial Line Communication on page 70. Open a terminal program.
2. Carry out the chemical purge (if available).
3. Press the ADJ button.
4. Remove the filter from the probe and insert the probe into a measurement hole of the dry end reference chamber (for example, LiCl: 11 % RH in the humidity calibrator.
5. Enter the CRH command and press ENTER.

CRH

6. Wait at least 30 minutes for the sensor to stabilize.
7. Type C and press ENTER a few times to check if the reading is stabilized.
8. When the reading is stabilized, give the reference humidity after the question mark and press ENTER.

>crh

<table>
<thead>
<tr>
<th>RH</th>
<th>Ref1 ? c</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.25</td>
<td>Ref1 ? c</td>
</tr>
<tr>
<td>11.25</td>
<td>Ref1 ? c</td>
</tr>
<tr>
<td>11.25</td>
<td>Ref1 ? c</td>
</tr>
<tr>
<td>11.24</td>
<td>Ref1 ? c</td>
</tr>
<tr>
<td>11.24</td>
<td>Ref1 ? 11.3</td>
</tr>
</tbody>
</table>

Press any key when ready ...

9. Now the device is waiting for the high end reference. Insert the probe into the measurement hole of the high end reference chamber (for example, NaCl: 75 % RH chamber in the humidity calibrator. Press any key when ready.
10. Let the probe stabilize for about 30 minutes. You can follow the stabilization by typing C and pressing ENTER.
11. When stabilized, type the high end reference value after the question mark and press ENTER.

>crh

<table>
<thead>
<tr>
<th>RH</th>
<th>Ref1 ? c</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.25</td>
<td>Ref1 ? c</td>
</tr>
<tr>
<td>11.24</td>
<td>Ref1 ? c</td>
</tr>
<tr>
<td>11.24</td>
<td>Ref1 ? 11.3</td>
</tr>
</tbody>
</table>

Press any key when ready ...
RH : 75.45 Ref2 ? c
RH : 75.57 Ref2 ? c
RH : 75.55 Ref2 ? c
RH : 75.59 Ref2 ? 75.5
OK
>

12. **OK** indicates that the adjustment has succeeded and the new calibration coefficients are calculated and stored. Enter the adjustment information (date and text) to the memory of the transmitter; see the commands **CTEXT** and **CDATE**.

13. Press the **ADJ** button on the motherboard to close the adjustment mode.

14. Take the probe out of the reference conditions and replace the filter.

**Relative Humidity Adjustment after Sensor Change**

**Using Display/Keypad**

When using the optional display/keypad, follow the instructions on Using Display/Keypad on page 140 but select **Adj. for new RH sensor** (instead of **1-point/ 2-point adjustment**).

**Using Serial Line**

After sensor change, carry out the procedure as described in previous sections. Just replace the **CRH** command with the **FCRH** command.

**FCRH**

**Example:**

```
>FCRH
RH : 1.82 1. ref ? 0
Press any key when ready...
RH : 74.22 2. ref ? 75
OK
>
```

The **OK** indicates that the calibration has succeeded.
Temperature Adjustment

Using Display/Keypad

1. Press the ADJ button on the motherboard to open the ADJUSTMENT MENU. If using a warmed probe for measuring, probe heating will be interrupted when ADJ key is pressed. Wait some time for the probe to reach ambient temperature.

2. Select ► Adjust T measurement, press ► key.

3. Select 1-point/ 2-point adjustment, press. Press START.

4. Remove the filter from the probe and insert the probe into the reference temperature.

5. Wait at least 30 minutes for the sensor to stabilize. Follow the stabilization from the GRAPH display.

6. Press READY when stabilized. Give the reference temperature by using the arrow buttons.

   When carrying out the 2-point adjustment proceed to the next adjustment point and carry out the procedure as described in the previous item. Please, note that the difference between the two temperature references must be at least 30 ºC.

7. Press OK. Press YES to confirm the adjustment.

8. Press OK to return to the adjustment menu.

9. Press EXIT to close the adjustment mode and return to the basic display.

Using Serial Line

1. Press the ADJ key on the motherboard to open the adjustment mode. If using a warmed probe for measuring, probe heating will be interrupted when ADJ key is pressed. Wait some time for the probe to reach ambient temperature.

2. Remove the probe filter and insert the probe into the reference temperature.

3. Enter the command CT or (CTA for additional T probe) and press ENTER.
or for additional T probe:

CTA

4. Type C and press ENTER a few times to check if the reading is stabilized. Let the reading stabilize, give the reference temperature after the question mark and press ENTER three times.

When using two reference temperatures (2-point calibration) press ENTER only twice and insert the probe to the second reference. When the reading is stabilized, give the second reference temperature after the question mark and press ENTER. Please, note that the difference between the two temperature references must be at least 30 ºC.

Example (1-point adjustment):

```
>ct
T : 16.06 Ref1 ? c
T : 16.06 Ref1 ? c
T : 16.06 Ref1 ? c
T : 16.06 Ref1 ? c
T : 16.06 Ref1 ? c
T : 16.06 Ref1 ? 16.0
Press any key when ready ...
T : 16.06 Ref2 ? c
OK
>
```

5. OK indicates that the calibration has succeeded. Enter the calibration information (date and text) to the transmitter's memory; see the serial commands CTEXT and CDATE.

6. Press the ADJ button on the motherboard to close the adjustment mode.

7. Take the probe out of the reference conditions and replace the filter.
Analog Output Adjustment

In the analog output calibration the analog output is forced to the following values:

- Current output: 2 mA and 18 mA
- Voltage output: 10 % and 90 % of the range

Connect transmitter to a calibrated current/voltage meter in order to measure either current or voltage depending on the selected output type.

Using Display/Keypad

1. Press the ADJ button to open the ADJUSTMENT MENU.
2. Select Adjust analog outputs, press ► button.
3. Select the output to be adjusted Adjust analog output 1/2, press START.
4. Measure the first analog output value with a multimeter. Give the measured value by using the arrow buttons. Press OK.
5. Measure the second analog output value with a multimeter. Give the measured value by using the arrow buttons. Press OK.
6. Press OK to return to the adjustment menu.
7. Press EXIT to close the adjustment mode and to return to the basic display.

Using Serial Line

Enter the ACAL command and type the multimeter reading for each case. Continue by pressing ENTER.

ACAL

Example (current outputs):

>ACAL
Ch1 I1 (mA) ? 2.046
Ch1 I2 (mA) ? 18.087
Ch2 I1 (mA) ? 2.036
Ch2 I2 (mA) ? 18.071
>
Feeding Adjustment Information

This information is shown on the device information fields (see section Device Information on page 99.)

Using Display/Keypad

1. If you are not in the adjustment menu, press the ADJ button on the motherboard (opens the ADJUSTMENT MENU).
2. Select Adjustment info, press the ► button.
3. Select Date, press SET. Give the date by using the arrow buttons. Press OK.
4. Select i, press SET. Enter information text including 17 characters at maximum by using the arrow buttons. Press OK.
5. Press EXIT to return to the basic display.

Using Serial Line

CTEXT

Use the CTEXT command to enter text to the adjustment information field.

Example:

>ctext
Adjust. info : (not set) ? HMK15
>

CDATE

Use the CDATE command to enter date to adjustment information field. Set the adjustment date in format YYYY-MM-DD.

Example.

>cdate
Adjust. date : (not set) ? 2008-05-21
>
CHAPTER 7
TECHNICAL DATA

This chapter provides the technical data of the product.

Specifications

Performance

Relative Humidity

Measurement range 0 ... 100 %RH
Accuray (including non-linearity, hysteresis and repeatability)

with HUMICAP®180 for typical applications
HUMICAP®180R for typical applications (standard)
HUMICAP®180C for applications with chemical purge
and/or warmed probe
HUMICAP®180RC for applications with chemical purge
and/or warmed probe

at +15 ... 25 °C ± 1 % RH (0 ... 90 % RH)
± 1.7 % RH (90 ... 100 %RH)
at -20 ... +40 °C ± (1.0 + 0.008 × reading) % RH
at -40 ... +180 °C ± (1.5 + 0.015 × reading) % RH

with HUMICAP®180L2 for applications with demanding chemical environment

at -10 ... +40 °C ± (1.0 + 0.01 × reading) % RH
at -40 ... +180 °C ± (1.5 + 0.02 × reading) % RH

Factory calibration uncertainty (+20 °C)
±0.6 % RH (0 ... 40 % RH)
±1.0 % RH (40 ... 97 % RH)
(Defined as ± 2 standard deviation limits.
Small variations possible, see also calibration certificate.)
Response time (90 %) for HUMICAP® 180, HUMICAP® 180C and HUMICAP® 180L2 at 20 °C in still air
8 s with grid filter
20 s with grid + steel netting filter
40 s with sintered filter

Response time (90 %) for HUMICAP® 180R and HUMICAP® 180RC at 20 °C in 0.1 m/s air flow
17 s with grid filter
50 s with grid + steel netting filter
60 s with sintered filter

**Temperature (+ Operating Pressure Ranges)**

<table>
<thead>
<tr>
<th>Range</th>
<th>Temperature (+ Operating Pressure Ranges)</th>
</tr>
</thead>
<tbody>
<tr>
<td>907023/331</td>
<td>-40 ... +60 °C (-40 ... +140 °F)</td>
</tr>
<tr>
<td>907023/333 (80 °C)</td>
<td>-40 ... +80 °C (-40 ... +176 °F)</td>
</tr>
<tr>
<td>907023/333 (120 °C)</td>
<td>-40 ... +120 °C (-40 ... +248 °F)</td>
</tr>
<tr>
<td>907023/334</td>
<td>-70 ... +180 °C (-94 ... +356 °F), 0 ... 10 MPa (0 ... 100 bar)</td>
</tr>
<tr>
<td>907023/335 (vapor tight)</td>
<td>-70 ... +180 °C (-94 ... +356 °F)</td>
</tr>
<tr>
<td>907023/337 (vapor tight)</td>
<td>-70 ... +180 °C (-94 ... +356 °F)</td>
</tr>
<tr>
<td>907023/338</td>
<td>-70 ... +180 °C (-94 ... +356 °F), 0 ... 4 MPa (0 ... 40 bar)</td>
</tr>
</tbody>
</table>

Accuracy at +20 °C (+68 °F) ± 0.2 °C
Accuracy over temperature range (see graph below):

**Figure 71  Accuracy over Temperature Range**

Temperature sensor  Pt 100 RTD 1/3 Class B  DIN EN 60 751
Optional Temperature Probe

Temperature measurement range: -70 ... +180 °C (-94 ... +356 °F)
Typical accuracy: 0.1 °C (0.18 °F)
Sensor: Pt100 PRT DIN IEC 751 class 1/4 B
Cable length: 2 m, 5 m, and 10 m
Pressure tight: up to 7 bar
Probe material: stainless steel

Calculated Variables

Table 29  Calculated Variables (Typical Ranges)

<table>
<thead>
<tr>
<th>Variable</th>
<th>907023/331 probe</th>
<th>907023/333 probe</th>
<th>907023/334/335/337/338 probes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dewpoint temperature</td>
<td>-20 ... +60 °C</td>
<td>-20 ... +80 °C</td>
<td>-20 ... +100 °C</td>
</tr>
<tr>
<td>Mixing ratio</td>
<td>0 ... 160 g/kg dry air</td>
<td>0 ... 500 g/kg dry air</td>
<td>0 ... 500 g/kg dry air</td>
</tr>
<tr>
<td>Absolute humidity</td>
<td>0 ... 160 g/m³</td>
<td>0 ... 500 g/m³</td>
<td>0 ... 500 g/m³</td>
</tr>
<tr>
<td>Wet bulb temperature</td>
<td>0 ... 60 °C</td>
<td>0 ... +100 °C</td>
<td>0 ... +100 °C</td>
</tr>
<tr>
<td>Enthalpy</td>
<td>-40 ... +1500 kJ/kg</td>
<td>-40 ... +1500 kJ/kg</td>
<td>-40 ... +1500 kJ/kg</td>
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<tr>
<td>Water vapor pressure</td>
<td>0 ... 1000 hPa</td>
<td>0 ... 1000 hPa</td>
<td>0 ... 1000 hPa</td>
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</table>

Accuracies of Calculated Variables

Accuracies of the calculated variables depend on the calibration accuracy of the humidity and temperature sensors; here the accuracies are given for ± 2 %RH and ± 0.2 °C.

Accuracy of Dewpoint Temperature °C

<table>
<thead>
<tr>
<th>Relative humidity</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
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</thead>
<tbody>
<tr>
<td>Temp.</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>-40</td>
<td>1.86</td>
<td>1.03</td>
<td>0.76</td>
<td>0.63</td>
<td>0.55</td>
<td>0.50</td>
<td>0.46</td>
<td>0.43</td>
<td>—</td>
<td>—</td>
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<tr>
<td>-20</td>
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<td>1.19</td>
<td>0.88</td>
<td>0.72</td>
<td>0.62</td>
<td>0.56</td>
<td>0.51</td>
<td>0.48</td>
<td>—</td>
<td>—</td>
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<tr>
<td>0</td>
<td>2.51</td>
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<td>1.00</td>
<td>0.81</td>
<td>0.70</td>
<td>0.63</td>
<td>0.57</td>
<td>0.53</td>
<td>0.50</td>
<td>0.48</td>
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<tr>
<td>20</td>
<td>2.87</td>
<td>1.56</td>
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<td>0.92</td>
<td>0.79</td>
<td>0.70</td>
<td>0.64</td>
<td>0.59</td>
<td>0.55</td>
<td>0.53</td>
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<tr>
<td>40</td>
<td>3.24</td>
<td>1.76</td>
<td>1.27</td>
<td>1.03</td>
<td>0.88</td>
<td>0.78</td>
<td>0.71</td>
<td>0.65</td>
<td>0.61</td>
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<tr>
<td>60</td>
<td>3.60</td>
<td>1.96</td>
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<td>1.14</td>
<td>0.97</td>
<td>0.86</td>
<td>0.78</td>
<td>0.72</td>
<td>0.67</td>
<td>0.64</td>
</tr>
<tr>
<td>80</td>
<td>4.01</td>
<td>2.18</td>
<td>1.58</td>
<td>1.27</td>
<td>1.08</td>
<td>0.95</td>
<td>0.86</td>
<td>0.79</td>
<td>0.74</td>
<td>0.70</td>
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<tr>
<td>100</td>
<td>4.42</td>
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<td>1.74</td>
<td>1.40</td>
<td>1.19</td>
<td>1.05</td>
<td>0.95</td>
<td>0.87</td>
<td>0.81</td>
<td>0.76</td>
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<tr>
<td>120</td>
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<td>2.66</td>
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<td>1.54</td>
<td>1.31</td>
<td>1.16</td>
<td>1.04</td>
<td>0.96</td>
<td>0.89</td>
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<tr>
<td>140</td>
<td>5.31</td>
<td>2.91</td>
<td>2.10</td>
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<td>1.44</td>
<td>1.26</td>
<td>1.14</td>
<td>1.05</td>
<td>0.97</td>
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<td>160</td>
<td>5.80</td>
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<td>1.14</td>
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</table>
### Accuracy of Mixing Ratio g/kg (Ambient Pressure 1013 mbar)

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Relative humidity</th>
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<tbody>
<tr>
<td></td>
<td>10</td>
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<tr>
<td>-40</td>
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<td>40</td>
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<td>60</td>
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<tr>
<td>100</td>
<td>16.26</td>
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<tr>
<td>120</td>
<td>40.83</td>
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</table>

### Accuracy of Wet Bulb Temperature °C

<table>
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<th>Relative humidity</th>
</tr>
</thead>
<tbody>
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</tr>
<tr>
<td>-20</td>
<td>0.21</td>
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<tr>
<td>0</td>
<td>0.27</td>
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<td>20</td>
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<td>40</td>
<td>0.84</td>
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<td>60</td>
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</tr>
<tr>
<td>140</td>
<td>4.57</td>
</tr>
<tr>
<td>160</td>
<td>5.25</td>
</tr>
</tbody>
</table>

### Accuracy of Absolute Humidity g/m³

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Relative humidity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10</td>
</tr>
<tr>
<td>-40</td>
<td>0.004</td>
</tr>
<tr>
<td>-20</td>
<td>0.023</td>
</tr>
<tr>
<td>0</td>
<td>0.10</td>
</tr>
<tr>
<td>20</td>
<td>0.37</td>
</tr>
<tr>
<td>40</td>
<td>1.08</td>
</tr>
<tr>
<td>60</td>
<td>2.73</td>
</tr>
<tr>
<td>80</td>
<td>6.08</td>
</tr>
<tr>
<td>100</td>
<td>12.2</td>
</tr>
<tr>
<td>120</td>
<td>22.6</td>
</tr>
<tr>
<td>140</td>
<td>39.1</td>
</tr>
<tr>
<td>160</td>
<td>63.5</td>
</tr>
</tbody>
</table>
Dewpoint Temperature (907023/337 Warmed Probe Option)

Find the intersection of the dewpoint temperature curve and the dewpoint difference reading (process temperature-dewpoint temperature) on the x-axis and read the accuracy in dewpoint measurement on the y-axis.

Figure 72  Accuracy in Dewpoint Measurement

Operating Environment

Operating temperature range
for humidity measurement  -70 ... +180 °C (-94 ... +356 °F) see probe specifications
for transmitter body electronics -40 ... +60 °C (40 ... +140 °F)
with display  0 ... +60 °C (+32 ... +140 °F)
Storage temperature  -55 ... +80 °C (-67 ... +176 °F)
Inputs and Outputs

- **Operating voltage**
  - with optional power supply module
  - 10 ... 35 VDC, 24 VAC
  - 100 ... 240 VAC, 50/60 Hz

- **Start-up time after power-up**
  - 3 s

- **Power consumption @ 20 °C (Uin 24VDC)**
  - RS-232
    - Uout 2 × 0 ... 1V / 0 ... 5V / 0 ... 10V
    - Iout 2 × 0 ... 20 mA
    - display and backlight during sensor purge
  - max 25 mA
  - max 60 mA
    - + 20 mA
    - + 110 mA max

- **Analog outputs (2 standard, 3rd optional)**
  - current output
  - voltage output
  - 0 ... 20 mA, 4 ... 20 mA
  - 0 ... 1 V, 0 ... 5 V, 0 ... 10 V
  - ± 0.05 % full scale
  - ± 0.005 %/°C full scale

- **External loads**
  - current outputs
  - 0 ... 1V output
  - 0 ... 5V and 0 ... 10V outputs
  - RL < 500 ohm
  - RL > 2 kohm
  - RL > 10 kohm

- **Max wire size**
  - 0.5 mm2 (AWG 20) stranded wires recommended

- **Digital outputs**
  - RS-232, RS-485 (optional)

- **Relay outputs (optional)**
  - 0.5 A, 250 VAC, SPDT

- **Display (optional)**
  - LCD with backlight, graphic trend display

- **Menu languages**
  - English, French, Spanish, German, Japanese, Russian, Swedish, Finnish, Chinese.

Mechanics

- **Cable bushing**
  - M20x1.5 for cable diameter
  - 8 ... 11mm/0.31...0.43"
  - 1/2"NPT

- **Conduit fitting**
  - M12 series 8- pin (male)

- **User cable connector (optional)**
  - option 1
    - with plug (female) with 5 m / 16.4 ft black cable
  - option 2
    - with plug (female) with screw terminals

- **Probe cable diameter**
  - 907023/333 80°C
  - 6.0 mm
  - 5.5 mm

- **Other probes**
  - 2 m, 5 m or 10 m

- **Probe cable lengths**
  - 907023/331

- **Probe tube material**
  - Chromed ABS plastic
  - AISI 316L
  - G-AISi 10 Mg (DIN 1725)

- **Housing material**
  - IP 65 (NEMA 4)
Transmitter Weight

Table 30 Transmitter Weight (in kg/lb)

<table>
<thead>
<tr>
<th>Probe Type</th>
<th>Probe Cable Length</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2 m</td>
</tr>
<tr>
<td>907023/333</td>
<td>1.1/2.4</td>
</tr>
<tr>
<td>907023/334</td>
<td>1.4/3.1</td>
</tr>
<tr>
<td>907023/335</td>
<td>1.3/2.9</td>
</tr>
<tr>
<td>907023/337</td>
<td>1.2/2.6</td>
</tr>
<tr>
<td>907023/338</td>
<td>1.3/2.9</td>
</tr>
<tr>
<td>178 mm</td>
<td></td>
</tr>
<tr>
<td>400 mm</td>
<td>1.4/3.1</td>
</tr>
</tbody>
</table>

Technical Specifications of Optional Modules

Power Supply Module

- Operating voltage: 100...240 VAC 50/60 Hz
- Connections: screw terminals for 0.5...2.5 mm² wire (AWG 20...14)
- Bushing: for 8...11 mm diameter cable
- Operating temperature: -40 ... +60 °C (-40 ... +140 °F)
- Storage temperature: -40 ... +70°C (-40 ... +158 °F)

Analog Output Module

- Outputs: 0 ... 20 mA, 4 ... 20 mA, 0 ... 1 V, 0 ... 5 V, 0 ... 10 V
- Operating temperature range: -40 ... +60 °C (-40 ... +140 °F)
- Power consumption:
  - \( U_{out} \) 0 ... 1 V max 30 mA
  - \( U_{out} \) 0 ... 5V/0 ... 10V max 30 mA
  - \( I_{out} \) 0 ... 20 mA max 60 mA
- External loads:
  - current outputs: \( R_L \leq 500 \) ohms
  - Max load + cable loop resistance:
    - 0 ... 1 V: \( R_L > 2000 \) ohms
    - 0 ... 5 V and 0 ... 10 V: \( R_L > 10000 \) ohms
- Storage temperature range: -55 ... +80 °C (-67 ... +176 °F)
- 3-pole screw terminal
- Max wire size: 1.5 mm² (AWG16)
**Relay Module**

- **Operating temperature range**: -40 ... +60 °C (-40 ... +140 °F)
- **Operating pressure range**: 500 ... 1300 mmHg
- **Power consumption @ 24 V**: max 30 mA
- **Contacts SPDT (change over)**, for example, Contact arrangement Form C
  - Imax: 0.5 A 250 VAC
  - Imax: 0.5 A 30 VDC
- **Safety standard for the relay component**: IEC60950 UL1950
- **Storage temperature range**: -55 ... +80 °C (-67 ... +176 °F)
- **3-pole screw terminal / relay Max wire size**: 2.5 mm² (AWG14)

**RS-485 Module**

- **Operating temperature range**: -40 ... +60 °C (-40 ... +140 °F)
- **Operating modes**: 2-wire (1-pair) half duplex
  - 4-wire (2-pair) full duplex
- **Operating speed max**: 115.2 kbaud
- **Bus isolation**: 300VDC
- **Power consumption @ 24V**: max 50 mA
- **External loads**: standard loads 32 RL > 10kohm
- **Storage temperature range**: -55 ... +80 °C (-67 ... +176 °F)
- **Max wire size**: 1.5 mm² (AWG16)

**LAN Interface Module**

- **Operating temperature range**: -40 ... +60 °C (-40 ... +140 °F)
- **Storage temperature range**: -40 ... +85 °C (-40 ... +185 °F)
- **Operating humidity range**: 5 ... 95 %RH
- **Power consumption @ 24V**: max 60 mA
- **Ethernet type**: 10/100Base-T
- **Connector**: RJ45
- **Supported protocols**: Telnet, HTTP

**WLAN Interface Module**

- **Operating temperature range**: -20 ... +60 °C (-4 ... +140 °F)
- **Storage temperature range**: -40 ... +85 °C (-40 ... +185 °F)
- **Operating humidity range**: 5 ... 95 %RH
- **Power consumption @ 24V**: max 80 mA
- **Connector**: RP-SMA
- **Supported protocols**: Telnet, HTTP
- **Security**: WEP 64/128, WPA
Data Logger Module

- Operating temperature range: -40 ... +60 °C (-40 ... +140 °F)
- Storage temperature range: -55 ... +80 °C (-67 ... +176 °F)
- Power consumption @ 24V: max 10 mA
- Logged parameters: up to three with trend/min/max values for each
- Logging interval: 10 s (fixed)
- Maximum logging period: 4 years 5 months
- Logged points: 13.7 million points / parameter
- Accuracy of the clock: better than ±2 min/year
- Battery lifetime:
  - at -40 ... +30 °C (-40 ... +86 °F) 7 years
  - at +30 ... +60 °C (+86 ... +140 °F) 5 years
Options and Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Item code</th>
<th>Sales No.</th>
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</thead>
<tbody>
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<td><strong>MODULES</strong></td>
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<td></td>
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<tr>
<td>Relay Module</td>
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<td>Analog Output Module</td>
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<td>Isolated RS485 Module</td>
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<td>POWER-1</td>
<td>90/00502447</td>
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<td>Installation Kit for Pole or Pipeline</td>
<td>215108</td>
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<tr>
<td>Rain Shield with Installation Kit</td>
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<td>DIN Rail Clips with Installation Plate</td>
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<td>Swagelok for 12mm Probe 1/2&quot; ISO Thread</td>
<td>SWG12ISO12</td>
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<td>Cable Gland M20x1.5 with Split Seal</td>
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<td>Duct Installation Kit for 907023/333 and 907023/337</td>
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<td>216681SP</td>
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<td>Conduit Fitting M20x1.5 for NPT1/2 Conduit</td>
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Dimensions (mm/inch)

Figure 73   Transmitter Body Dimensions
Figure 74  WLAN Antenna Dimensions

907023/331

Figure 75  907023/331 Probe Dimensions
907023/333

Figure 76   907023/333 Probe Dimensions

907023/334

Figure 77   907023/334 Probe Dimensions
**907023/335**

The flange is available as an option for the 907023/335 probe.

**Figure 78  907023/335 Probe Dimensions**

**907023/337**

**Figure 79  907023/337 Probe Dimensions**
Figure 80 907023/338 Probe Dimensions

Temperature Probe 907023/337B

Figure 81 Optional Temperature Probe Dimensions
APPENDIX A

PROBE INSTALLATION KITS AND INSTALLATION EXAMPLES

Duct Installation Kits (for 907023/333/337/335)

Duct installation kit includes a flange, a sealing ring, a supporting bar, a probe attaching part, and screws for attaching the flange to the duct wall.

Figure 82  Duct Mounting Installation Kit

The following numbers refer to Figure 82:

1 = Duct wall
2 = Flange
3 = Sealing ring
4 = Supporting bar (not included in the kit for 907023/335)
5 = Probe attaching part (to be fixed with the supporting bar)
6 = Relative humidity probe

NOTE

When the temperature difference between the duct and the air outside the duct is remarkable, the supporting bar must be installed as deep in the duct as possible. This prevents errors caused by the heat conduction in the bar and cable.
Duct Installation Kit for Temperature Probe (for 907023/337)

JUMO duct installation kit for the T-probe includes flange, supporting bar, probe attaching part, sealing ring and the fixing screws (4 pcs).

The following numbers refer to Figure 83:

1 = Duct wall
2 = Flange
3 = Sealing ring
4 = Supporting bar
5 = Probe support (to be fixed to the supporting bar)
6 = Retainer bushing (to be fixed to the probe support)
7 = Temperature probe (to be fixed to the retainer bushing)
Pressure Tight Swagelok Installation Kits (for 907023/337)

**RH Probe Installation**

Swagelok installation kit for the relative humidity probe includes Swagelok connector with ISO3/8" or NPT1/2" thread. Order codes: SWG12ISO38 or SWG12NPT12.

![RH Probe Installation Diagram]

The following numbers refer to Figure 84:

1 = Relative humidity probe  
2 = Duct connector  
3 = ISO3/8" or NPT1/2" thread  
4 = Swagelok connector  
5 = Ferrules

**Temperature Probe Installation**

Swagelok installation kit for T-probe includes Swagelok connector with either ISO1/8" or NPT1/8" thread. Order codes: SWG6ISO18 or SWG6NPT18.

![Temperature Probe Installation Diagram]

The following numbers refer to Figure 85:

1 = T-probe  
2 = Duct connector  
3 = Swagelok connector  
4 = Ferrules
Examples of Vapor Tight Installations with Cable Gland

RH-Probe Installations (for 907023/333/337)

Cable gland AGRO is available from JUMO

(Type: HMP247CG.)

![Diagram of Cable Installation with Cable Gland]

**Figure 86**  Cable Installation with Cable Gland

The following numbers refer to Figure 86:

1  =  Nut (to be tightened to the body)
2  =  Seal
3  =  Body and O-ring

![Diagram of Probe Installation with Cable Gland]

**Figure 87**  Probe Installation with Cable Gland

Probe installation with cable gland is not available from JUMO.

The following numbers refer to Figure 87:

1  =  AGRO 1160.20.145 (T= -40 ... +100 °C)
    Not available from JUMO.
2 = In pressurized places, use a locking ring (for example: 11×1 DIN471).

T- Probe Installations (907023/337)

Figure 88  Vapor Tight Installation

Vapor Tight Installation is not available from JUMO.

The following numbers refer to Figure 88:
1 = Cable gland. For example AGRO 1100.12.91.065 (T= -25 ... +200 °C)
2 = In pressurized processes, use a locking ring (example: 6x 0.7 DIN471)

Figure 89  Wall Mounting Installation

Wall Mounting Installation is not available from JUMO.

The following numbers refer to Figure 89:
1 = Cable gland. For example AGRO 1100.12.91.065
2 = Compacted PTFE sleeve
3 = Silicon glue between the PTFE sleeve and the cable
4 = Temperature probe
5 = Recommended support to keep the probe in horizontal position
Example of Climate Chamber Installation

Figure 90  Climate Chamber Installation

(not Available from JUMO)

The following numbers refer to Figure 90:

1 = PTFE sleeve
2 = Cable gland, for example: AGRO 1100.12.91.065
3 = Stainless steel cable tie or similar fastener
4 = To be sealed (silicone)
5 = Temperature probe
6 = Relative humidity probe
7 = HMP247CG, Cable gland AGRO (available from JUMO)

NOTE

Let the cables hang loosely to prevent condensed water running to the probe.
Example of Installation Through Roof

The following numbers refer to Figure 91:

1 = Insulated probe cables
2 = Sealings
3 = Roof
4 = Cable gland for temperature probe (for example: AGRO 1100.12.91.065)
5 = Temperature probe
6 = Relative humidity probe
7 = Cable gland for relative humidity probe (for example: AGRO 1160.20.145)
8 = Plastic adapter to protect probes from condensation water coming from the pipe. Diameter slightly smaller than tube diameter.
9 = Plastic tube for probe (2 pcs)
10 = Stainless steel tube coming through the roof.
11 = Two thread bars holding the plastic adapter.
12 = Insulated pipe ending.

Process:
For example
+85 °C, 85 %RH
Ball Valve Installation Kit for 907023/338

The ball valve installation kit (Order code: BALLVALVE-1) is preferred when connecting the probe to a pressurized process or pipeline. Use the ball valve set or a 1/2” ball valve assembly with a ball hole of ø14 mm or more. If you install the probe (ø12 mm) in a process pipe, please note that the nominal size of the pipe must be at least 1 inch (2.54 cm). Use the manual press handle to press the probe into the pressurized (< 10 bar) process or pipeline.

Figure 92 Installing the 907023/338 Probe Through a Ball Valve Assembly

The following numbers refer to Figure 92:

1 = Manual press tool
2 = Handle of the ball valve
3 = Probe
4 = Process chamber or pipeline
5 = Groove on the probe indicates the upper adjustment limit
6 = Filter
7 = Ball of the ball valve
8 = Fitting screw
NOTE

The probe can be installed in the process through the ball valve assembly provided that the process pressure is less than 10 bars. This way, the process does not have to be shut down when installing or removing the probe. However, if the process is shut down before removing the probe, the process pressure can be max. 20 bars.

NOTE

When measuring temperature dependent quantities make sure that the temperature at the measurement point is equal to that of the process, otherwise the moisture reading may be incorrect.

Follow the steps below to install the 907023/338 probe through a ball valve assembly. After the installation, the probe should be sitting in the process chamber or pipeline as shown in Figure 92 on page 170.

1. Shut down the process if the process pressure is more than 10 bars. If the pressure is lower there is no need to shut down the process.
2. Close the ball valve.
3. Seal the threads on the fitting body; refer to Figure 26 on page 42.
4. Attach the fitting body to the ball valve and tighten it.
5. Slide the clasp nut of the probe toward the filter, as far as it will go.
6. Insert the probe to the fitting body, and manually tighten the clasp nut to the fitting body.
7. Open the ball valve.
8. Push the probe through the ball valve assembly into the process. If the pressure is high, use the pressing handle that is provided with the probe. If you push the probe hard without using the handle, you may damage the cable.

Note that the probe must be pushed so deep that the filter is completely inside the process flow.
9. Mark the fitting screw and the clasp nut.
10. Tighten the clasp nut with a fork spanner a further 50 ... 60° (ca. 1/6 turn). If you have a suitable torque spanner, tighten the nut to max 45 ± 5 Nm (33 ± 4 ft-lbs). Refer to Figure 27 on page 43.
NOTE

Take care not to tighten the clasp nut more than 60° to avoid difficulties when opening it.

If you wish to remove the probe from the process, note that you have to pull the probe out far enough. You cannot close the valve if the groove on the probe body is not visible.

Meteorological Installation Kit (for 907023/337)

The meteorological Installation Kit TRANSMITTERMIK (Order code: TRANSMITTERMIK) enables the 907023/337 to be installed outdoors to obtain reliable measurements for meteorological purposes. For more information, see TRANSMITTERMIK brochure and order form.

![Diagram of Meteorological Installation Kit](image)

Figure 93  Meteorological Installation Kit for Outdoor Installation
APPENDIX B
CALCULATION FORMULAS

This Appendix contains the formulas used for the calculated output quantities.

The 907023 series transmitters measure relative humidity and temperature. From these values dewpoint, mixing ratio, absolute humidity and enthalpy in normal pressure are calculated using the following equations:

Dewpoint:

\[ T_d = \frac{T_n}{m} - 1 \]

\[ \log \left( \frac{P_w}{A} \right) \]

\( P_w \) is the water vapor pressure. The parameters \( A, m, \) and \( T_n \) depend on temperature according to the following table:

<table>
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<th>t</th>
<th>A</th>
<th>m</th>
<th>Tn</th>
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<tbody>
<tr>
<td>&lt;0 °C</td>
<td>6.1134</td>
<td>9.7911</td>
<td>273.47</td>
</tr>
<tr>
<td>0 ... 50 °C</td>
<td>6.1078</td>
<td>7.5000</td>
<td>237.3</td>
</tr>
<tr>
<td>50 ... 100 °C</td>
<td>5.9987</td>
<td>7.3313</td>
<td>229.1</td>
</tr>
<tr>
<td>100 ... 150 °C</td>
<td>5.8493</td>
<td>7.2756</td>
<td>225.0</td>
</tr>
<tr>
<td>150 ... 180 °C</td>
<td>6.2301</td>
<td>7.3033</td>
<td>230.0</td>
</tr>
</tbody>
</table>

1) Used for frostpoint calculation if the dewpoint is negative
Mixing ratio:

\[ x = 621.99 \cdot \frac{P_w}{p - P_w} \]  

(2)

Absolute humidity:

\[ a = 216.68 \cdot \frac{P_w}{T} \]  

(3)

Enthalpy:

\[ h = (T - 273.15) \cdot (1.01 + 0.00189 \cdot x) + 2.5 \cdot x \]  

(4)

The water vapor saturation pressure \( P_{ws} \) is calculated by using two equations (5 and 6):

\[ \Theta = T - \sum_{i=0}^{3} C_i T^i \]  

(5)

where:

- \( T \) = temperature in K
- \( C_i \) = coefficients
- \( C_0 = 0.4931358 \)
- \( C_1 = -0.46094296 \times 10^{-2} \)
- \( C_2 = 0.13746454 \times 10^{-4} \)
- \( C_3 = -0.12743214 \times 10^{-7} \)

\[ \ln P_{ws} = \sum_{i=-1}^{3} b_i \Theta^i + b_4 \ln \Theta \]  

(6)

where:

- \( b_i \) = coefficients
- \( b_{-1} = -0.58002206 \times 10^4 \)
- \( b_0 = 0.13914993 \times 10^1 \)
where:

\[ b_1 = -0.48640239 \times 10^{-1} \]
\[ b_2 = 0.41764768 \times 10^{-4} \]
\[ b_3 = -0.14452093 \times 10^{-7} \]
\[ b_4 = 6.5459673 \]

The water vapor pressure is calculated using:

\[ P_w = RH \cdot \frac{P_{ws}}{100} \] (7)

Parts per million by volume is calculated using:

\[ ppm_v = 10^6 \cdot \frac{P_w}{P - P_{ws}} \] (8)

Symbols:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
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<td>( T_d )</td>
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<td>( P_w )</td>
<td>water vapor pressure (hPa)</td>
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<tr>
<td>( P_{ws} )</td>
<td>water vapor saturation pressure (hPa)</td>
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<tr>
<td>( RH )</td>
<td>relative humidity (%)</td>
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<tr>
<td>( x )</td>
<td>mixing ratio (g/kg)</td>
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<td>( p )</td>
<td>atmospheric pressure (hPa)</td>
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<tr>
<td>( A )</td>
<td>absolute humidity (g/m3)</td>
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<td>( T )</td>
<td>temperature (K)</td>
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<tr>
<td>( h )</td>
<td>enthalpy (kJ/kg)</td>
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