Humidity/Temperature Measuring Instrument
for industrial applications, capacitive method of measurement

AFK-E

- Measuring range: 0...100% rH, -40...+180 °C
- Maximum accuracy up to 180 °C
- High degree of resistance of sensor to chemicals
- Output of measured values (rH, °C) deviated values (dew point, absolute humidity etc.) via RS232
- Pressure-tight version 0.01...20 bar abs.
- Display
- Sensor coating
- Including factory calibration

KOBOLD companies worldwide:
ARGENTINA, AUSTRALIA, AUSTRIA, BELGIUM, BULGARIA, CANADA, CHILE, CHINA, COLOMBIA, CZECHIA, EGYPT, FRANCE, GERMANY, GREAT BRITAIN, HUNGARY, INDIA, INDONESIA, ITALY, MALAYSIA, MEXICO, NETHERLANDS, PERU, POLAND, REPUBLIC OF KOREA, ROMANIA, SINGAPORE, SPAIN, SWITZERLAND, TAIWAN, THAILAND, TUNISIA, TURKEY, USA, VIETNAM
Description
The measuring instruments AFK-E have been designed for the accurate measurement of humidity and temperature in industrial applications. They allow measurements in the range 0...100% rH and between -40°C...+180°C.

A capacitive humidity sensor element with excellent longterm stability, minimum hysteresis and high chemical resistance forms the basis for this highly accurate transmitter series.

The values for humidity and temperature are displayed on two analogue outputs. A scalable and selectable current signal in the range 4 - 20 mA or any voltage signal between 0 and 10 V are available for selection.

This flexibility is achieved with cutting-edge microprocessor technology, whereby the scaling and selection of the output signal is carried out with a user-friendly graphic interface running under MS Windows. The factory setting can thus be changed easily on site by the user.

In addition to measured values for humidity and temperature, the transmitters supplies the following values:

- Dew-point temperature
- Freezing point temperature
- Wet-bulb temperature
- Water-vapour partial pressure
- Mixing ratio
- Absolute humidity
- Specific enthalpy

The measured values are also output to an RS232 serial port for further processing by software.

Application Examples

Control
- Humidity of clean rooms
- Air-conditioning cabinets
- Cheese ageing rooms

Drying
- Ceramics
- Bricks
- Wood
- Pharmaceutical products
- Pasta & noodles

Warehousing
- Medicines
- Fruit and vegetables

Technical Details

Characteristic data of humidity sensor

Measuring range: 0...100% rH
(notice operating range of humidity sensor)

Accuracy
(including hysteresis, non-linearity and repeatability)

- at -15...+40°C / <90% rH: ±(1.3 + 0.3% of reading) % rH
- at -15...+40°C / >90% rH: ±2.3% rH
- at -25...+70°C: ±(1.4 + 1% of reading) % rH
- at -40...+180°C: ±(1.5 + 1.5% of reading) % rH

Temperature dependence of electronics: typically ±0.01% rH/°C

Response time t_{10/90} at 20°C
- without filter: <6 s
- with st. steel sintered filter: 30 s
- with PTFE filter: 14 s
- with metal screen: <15 s

Characteristic data of temperature sensor

Measuring range: -40...+180°C
Sensor: Pt 1000
(DIN EN 60751, category A)

Accuracy:

Temperature dependence of electronics: typically 0.005°C/°C

Electrical characteristic data

Analogue outputs
(selectable and scalable):
- 0 - 5 V < 1.0 mA
- 0 - 10 V < 1.0 mA
- 4 - 20 mA R_L < 500 Ω
- 0 - 20 mA R_L < 500 Ω

Supply voltage:
- SELV 8...35 V_{DC}
- SELV 12...30 V_{AC}

- with optional plug-in power supply unit: 100 - 240 V_{AC}

Alarm outputs

An alarm module is available for control and alarm purposes, which may be configured with the configuration software and USB interface cable.

The user thus has the option of setting the measurand to be monitored (RH, T, Td,...) and the threshold hysteresis for each relay.
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Max. switched voltage / max. switched current: 250 VAC / 6 A; 28 VDC / 6 A
Minimum load: >100 mA / 12 V

Current consumption:
• 2 x voltage output: typically 40 mA for 24 VDC/AC
• 2 x current output: typically 80 mA
with plug-in power supply unit:
• 2 x voltage output: typically 15 mA
• 2 x current output: typically 15 mA

General characteristic data
Resistance to pressure:
• Standard version: atmospheric
• Pressure-tight version: 0.01...20 bar abs. (½” Swagelok screwing)
Housing:
• Aluminium, fixed wall mounting integrated
Electr. connection:
• Screw terminals to max. 1.5 mm²
Sensor protection:
• Stainless steel sintered filter (PTFE filter and metal screen optional)
Cable lengths:
• 2 m, 5 m, 10 m, 20 m (PTFE cable up to 200 °C)
Operating temperature/storage temperature electronics:
• -40...+60 °C without display
• -20...+50 °C with display
Electromagnetic compatibility:
• According to EN61326-1 industrial environment, EN61326-2-3
Protection class:
• IP 65

Communication
Microsoft® Windows XP® or higher,
USB Interface for PC communication.

Calculated Functions
The following calculated functions are given out from the transmitter AFK-E out of the measured values for temperature and relative humidity:

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Standard ranges</th>
<th>max. adjustable ranges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative humidity (rH)</td>
<td>0...100 % rF</td>
<td>0...100 % rF</td>
</tr>
<tr>
<td>Temperature (T)</td>
<td>-40...+180 °C</td>
<td>-40...+180 °C</td>
</tr>
<tr>
<td>Dew-point temperature (Td)</td>
<td>-40...+100 °C</td>
<td>-40...+100 °C</td>
</tr>
<tr>
<td>Freezing point temperature (Tf)</td>
<td>-40...0 °C</td>
<td>-40...0 °C</td>
</tr>
<tr>
<td>Wet-bulb temperature (Tw)</td>
<td>0...+100 °C</td>
<td>0...+100 °C</td>
</tr>
<tr>
<td>Water-vapour partial pressure (e)</td>
<td>0...1000 mbar</td>
<td>0...1100 mbar</td>
</tr>
<tr>
<td>Mixing ratio (r)</td>
<td>0...500 g/kg</td>
<td>0...999 g/kg</td>
</tr>
<tr>
<td>Absolute humidity (dv)</td>
<td>0...600 g/m³</td>
<td>0...700 g/m³</td>
</tr>
<tr>
<td>Specific enthalpy (H)</td>
<td>-40...1500 kJ/kg</td>
<td>-50...2800 kJ/kg</td>
</tr>
</tbody>
</table>

These values can be indicated on the display (option) and are also available as analogue outputs. For software processing the measuring values are in addition given out via a serial RS232 interface.

Options
Pressure resistant measuring sensor
The pressure resistant measuring sensor can be operated at a maximum pressure of 20 bar. For mounting this measuring sensor a pressure tight duct with a ½” thread is enclosed in the shipment.

Measured value display
The two line LCD can display two measured or two calculated values.

Sensor coating
For strongly contaminated or corrosive atmospheres special coated sensors are available. By means of the polymeric coating the sensors get a drastically improvement of their chemical resistance and therefore a considerable increase of the long-term stability of the measuring transmitter. Especially for drying processes the use of the coating has been proved and tested.

Cable length
The connection cable between sensor and transmitter is available in the following lengths:
• 2, 5, 10 and 20 mm.

* The grey area indicates the allowed measuring area for the humidity sensor. Operating points outside this area do not cause damage to the element, however the specified measuring accuracy cannot be guaranteed.

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Accessories

Dustproof filter covers

- **Stainless steel sintered filters**: for tough industrial applications where the detecting sensors are exposed to strong mechanical and thermal stresses; serviceable to 180 °C.
  Model AFZ-E1

- **PTFE filter**: for chemically aggressive environments and high temperatures, serviceable to 180 °C (not with pressure-tight version)
  Model AFZ-E2

- **Metal screen**: with high humidity, danger of moisture condensation or with rapidly alternating humidity cycles, serviceable to 120 °C (not with pressure-tight version)
  Model AFZ-E3

- **External plug-in power supply unit with 1.5 m cable**: for direct connection to a supply voltage of 100...240 V<sub>AC</sub>.
  Model AFZ-E4

- **Stainless steel mounting flange**: for installation of humidity sensor in the duct
  Model AFZ-E6

  Hole circle: Ø 46 mm
  Boreholes: 4 x 6 mm

- **Dripping water protection cap (85 mm)**: for protection of the sensor element from condensed water in case of hanging mounted sensor
  Model AFZ-E8
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Resistance table for humidity transmitter AFK-E (without sensor coating »P«)

<table>
<thead>
<tr>
<th>Chemical product</th>
<th>Formula</th>
<th>Gas rate up to</th>
<th>Harmless</th>
<th>Negative effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia</td>
<td>NH₃</td>
<td>500 ppm</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Chlorine</td>
<td>Cl₂</td>
<td>0.5 ppm</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Chlorine methane</td>
<td>CH₂Cl₂</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethanol (liquid for cleaning)</td>
<td>CH₃CH₂OH</td>
<td>100 ppm</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Ethylene oxide</td>
<td>C₂H₄O</td>
<td>2 ppm</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Hydrofluoric acid</td>
<td>HF</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Formaldehyde</td>
<td>HCHO</td>
<td>6 mg/m³</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Freon 113</td>
<td>C₂Cl₆F₁₂</td>
<td>5000 ppm, 39 g/m³</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Isopropanol (liquid, for cleaning)</td>
<td>(CH₃)₂CHOH</td>
<td>100 ppm</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Carbon monoxide</td>
<td>CO</td>
<td>100000 ppm</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Methanol (liquid, for cleaning)</td>
<td>CH₃OH</td>
<td>40 ppm</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Ozone</td>
<td>O₃</td>
<td>2 mg/m³</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Hydrochloric acid</td>
<td>HCl</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Sulphur dioxide</td>
<td>SO₂</td>
<td>100 ppm</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Hydrogen sulphide</td>
<td>H₂S</td>
<td>500 ppm</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Hydrogen oxide</td>
<td>NO₂</td>
<td>20 ppm</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>UV-light</td>
<td></td>
<td>at 300-400 nm and 2J/cm²- duration of exposure approx. 5 min ultra violet endangered sensor areas are protected via metal layer</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Hydrogen peroxide</td>
<td>H₂O₂</td>
<td>use protection filter cap H₂O₂</td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>

Insertable in Argon and N₂-Gas with coated sensor

Order Details (Example: AFK-E 2S 1 K 02 N)

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Pressure resistance</th>
<th>Display</th>
<th>Sensor coating</th>
<th>Cable length</th>
<th>Calibration</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFK-E</td>
<td>Humidity measuring instrument</td>
<td>2S = atmospheric</td>
<td>1 = without display</td>
<td>K = not Polymer coated</td>
<td>02 = 2 m</td>
<td>N° = standard ±2 % rH (0...90 % rH)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2D = pₚmax 20 bar</td>
<td>2 = with display</td>
<td>P = Polymer coated</td>
<td>05 = 5 m</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10 = 10 m</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20 = 20 m</td>
<td></td>
</tr>
</tbody>
</table>

* Factory certificate according to EN 10204 (3 points at 23 °C) is in delivery scope

Order Details Accessories (Example: AFZ-E 1)

<table>
<thead>
<tr>
<th>Model</th>
<th>Accessories</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFZ-E</td>
<td>1 = stainless steel sintered filter</td>
</tr>
<tr>
<td></td>
<td>2 = PTFE filter</td>
</tr>
<tr>
<td></td>
<td>3 = metal screen</td>
</tr>
<tr>
<td></td>
<td>4 = external plug-in power supply unit</td>
</tr>
<tr>
<td></td>
<td>6 = stainless steel mounting flange</td>
</tr>
<tr>
<td></td>
<td>8 = dripping water protection cap</td>
</tr>
</tbody>
</table>
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Dimensions [mm]

Housing depth: 66.5 mm
Mounting holes: 150 x 57 mm, Ø 4.2 mm

Pressure rating (2S = pressureless)
Pressure rating (2D = 20 bar)

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