Humidity Monitoring in Compressed Air
Increase safety - Cut costs
The humidity sensor

Optimal for trace humidity measurement
The testo humidity sensor is generally calibrated at several points to ensure minimum deviations. For trace humidity measurement, a high-precision reference measurement (dewpoint mirror) is used to help carry out a calibration at -40 °C (pressure dewpoint).
To demonstrate the accuracy of testo’s humidity sensors, five sensors were extensively tested in a large number of international calibration institutes over a 5-year period. All the measurement results confirmed the high accuracy of 1% RH.

Monitor trace humidity, avoid damage
Dry air, compressed air and dry gases are used in all areas of industry. Humidity is normally undesirable because it can cause damage or impair the quality of the end product, as the graphic underneath shows.

- Corrosion in pipes and function elements
- Formation of ice in cold and external zones
- Bacterial growth (European drug legislation)
- Moist powder conglutinated
- e.g. transport air for pharmaceutical powder
- e.g. medical compressed air

That's why you need the testo 6740 for effective trace humidity measurement

Granulate drying: dry air is a requirement for product quality
Compressed air systems: drier monitoring to avoid damage caused by humidity
Medical compressed air: minimum humidity as a hygiene requirement
Gas engineering: humidity causes damage and reduces the value of the gas in the system
What is compressed air quality?
The international standard ISO 8573 defines seven classes of compressed air quality and lays down the humidity, the oil content, the particle content etc. which the compressed air is allowed to have. Class 1 represents the highest requirements. Class 4 is satisfied if, for instance, the pressure dewpoint does not exceed 3 °CtP or 37 °FtP or an absolute humidity of 6 g water vapour per m³ or 8,150 ppmv (parts per million, relative to the volume).
The main way of ensuring compliance with a quality class involves installing a suitable drier. Its monitoring and, where appropriate, its control (see below), is handled by the testo 6740.

How can costs be reduced?
Of course, the main reason for using the testo 6740 is to monitor and avoid excessive humidity in the system so as to avoid damage (cf. p. 2 below). In addition, dryer operating costs can be reduced sharply.

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### Adsorption driers:
If chamber switchover is humidity-controlled using the testo 6740 rather than being time-controlled (see diagram on the right), the dry phases (blue) are normally much longer than the regeneration phases (red). During this time no regeneration air must be generated, so that the compressors can be reduced from 100% to about 85% volumetric flow rate. This results in significant savings in operating costs.

### Cooling driers:
In non-critical systems, low-temperature driers can be switched off completely when air humidity is low (e.g. in the winter). The testo 6740 supplies the humidity measurement here as well. If the humidity surges that occur when the low-temperature driers are switched on are to be avoided, a downstream low-temperature drier can be kept in continuous operation to trap this humidity. This results in tangible savings in operating costs.

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### ISO 8573 Trace humidity

<table>
<thead>
<tr>
<th>Class</th>
<th>°CtP</th>
<th>°FtP</th>
<th>g/m³</th>
<th>ppmv</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-70</td>
<td>-94</td>
<td>0.003</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>-40</td>
<td>-40</td>
<td>0.12</td>
<td>163</td>
</tr>
<tr>
<td>3</td>
<td>-20</td>
<td>-4</td>
<td>0.88</td>
<td>1200</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>37</td>
<td>6</td>
<td>8150</td>
</tr>
<tr>
<td>5</td>
<td>7</td>
<td>44</td>
<td>7.8</td>
<td>10600</td>
</tr>
<tr>
<td>6</td>
<td>10</td>
<td>50</td>
<td>9.4</td>
<td>12800</td>
</tr>
<tr>
<td>7</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Typical application**
- Semi-cond. prod.
- Granulate drier
- Transport air
- Pneu. tube conveyor
- Vacuum eng.
- Working/energy air
- Blow air

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<table>
<thead>
<tr>
<th>Equipment</th>
<th>Compressed air drier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitoring/</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>testo 6740</td>
</tr>
</tbody>
</table>

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![Diagram of Adsorption Driers](image-url)

![Diagram of Cooling Driers](image-url)
Features and benefits

- Maximum reliability
  - Long-term stability, testo humidity sensor applied 100,000 times over
  - Demonstrably correct indication of measurement ranges and data
  - Highest manufacturing quality
- Calculation of the most important trace humidity variables
  - e.g. °Ctpd, °Ftd atmospheric, ppmv
- Calibration protocol
- Convenient operation
  - Via the display menu without additional aids
  - Without display via the internal interface and scaling adapter software (cf. p. 6)
  - Local 1-point calibration

The long-term stable testo humidity sensor with protocolled precision calibration at residual humidity -40 °Ctpd

Ultra-easy menu operation (cf. p.6) via buttons
- Select the humidity variable
- Change the scaling
- Set alarms, incl. hysteresis
- Carry out local 1-point calibration
- Test analog signal and alarm outputs
- Call up historic min./max. values

Housing

Material Plastic, polyacrylamide
Dimensions 199.5x37x37 (with analog output plug)
203.5x37x37 (with limit signal output plug)
Ambient temperature −20 ... 70 °C
Storage temperature −40 ... 80 °C
Protection type IP 65
Rotation of housing By 350° (to align display)

Sensor and sensor protection

Humidity sensor testo humidity sensor with protocolled trace humidity adjustment at −40 °Ctpd
Temperature sensor NTC
Sensor guard Sintered stainless steel cap
Meas. uncertainty

Humidity +/− 1 K at 0 °Ctpd
+/− 3 K at −20 °Ctpd
+/− 4 K at −40 °Ctpd
Temperature +/− 0.5 K (0 ... 50 °C)

Limit signal outputs (optional, 0554.3302)

Contacts 2 floating NO contacts, max. 30 V/0.5 A
Operating points Standard: 4 ... 12 °C/°F
with freely programmable display

Technical data testo 6740

Measuring range

Pressure dewpoint temperature (trace humidity) − 60 to +30 °Ctpd
at pressure dewpoints < 0 °Ctpd display of frost point, at > 0 °Ctpd of dewpoint

Temperature 0 ... 50 °C

Atmospheric dewpoint
(cf. diagram on p.7)
− 80 ... − 15 °Ctd (at 30 bar rel.)
− 70 ... + 10 °Ctd (at 3 bar rel.)
− 60 ... + 30 °Ctd (at 0 bar rel.)

Pressure resistance testo 6740: Up to 50 bar absolute
Measurement chamber 0554.3303: Up to 15 bar absolute

Analog output

Signal 4 ... 20 mA, two-wire
Scaling Freely scalable via display/buttons
Standard: 4 ... 20 mA = −60 ... +30 °Ctpd

Output variables °Ctpd, °Ftd, °CtA (atm. dewpoint),
°FtA, %RH, ppmv, mg/m³, °C, °F
Resolution 12 Bit
Accuracy +/− 0.4 µA

Supply

Voltage 24 VDC (10 ... 30 VDC allowed); with alarm plug (0554 3302) 20 to 28 VDC
Max. load 10 VDC: 100 Ohm, 30 VDC: 950 Ohm, cf. p.7

EMC

According to Directive 89/336 EEC
**Customised combinations**

Every measuring point can be optimally configured. With or without a display, with European G 1/2 thread or American NPT 1/2” thread. With or without limit signal output.

Directly assembled, with measurement chamber or with cooling coil. All combinations are possible, ensuring your needs are met optimally.

**The 4 types of the testo 6740 family**

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>G 1/2</td>
<td>Basic instrument</td>
<td>0555 6741</td>
</tr>
<tr>
<td>NPT 1/2</td>
<td>Basic instrument, NPT thread</td>
<td>0555 6742</td>
</tr>
<tr>
<td>G 1/2</td>
<td>Basic instrument, with display</td>
<td>0555 6743</td>
</tr>
<tr>
<td>NPT 1/2</td>
<td>Basic instrument, with display, NPT thread</td>
<td>0555 6744</td>
</tr>
</tbody>
</table>

**Ordering data testo 6740**

<table>
<thead>
<tr>
<th>Description</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic instrument (incl. plug for analog signal output)</td>
<td>0555 6741</td>
</tr>
<tr>
<td>testo 6741, G 1/2 thread, without display</td>
<td>0555 6742</td>
</tr>
<tr>
<td>testo 6743, G 1/2 thread, with display</td>
<td>0555 6743</td>
</tr>
<tr>
<td>testo 6744, NPT 1/2” thread, with display</td>
<td>0555 6744</td>
</tr>
</tbody>
</table>

**Accessories**

<table>
<thead>
<tr>
<th>Description</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable connection plug for analog output 4 ... 20 mA, with 2 floating switch contacts and 2 LEDs</td>
<td>0554 3302</td>
</tr>
<tr>
<td>Measurement chamber (for 6741, 6742), up to 15 bar</td>
<td>0554 3303</td>
</tr>
<tr>
<td>Cooling coil (up to 200 °C, use only with measurement chamber)</td>
<td>0554 3304</td>
</tr>
<tr>
<td>Scaling adapter for testo 6741 / 6742 incl. software</td>
<td>0554 3305</td>
</tr>
<tr>
<td>ISO calibration certificate, two calibration points (-10 °/-40 °Ctp at 6 bar)</td>
<td>0520 0136</td>
</tr>
<tr>
<td>ISO calibration certificate, pressure dewpoint (-40 °...0 °Ctpd at 6 bar)</td>
<td></td>
</tr>
</tbody>
</table>

**Basic costs**

<table>
<thead>
<tr>
<th>Description</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO calibration certificate, two calibration points (-10 °/-40 °Ctp at 6 bar)</td>
<td>0520 0116</td>
</tr>
</tbody>
</table>

**External display testo 54-2AC, 2 limit signal outputs (up to 300 VAC, 3 A), supply 230 VAC**

**Power supply**

<table>
<thead>
<tr>
<th>Description</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply (bench unit) 90...264 VAC / 24 VDC (350 mA)</td>
<td>0554 1748</td>
</tr>
<tr>
<td>Power supply (DIN rail mounting) 90...264 VAC / 24 VDC (3 A)</td>
<td>0554 1749</td>
</tr>
</tbody>
</table>

**Selection advice: choosing the right components for your application**

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Measurement chamber (0554 3303)</td>
<td>For process temperatures &gt; 50 °C (up to 200 °C), use a cooling coil (0554,3304) &amp; measurement chamber (0554,3303).</td>
</tr>
<tr>
<td>B</td>
<td>Cooling coil (0554 3304)</td>
<td>For atmospheric dry air (e.g. granulate driers), a teflon tube is used and the valve of the measuring chamber is opened fully. At process temperatures &gt; 50 °C, connect a cooling coil upstream.</td>
</tr>
<tr>
<td>C</td>
<td>Teflon tube (0669 2824/4)</td>
<td>For dirty, oily media, connect a 40 µm filter upstream.</td>
</tr>
<tr>
<td>D</td>
<td>Compressed air quick connection (plug NW 7.2)</td>
<td>If neither A nor B is required: just screw directly into the G1/2 or NPT 1/2” thread. Depressurised tube required during installation.</td>
</tr>
</tbody>
</table>

**System components, ordering details**

**Measurement chamber (0554 3303)**

For optimal flows past the sensor (valve can be infinitely adjusted) and quick installation.

**Cooling coil (0554 3304)**

For process temperatures 50 ...200 °C (only with measurement chamber).

**Teflon tube (0669 2824/4)**

For dry air.
The ideal operating concept

Easy to operate with or without a display
Does the unit have to be changed from °Ctpd to ppmv, or do the operating points need to be corrected? These and many other settings can be easily configured via the display. Or - and this is particularly advantageous for OEM customers such as manufacturers of compressed air dryers - these adjustments can be handled by a PC running the scaling adapter software 0554.3305, even without a display.

With display, testo 6743, testo 6744
Without display, testo 6741, testo 6742

The display and buttons enable ultra-easy
menu operation with maximum convenience for the user

- Change units
- Change scaling
- Single-point calibration
- Reset

The display menu
Fully oriented to field requirements: Alternating display value and unit, option of switching off the display, password protection, unit selection, etc. Try it out! You will certainly appreciate the intuitive operation.

The scaling adapter software permits mobile
access, perfect for OEM or service personnel

- Firmware version
- Digital values
- Keyboard test
- Further information

The display menu

- Alternating display
  Measure value 6 s  Unit 2 s

Select unit

- °Ctpd
- °Ftpd
- °CtA
- °FRA
- %RH
- ppmv
- mg/m³
- °C
- °F

Define scale

- 4 mA *
- 20 mA *

* testo 6740 specifies typical scale defaults for the chosen UNIT. These can be changed as desired.

** Only necessary for UNITs °CtA, °FRA (atm. dewpoint) or mg / m³ (absolute humidity)
Pressure dewpoint or atmospheric dewpoint?

Atmospheric air is able to store more water vapour than compressed air. If the compressed air is cooled down, it reaches its dew point ("pressure dewpoint" in °CtP or °FtP) at higher temperatures, while atmospheric air can be cooled down further until condensate is first produced ("atmospheric dewpoint" in °CtA or °FtA). Only the pressure dewpoint is relevant to the monitoring of compressed air systems for trace humidity because this indicates how far away the "danger threshold" (= dewpoint) is. Since some users are accustomed to working with an atmospheric dewpoint, however, the testo 6740 allows the option of outputting both the pressure dewpoint and the atmospheric dewpoint (the absolute process pressure is input for the latter).

1. Pressure dewpoint (35 bar) is relieved to 4 bar. The pressure dewpoint thus falls from 10 °CtP to -23 °CtP.

2. Compressed air (7 bar) has a pressure dewpoint of 20 °CtP. This corresponds to an atmospheric dewpoint of -8 °CtA.

The electrical wiring

![Electrical Wiring Diagram]

**What is \( R_L \)?**

The total resistance of the 2-wire connection, consisting of the line, and possibly an external display and control unit

\[
R_L = \text{Load impedance, external load}
\]

<table>
<thead>
<tr>
<th>( V )</th>
<th>( A )</th>
<th>( B )</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 V</td>
<td>300 Ohm</td>
<td></td>
</tr>
<tr>
<td>24 V</td>
<td>650 Ohm</td>
<td>650 Ohm</td>
</tr>
<tr>
<td>30 V</td>
<td>950 Ohm</td>
<td></td>
</tr>
</tbody>
</table>

\( \text{LS} = \text{Lower Switch} \quad \text{US} = \text{Upper Switch} \)