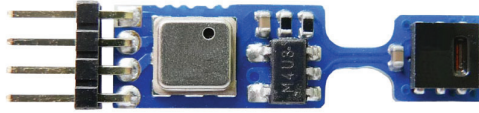## Miniature multi-sensor module for measuring temperature, humidity, and pressure with integrated EEPROM FH0D 46-C

Our new plug-in digital multi-sensor module - with its miniature design and extremely low energy consumption - combines the measurable variables - temperature, atmospheric humidity, and atmospheric pressure. It takes a complete reading of all these ambient parameters and can thus accurately determine all humidity-related and pressure-dependent variables, e.g. the frequently needed mixture ratio (r).

It communicates its findings via an I²C interface; the user can selectively access individual sensor variables and data saved to the integrated EEPROM.

Before leaving our factory the sensor module is adjusted and assigned an electronic identification code that can be read out on receipt of the appropriate command. The integrated EEPROM can be used to save the user's own adjustment data, fine tuning, or electronic ID data (ID number, comments text, etc.). Since the saved parameters are retained in the EEPROM, a multi-sensor module can only be exchanged or replaced with modules that are identically calibrated and have all the same data.

The module is specially designed with very good thermal isolation to withstand temperature influence / thermal conduction and thus ensure that all variables are measured precisely. This system - unlike analog measured value processing - virtually excludes the risk of varying line lengths or disturbance factors adversely affecting the accuracy of measured results.

Technical data

Temperature range	-40 to +85 °C
Accuracy	+5 to +60 °C, typical ±0.2 K
	+5 to +60 °C, maximum 0.4 K
	-20 to +85 °C, maximum 0.7 K
Reproducibility	typical ±0.1 K
Humidity range	5.0 to 98.0 % RH
Accuracy	10 to 90 % RH, maximum ±2 % RH at 23 °C ±5 K
	5 to 98 % RH, maximum ±4 % RH at 23 °C ±5 K
Hysteresis	typical ±1 % RH
Pressure range	300 to 1100 mbar
Accuracy	700 to 1100 mbar, ±2.5 mbar at 23 °C ±5 K
Internal memory	two-wire serial EEPROM 4 kbit (512 x 8 bit)

I²C interface	
Data rate	0 to 400 kHz
Sampling rate	2/sec at highest resolution
Electrical data	
Power supply	2.1 to 3.6 V, typical 3.3 V
Current consumption	during measuring typical 310 µA
	in standby typical 0.35 µA
Energy consumption	during measuring typical 1.02 mW
	in standby typical 1.16 µW
Connection	male strip connector, 4-pin, spacing 1.27 mm see pin assignment

lead-free, halogen-free, and RoHS-compliant (restriction of hazardous substances)

Pin assignment

1 SDA
2 VCC
3 GND
4 SCL

Dimensions

22,8
5,2
2,4
5,7
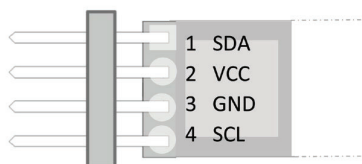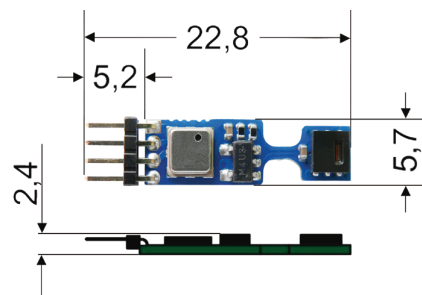
Variants

Order no.

Miniature multi-sensor module for, humidity, temperature, and pressure with integrated EEPROM

packaging unit 1 piece	**FH0D46C**
packaging unit 10 pieces	**FH0D46CVE0010**
packaging unit 100 pieces	**FH0D46CVE0100**

Air humidity

Digital sensor for temperature, humidity, and atmospheric pressure FHAD 46-Cx
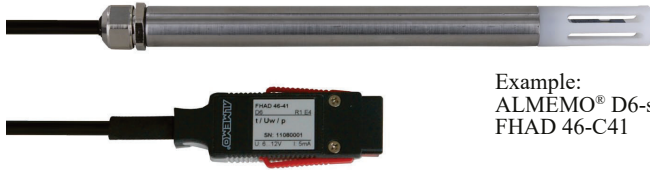
Example:
ALMEMO® D6-sensor
FHAD 46-C41

Digital sensor for temperature, humidity, and atmospheric pressure FHAD46-Cx, with ALMEMO® D6 plug
new: atmospheric pressure sensor integrated in the multi-sensor module, for automatic atmospheric pressure compensation

Common technical features FHAD 46-Cx

- All sensors in 1 multi-sensor module: capacitive digital sensor for humidity and temperature, digital atmospheric pressure sensor. Additional EEPROM data storage medium in the sensor module.
- The sensor module is thoroughly adjusted. All sensor characteristic and adjustment data are stored on the data storage medium of the sensor module itself. In the process of readjusting the individual sensors the adjustment values are directly saved on the data storage medium of the sensor module.
- *new:* Every sensor module has an unique serial number saved on the humidity sensor. The serial number is either displayed in the sensor menu of the measuring instrument or in the ALMEMO® Control software. Hence, calibrated sensor modules can clearly be assigned to the calibration certificate.
- Replacement sensor modules are inexpensive: The sensor module is pluggable and can simply be exchanged on-site. Full accuracy without any adjustment, especially with calibrated sensors. The ALMEMO® connecting cable and the ALMEMO® measuring instrument have no influence on the calibration.
- new: The atmospheric pressure is measured directly at the measuring point in the sensor tip. Hence, the atmospheric pressure dependent humidity variables are automatically pressure compensated.

- All relevant ambient parameters are measured with just one sensor.
- Humidity calculation on the basis of formulae as per Dr. Sonntag and the enhancement factor as per W. Bögel (correction factor fw(t,p) for real mixed gas systems) This substantially widens the measuring range and improves the accuracy of humidity variable calculations.
- *new:* Humidity variable : Absolute humidity in g/m³
- The humidity variables are calculated from the three primary measuring channels (real measurable variables). temperature, relative humidity, atmospheric pressure
- Freely selectable measurable variables
  Four measuring channels are programmed (at our factory). temperature (°C, T, t), relative humidity (%H, RH, Uw), dewpoint (°C, DT, td), atmospheric pressure (mbar, AP, p) Other humidity variables can also be selected.
  mixture (g/kg, MH, r), absolute humidity (g/m³, AH, dv), vapor pressure (mbar, VP, e), enthalpy (kJ/kg, En, h)
  The configuration is performed on the ALMEMO® V7 measuring instrument or directly on the PC using the USB adapter cable ZA1919AKUV (see chapter "ALMEMO® Network technology").

Common technical data FHAD 46-Cx

Digital temperature / humidity sensor (including A/D converter)

Operative range	depending on sensor type
Humidity	
Measuring range	0 to 98 % RH
Sensor	CMOSens® technology
Accuracy	±2.0 % RH in range 10 to 90 % RH
	±4.0 % RH in range 5 to to 98 % RH
	at nominal temperature
Hysteresis	typical ±1 % RH
Nominal temperature	+23 °C ±5 K
Sensor operating pressure	Atmospheric pressure
Response time T_{63}	typical 8 seconds at +25 °C, 1 m/s (without filter)
Temperature	
Sensor	CMOSens® technology

Accuracy	typical ±0.2 K at 5 to 60 °C
	maximum ±0.4 K at 5 to 60 °C
	maximum ±0.7 K at -20 to +80 °C
Reproducibility	typical ±0.1 K
Response time T_{63}	typical 20 seconds (without filter)

ALMEMO® connecting cable
  PVC; Length (see variants) with ALMEMO® D6 plug
  new FHAD 46-C4xAx silicone

Digital atm. pressure sensor (integrated in the multi-sensor module)

Measuring range	700 to 1100 mbar
Accuracy	±2.5 mbar (at 23 °C ±5 K)

ALMEMO® D6 plug

Refresh rate	1 seconds for all four channels
Supply voltage	6 to 13 VDC
Current consumption	3 mA

DAkkS or factory calibration KH9xxx temperature, humidity for digital sensor (see chapter „Calibration certificates").
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

Digital sensor for temperature, humidity, and atm. pressure FHAD 46-C4AG
in protective all-weather housing cable length up to 100 meters with ALMEMO® D6 plug

Technical data and variants
(see chapter „Meteorology")

Air humidity

MetiorLAB

Digital sensor for temperature, humidity, and atm. pressure FHAD 46-C4xAx
Version in stainless steel, with protective cap with ALMEMO® D6 plug

Replacement multi-sensor module FH0D 46-C

Technical features

- *new* extended operating temperature range.
- *new* Silicone connecting cable.

- Four measuring channels are programmed (at our factory). temperature (°C, T, t), relative humidity (%H, RH, Uw), dewpoint (°C, DT, td), atmospheric pressure (mbar, AP, p)

Technical data

Operative range	-40...+85 °C / 5...98 % RH		Length (see variants)
Mechanical design		Protective cap	slotted, open cap, SK10
Sensor tube	Stainless steel, diameter 12 mm	Screw-fit cable gland	Splash-protected

General description and common technical data see FHAD 46 Cx

Variants including manufacturer's test certificate

	Order no.
Digital sensor for temperature, humidity, and atmospheric pressure, protective cap, stainless steel tube, with fitted cable and ALMEMO® D6 plug.	
Sensor length 160 mm, Connecting cable, length 2 meters	**FHAD46C41A**
Sensor length 160 mm, Connecting cable, length 5 meters	**FHAD46C41AL05**
Sensor length 160 mm, Connecting cable, length 10 meters	**FHAD46C41AL10**
Sensor length 270 mm, Connecting cable, length 2 meters	**FHAD46C42A**
Sensor length 270 mm, Connecting cable, length 5 meters	**FHAD46C42AL05**
Sensor length 270 mm, Connecting cable, length 10 meters	**FHAD46C42AL10**
Sensor length 530 mm, Connecting cable, length 2 meters	**FHAD46C43A**
Sensor length 530 mm, Connecting cable, length 5 meters	**FHAD46C43AL05**
Sensor length 530 mm, Connecting cable, length 10 meters	**FHAD46C43AL10**
Replacement multi-sensor module, digital, adjusted, plug-in	**FH0D46C**

Protective caps

Dimensions :
length approx. 33 mm, diameter 12 mm

	Designation	Pore size	max. temp.*	Typical Application	Order no.
SK10	slotted, open cap without filter	open	100°C	short response time, no dirt load	ZB9600SK10
SK7	Metal-mesh filter in PC-housing	100 μm	120°C	Universal, for medium, contamination, also high humidity	ZB9600SK7
SK6	PTFE-Sinterfilter	50 μm	180°C	High chemical resistance	ZB9600SK6
SK8	Stainless steel sinter filter	10 μm	180°C	For severe mechanical stress, heavy contamination, strong air flow	ZB9600SK8

* Observe application range

Accessories

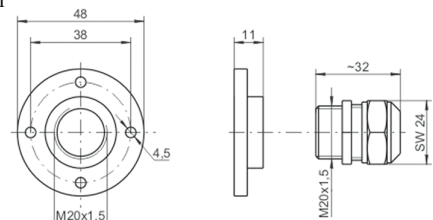Brackets for wall mounting, distance from wall approx. 40 mm
ZB9600W

D = 4-15mm
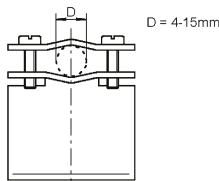
Movable brass screw connection with plastic sealing ring
ZB9600KV20
Connecting flange for screw connection, hole circle 38 mm Ø
ZB9600F20

48
38
11
~32
4,5
M20x1,5
SW 24
M20x1.5

08.09

Air humidity

Digital sensor for temperature, humidity, and atmospheric pressure FHAD 46-C2
Version in plastic, with slotted sensor cap with ALMEMO® D6 plug

FHAD 46-C2
Multi-sensor module incorporated
in slotted sensor cap
compact design, short response time

FHAD 46-C2 Option with plug-in extension tube

Replacement multi-sensor module FH0D 46-C2

FHAD 46-C2L00

Extension tube

- Four measuring channels are programmed (at our factory).
  Temperature (°C, T, t), Relative humidity (%H, RH, Uw)

Dewpoint (°C, DT, td)
Atmospheric pressure (mbar, AP, p).

Technical data

Operative range	-20 to +60 °C / 5 to 98 % RH	Extension tube	Ø 8 mm, length 97 mm
Mechanical design			
Sensor cap	Ø 8 mm, length 36 mm	General description and common technical data see FHAD 46-Cx	
Plug connection	Ø approx. 9 mm, IP40		

Variants including manufacturer's test certificate

Order no.

Digital sensor for temperature, atmospheric humidity, and atmospheric pressure, with multi-sensor module in slotted sensor cap, plug connector, including ALMEMO® connecting cable with coupling and ALMEMO® D6 plug.

Connecting cable, length 2 meters	**FHAD46C2**	Cable stub approx. : 80 mm (incl. multi-sensor module)	**FHAD46C2L00**
Connecting cable, length 5 meters	**FHAD46C2L05**	Spare sensor element for FHAD462, digital, enclosed in slotted sensor cover, adjusted	**FH0D46C2**
Connecting cable, length 10 meters	**FHAD46C2L10**	Extension tube, Ø 8 mm, length 97 mm, plug-in, for FHAD 46-C2	**ZB0D462VR**

Digital sensor for temperature, humidity, and atm. pressure FHAD 46-C0
Uncovered multi-sensor module with ALMEMO® D6 plug

FHAD 46-C0
Uncovered multi-sensor module
most compact design, short response time

Replacement multi-sensor module FH0D 46-C

- Four measuring channels are programmed (at our factory).
  Temperature (°C, T, t), Relative humidity (%H, RH, Uw)

Dewpoint (°C, DT, td),
Atmospheric pressure (mbar, AP, p).

Technical data

Operative range	-20 to +80 °C / 5 to 98 % RH	Multi-sensor module (dimensions over all) approx. 6 x 14 x 3 mm	
Mechanical design		Plug connection	Width approx. 7 mm

Variants including manufacturer's test certificate

Order no.

Digital sensor for temperature, humidity, and atmospheric pressure, with uncovered multi-sensor module, plug connector, including ALMEMO® connecting cable with coupling and ALMEMO® D6 plug.

		Connecting cable, length 10 meters	**FHAD46C0L10**
		Replacement multi-sensor module, digital, adjusted, plug-in	**FH0D46C**
Connecting cable, length 2 meters	**FHAD46C0**		
Connecting cable, length 5 meters	**FHAD46C0L05**		

08.10

High-precision sensor for temperature, humidity, atmospheric pressure FHAD 36 RAx
Wide operating temperature range Automatic atmospheric pressure compensation
Digital sensor with ALMEMO® D6 plug

ALMEMO® connecting cable
with sensor
(example FHAD 36 RAS)

**General features,
ALMEMO® D6 sensors**
see page 01.08

Common technical features FHAD 36 RAx

- Digital capacitive humidity sensor with integrated signal processor, designed to meet the highest accuracy requirements in humidity measurement
- Unique correction and adjustment process All sensor characteristics and adjustment data are saved in the humidity sensor itself.
- A digital atmospheric pressure sensor integrated in the ALMEMO® D6 plug itself provides automatic pressure compensation for all pressure-dependent humidity variables.
- Humidity calculation on the basis of formulae as per Dr. Sonntag and the enhancement factor as per W. Bögel (correction factor fw(t,p) for real mixed gas systems) This substantially widens the measuring range and improves the accuracy of humidity variable calculations.
- Humidity variable, Absolute humidity in g/m³

- All relevant ambient parameters are measured with just one sensor.
- The humidity variables are calculated from the three primary measuring channels (real measurable variables). temperature, relative humidity, atmospheric pressure
- Freely selectable measurable variables
- Four measuring channels are programmed (at our factory). temperature (°C, T, t), relative humidity (%H, RH, Uw), dewpoint (°C, DT, td), atmospheric pressure (mbar, AP, p) Other humidity variables can also be selected: mixture (g/kg, MH, r), absolute humidity (g/m³, AH, dv), vapor pressure (mbar, VP, e), enthalpy (kJ/kg, En, h) This device can be configured directly on a PC using USB adapter cable ZA 1919 AKUV. (see chapter „Networking").

! **The recommended application range for capacitive sensors** is up to dew point temperatures in the range of 80°C td. Measurements at high humidity and high temperatures can lead to a larger sensor drift with capacitive sensors. Permanent changes in sensor characteristics can be caused by chemical / physical processes. Contamination in the measuring medium and falling below the dew point temperature (in extreme climates), can further intensify this effect.

Common technical data FHAD 36 RAx

Digital temperature / humidity sensor (including A/D converter)

Operative range	depending on sensor type
Humidity	
Sensor	capacitive
Measuring range	0 to 100 % RH
Adjusted	at +23 °C and 10%, 35%, 80% RH
Accuracy	±1.3 % RH (at +23°C ±5 K)
Reproducibility	0.3 % RH
Response time T$_{63}$	typical 15 seconds at typical 1 m/s (without filter)
Temperature	
Sensor	Pt100
Measuring range	-100 to +170 °C
	Please observe operative range ! (depending on sensor type)
Accuracy at +23 °C ±5 K	±0.2 K
Reproducibility	0.05 °C

Sensor connector on the sensor / sensor cable

Plug connector (Materials : anticorodal aluminum, anodized) IP65	
Operative range of the electronics	
in the connecting cable (coupling) -40 to +90 °C	
in the grip (of hand-held sensors) -40 to +85 °C	
ALMEMO® connecting cable	
Coupling (length = 100 mm) with cable, length = 2 or 5 meters (Materials : TPU, -40 to +90 °C) with ALMEMO® D6 plug	
Digital atm. pressure sensor (integrated in ALMEMO® D6 plug)	
Measuring range	700 to 1100 mbar
Accuracy	±2.5 mbar (at 23 °C ±5 K)
ALMEMO® D6 plug	
Refresh rate	1 second for all four channels
Supply voltage	6 to 13 VDC
Current consumption	12 mA

DAkkS or factory calibration KH9xxx temperature, humidity for digital sensor (see chapter „Calibration certificates").
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

ALMEMO® D6

High-precision sensor for temperature, humidity, atmospheric pressure FHAD 36 RAS
Automatic atmospheric pressure compensation. Digital sensor with ALMEMO® D6 plug

108 mm

Ø 15 mm

General description and common technical data
FHAD 36 Rx (see page 08.11)

Technical data

Operative range	-50 to +90 °C	Filter cartridge	Polycarbonate
Housing material	Polycarbonate	Filter	Polyethylene

Accessorie	Order no.
Brackets for wall mounting (see page 08.05)	**ZB9600W**

Variants Including factory test certificate and polyethylene filter	**Order no.**
High-precision digital temperature / humidity sensor, with plug connector, including ALMEMO® connecting cable with coupling and ALMEMO® D6 plug, and integrated digital atmospheric pressure sensor	
Connecting cable, length 2 meters	**FHAD36RAS**
Same as above Connecting cable, length 5 meters	**FHAD36RASL05**

Filters

for FHAD 36-RAS

Variants	**Order no.**
Filter insert made from polyethylene with a polycarbonate filter cartridge for standard applications good response time and good protection against fine particulates	**ZB9636APE**
Filter insert made from stainless-steel wire fabric with a polycarbonate filter cartridge quickest response time not suitable for environments that are bioactive or contaminated with fine particulates (risk of congestion)	**ZB9636AWM**
Filter insert made from PTFE (polytetrafluoroethylene) with a polycarbonate filter cartridge good protection against fine particulates, high chemical resistance, slower response time	**ZB9636APTFE**

High-precision sensor for temperature, humidity, atmospheric pressure FHAD 36 RAIC
Industrial-standard design for high temperatures up to +170 °C
Automatic atmospheric pressure compensation. Digital sensor with ALMEMO® D6 plug

General description
and common technical data
FHAD 36 Rx (see page 08.11)

Technical data

Operative range	-100 to +170 °C	Filter cartridge	Stainless steel 1.4301
Sensor length	144 mm incl. sensor	Filter	Stainless-steel wire fabric filter
(Other lengths 294 mm are available on request.)		Electronics	length: 111 mm
Housing material	PEEK		

Accessories   Order no.

Assembly screw fittings for 15 mm sensor Brass, nickel-plated
Thread M20x1.5 Viton® seal, up to +200 °C   **ZB9636KV**

Mounting flange Steel, nickel-plated Diameter 80 mm   **ZB9636F**

Variants Including factory test certificate and stainless-steel wire fabric filter   Order no.

High-precision digital temperature / humidity sensor, industry-standard, with high-temperature
sensor cable and plug connector, including ALMEMO® connecting cable with coupling and ALMEMO® D6 plug
Integrated digital atmospheric pressure sensor
Sensor cable, length = 2 meters, Connecting cable, length 2 meters   **FHAD36RAIC102**
Same as above Sensor cable, length = 5 meters, Connecting cable, length 2 meters   **FHAD36RAIC105**
Same as above Sensor cable, length = 2 meters, Connecting cable, length 5 meters   **FHAD36RAIC102L05**
Same as above Sensor cable, length = 5 meters, Connecting cable, length 5 meters   **FHAD36RAIC105L05**

Filter

for sensors with filter cartridge
for FHAD 36 RAIC

Variants   Order no.

Stainless-steel wire fabric filter quickest response time
not suitable for environments that are bioactive or contaminated with fine particulates (risk of congestion)   **ZB9636AIWM**
Stainless-steel sinter filter best protection in environments heavily contaminated with particulates
good response time for low humidities (not to be used for high humidities)   **ZB9636AISSS**
PTFE filter good protection against fine particulates, high chemical resistance, slower response time   **ZB9636AIPTFE**
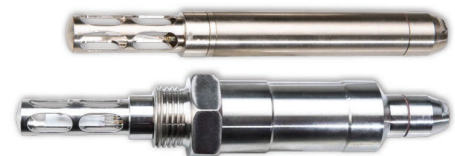
Other designs are available on request

FHAD 36-RAIMx :
Industry-standard humidity sensor FHAD 36 RAIM
in stainless steel Diameter 15 mm, -100 to +170 °C

FHAD 36-RAIEx :
Screw-fit humidity sensor FHAD 36 RAIE, up to 100 bar,
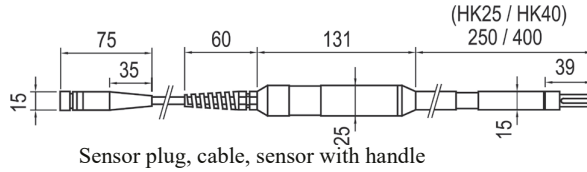stainless steel Thread G 1/2-inch, -100 to +170 °C

Air humidity

High-precision sensor for temperature, humidity, atmospheric pressure FHAD 36 RHK
Hand-held sensor for temperatures up to +170 °C
Automatic atmospheric pressure compensation, Digital sensor with ALMEMO® D6 plug

For on-site test measurements,
not for stationary installation

General description and
common technical data FHAD 36 Rx
(see page 08.11)

75   60   131   (HK25 / HK40)
35   250 / 400
15   39
25   15

Sensor plug, cable, sensor with handle

Technical data

Operative range	-100 to +150 / +170 °C (see variants)	Filter cartridge	Brass, nickel-plated
Operative range of the electronics in the grip -40 to +85 °C		Filter	Stainless-steel wire fabric filter
Housing material	Shaft PEEK	Response time T_{63}	<10 seconds at typical 1 m/s, without filter

---

Filter

for sensors with filter cartridge
for FHAD 36 RIC and FHAD 36 RHK

Variants	Order no.
Stainless-steel wire fabric filter quickest response time	
not suitable for environments that are bioactive or contaminated with fine particulates (risk of congestion)	ZB9636M15
Stainless-steel sinter filter best protection in environments heavily contaminated with particulates	
good response time for low humidities (not to be used for high humidities)	ZB9636S15
PTFE filter good protection against fine particulates, high chemical resistance, slower response time	ZB9636T15

Variants Including factory test certificate and stainless-steel wire fabric filter	Order no.
High-precision digital temperature / humidity sensor	
Handle with 2-meter sensor cable and plug connector, including ALMEMO® connecting cable, length 0.3 meters,	
with coupling and ALMEMO® D6 plug Integrated digital atmospheric pressure sensor	
Operative range up to +150 °C Sensor length 250 mm	**FHAD36RHK25**
Operative range up to +170 °C Sensor length 400 mm	**FHAD36RHK40**

Other designs are available on request

FHAD 36-RHPx :
Humidity probe with pointed tip, Diameter 10 mm
for taking meas. in loose bulk materials, -40 to +85 °C

FHAD 36-RHSx :
Humidity probe with flat blade 18 x 4 mm
for taking meas. in paper or textile stacks, -40 to +85 °C

High-humidity sensor FHAD 36-E33x available on request

Digital humidity and temperature sensor for high humidity application. Humidity sensor
with heatable monolithic measurement cell for measurement operations in the high-humidity range near condensation.

Capacitive humidity sensor FHA 646 R, miniature sensor

- Compact sensor, extremely small dimensions
- Wide operating temperature range
- Particularly suitable for measuring operations between PCBs,

inside cases, in walls, ceilings, and insulation layers used in the construction industry, and for the protection of listed historic monuments

Technical data

Operative range	-30 to +100 °C, 5 to 98 % RH
Humidity measuring circuit	
Measuring range	0 to 100 % RH
Sensor	capacitive
Accuracy	±2 % RH in the range <90 % RH at nominal temperature
Reproducibility	<1% RH at nominal temperature
Nominal temperature	+25 ±3 °C
Response time T63	approx. 10 seconds at 1 m/s

Temperature measuring circuit	
Sensor	NTC type N
Accuracy	-20 to 0 ±0.4 K, 0 to +70 ±0.2 K +70 to +100 ±0.6 K
Reproducibility	0.1 K
Mechanical design	
Sensor tube	nickel-plated, 50 mm long, 5 mm Ø
Protective cap	None
Cable	High-temperature cable (up to +100 °C), 2 meters long, with ALMEMO® plug (no other lengths available)

! The sensor can only be operated by plugging DIRECTLY onto an ALMEMO® device.
(NOT with extension cables ZA9060VKx or ZA9090VKCx).
Or, alternatively, the following sensor types can be used. FHAD36RAS up to +100 °C (see page 08.08)
FHAD46-C2 or FHAD46-C0 Compact design (see page 08.06)

| Accessories	Order no.
PTFE filter, inside diameter 5 mm suitable for protection against dust, not water-proof	**ZB9646SKR**

Variants	Order no.
Miniature sensor for temperature / humidity, with fitted high-temperature cable, length 2 meters, with ALMEMO® plug	**FHA646R**

DAkkS or factory calibration KH9xxx temperature, humidity for measuring chain (sensor + device) (see chapter „Calibration certificates").
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

10/2021 • We reserve the right to make technical changes.

Air humidity

ALMEMO® D6

Digital sensor for measuring temperature and humidity FHAD 46-C7,
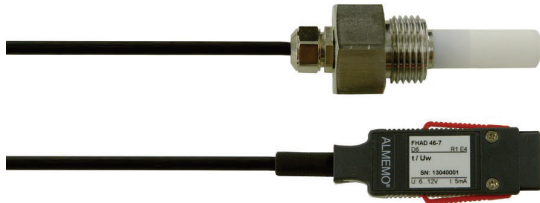
Pressure-sealed variant up to 16 bar,
with ALMEMO® D6 plug

- Compact sensor made from stainless steel
- Screw thread, for pressure pipes
- Option - adapter for compressed air pipes
- Capacitive digital sensor for humidity and temperature. Additionally EEPROM data storage medium in the multi-sensor module.
- The sensor module is thoroughly adjusted. All sensor characteristic and adjustment data are stored on the data storage medium of the sensor module itself. In the process of readjusting the individual sensors, the adjustment values are directly saved on the data storage medium of the sensor module.
- *new:* Every sensor module has an unique serial number saved on the humidity sensor. The serial number is either displayed in the sensor menu of the measuring instrument or in the ALMEMO® Control software. Hence, calibrated sensor modules can clearly be assigned to the calibration certificate.
- Replacement sensor modules are inexpensive: The sensor

module is pluggable and can simply be exchanged on-site. Full accuracy without any adjustment, especially with calibrated sensors. The ALMEMO® connecting cable and the ALMEMO® measuring instrument have no influence on the calibration.
- The humidity variables are calculated from the two primary measuring channels (real measurable variables): temperature, relative humidity
- Three measuring channels are programmed: temperature (°C, T, t), relative humidity (%H, RH, Uw), dewpoint (°C, DT, td) One further humidity variable can also be selected: mixture (g/kg, MH, r), absolute humidity (g/m³, AH, dv), vapor pressure (mbar, VP, e), enthalpy (kJ/kg, En, h) The configuration of the channels and the input of the system pressure for the automatic pressure compensation of the pressure dependent humidity variables is performed on the ALMEMO® V7 measuring instrument or directly on the PC using the USB adapter cable ZA1919AKUV (see chapter "ALMEMO® Network technology").

Technical data

Operative range	-20 to +80 °C, 5 to 98 % RH

Digital temperature / humidity sensor (including A/D converter)

Humidity
Measuring range	0 to 98 % RH
Sensor	CMOSens® technology
Accuracy	±2.0 % RH in range 10 to 90 % RH
	±4.0 % RH in range 5 to to 98 % RH
	at nominal temperature
Hysteresis	typical ±1 % RH
Nominal temperature	+23 °C ±5 K
Sensor operating pressure	up to 16 bar

Temperature
Sensor	CMOSens® technology
Accuracy	typical ±0.2 K at 5 to 60 °C
	maximum ±0.4 K at 5 to 60 °C
	maximum ±0.7 K at -20 to +80 °C
Reproducibility	typical ±0.1 K

ALMEMO® connecting cable
PVC Length (see variants) with ALMEMO® D6 plug

ALMEMO® D6 plug
Refresh time	1 second for all four channels
Supply voltage	6 to 13 VDC
Current consumption	3 mA

Mechanical design
Sensor	Stainless steel, diameter 12 mm
	Overall length approx. 77 mm
Filter cap	PTFE sinter filter SK6
Process connection	Male thread G 1/2-inch
	Fitted length 48 mm, Width across flats 27
Screw-fit cable gland	Splash-protected

Adapter for
compressed air pipes

Accessories

	Order no.
Adapter for compressed air pipes	ZB96467AP
PTFE sinter filter (spare) (see page 08.09)	ZB9600SK6
Stainless-steel sinter filter (see page 08.09)	ZB9600SK8

Variants

	Order no.
Digitaler sensor for temperature and humidity, filter cap PTFE, pressure-sealed variant, with fitted cable and ALMEMO® D6 plug, manufacturer's test certificate	
Connecting cable, length 2 meters	**FHAD46C7**
Connecting cable, length 5 meters	**FHAD46C7L05**
Connecting cable, length 10 meters	**FHAD46C7L10**
Replacement sensor element, digital, adjusted, plug-in	**FH0D46C**

DAkkS or factory calibration KH9xxx, temperature, humidity, for digital sensor (see chapter „Calibration certificates").
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

new

Digital sensor for dew point, air humidity, temperature FHAD 46-DTC2, Pressure-sealed variant with screw thread, with ALMEMO® D6 plug

G 1/2"   SW 27

Ø12.0

30.2

27.0   83.2

123,2
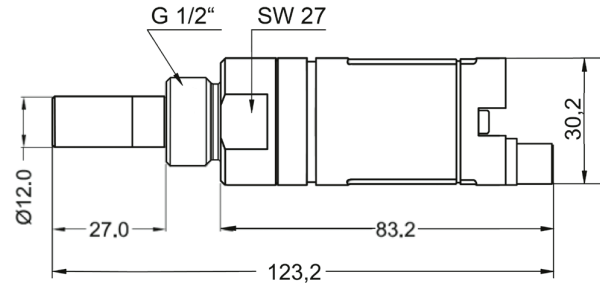
Technical features

- The dew point sensor is intended for continuous monitoring of the dew point in industrial applications. Compressed air systems (refrigerant and adsorptions dryers), pellet dryer, medical gases, non corrosive gases, e.g. Nitrogen.
- High accuracy when measuring the dew point temperature.
- Reliably measuring the dew point in clean, dry, and oil-free gases and compressed air.
- Recommended installation of the sensor indirectly through the measuring chamber (accessory). The measuring chamber is connected to the compressed air pipe via the quick-coupling. Advantage: Simple installation and removal of the sensor (under operating pressure in the line). Fast response time of the sensor thanks to the perforated protective cap and the controlled flow. Protected installation of the sensor. For oily and dirty compressed air, a prefilter can be used in front of the measuring chamber (provided by the customer).

- Alternatively: Installing the sensor via the thread G 1/2" directly into in the dryer respectively the compressed air pipe. Using the sintered stainless steel filter.
- The dew point sensor is also available with a process connection for high pressures (up to 350 bar) (option).
- The sensor will be supplied in a robust industrial housing.
- The digital dew point sensor works with an integrated AD converter. The measured values are calculated within the sensor and are digitally transmitted via the ALMEMO® D6 plug to the ALMEMO® device.
- 3 measuring channels are preprogrammed: Temperature (°C, t), Relative Humidity (%H, Uw), Dew point (°C, td).
- The overall accuracy of the digital ALMEMO® dew point sensor is independent from the ALMEMO® display device / data logger and from extension cables used.

Technical data:

Measuring range:	-80 °C to +20 °C td dew point temperature		Storage temperature:	-40 to 80 °C
Accuracy at 23 °C:	±1 °C td from -20 to +20 °C td		Output:	digital, plug connection
	±2 °C td from -50 to -20 °C td		Power supply:	via ALMEMO® D6 plug
	±3 °C td from -80 to -50 °C td		ALMEMO® connection cable: pluggable, 2 m PVC cable, with ALMEMO® D6 plug	
Nominal conditions:	23 °C ±5 K, pressure: 6 bar			
Measuring channels:			ALMEMO® D6 plug:	
Temperature:	-20.0 to +70.0 °C		Refresh time:	0.5 sec. for all 3 channels
Relative humidity:	0 to 9.0 % RH		Supply voltage:	6 to 13 V DC
Dew point:	-80.0 to +20,0 °C td		Current consumption:	typical 20 mA
Operating temperature:	-20 to +70 °C, recommended: 0 to 50 °C		Housing:	
Process connection:	screw thread G1/2" stainless steel		Material:	zinc alloy
Protective cap:	sintered stainless steel filter (50 µm)		Protection class:	IP65
Pressure range:	-1 to 50 bar standard			

Accessories		Order no.
	Screw-on measuring chamber for connecting a dew point transmitter to compressed air pipes via quick coupling, up to a maximum of 16 bar, including perforated protective cap Advantage: fast measurement without installation costs.	**ZB9646DTCK**

Option

Dew point sensor for process pressure up to 350 bar	**OA9646DTC2P**

| Variants including factory calibration certificate	Order no.
Digital sensor for dew point, air humidity, temperature, pressure-sealed variant with screw thread sintered stainless steel filter, plug connection, ALMEMO® connection cable 2 m with ALMEMO® D6 plug	**FHAD46DTC2**
Factory calibration certificate KH93xx, dew point, for digital sensors (see chapter "Calibration certificates")	

Digital psychrometer, FPAD 36-3 with ALMEMO® D6 plug
with integrated atmospheric pressure sensor, for automatic pressure compensation

new
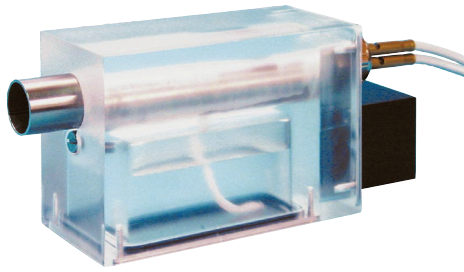
- *new:* Digital temperature sensors (adjusted) with high precision and synchronism up to 90 °C.
- *new:* Automatic air pressure compensation with built-in air pressure sensor.
- *new:* Flexible, thin, stable sensor cable.
- Version optimized for long-term measuring operations
- Automatic humidification of the wick after filling the water tank.

General features of ALMEMO® D6 sensors: see page 01.05

Technical data and functions

- *new:* The two digital Pt100 sensors for dry temperature and wet temperature are characterized by particularly high precision and synchronism up to 90 °C.
  The Pt100 sensors are connected to the digital ALMEMO® D6 connector (as a complete measuring chain) adjusted at 0 °C and 85 °C in the calibration laboratory. The accuracy of the temperature measurement is thus independent of the ALMEMO® measuring instrument. The two digital Pt100 sensors are easily exchangeable in case of service.
- *new:* Flexible, thin, stable sensor cable with shielding and insulation FEP.
- *new:* The digital psychrometer can be operated with any ALMEMO® measuring instrument without affecting its measuring accuracy. The digital psychrometer is calibrated without ALMEMO® device.
- *new:* A digital atmospheric pressure sensor integrated in the ALMEMO® D6 plug itself provides automatic pressure compensation for all pressure-dependent humidity variables.
- *new:* Humidity calculation (Calculation is done in the ALMEMO® D6 connector) on the basis of formulae as per Dr. Sonntag and the enhancement factor as per W. Bögel (correction factor fw(t,p) for real mixed gas systems)

This substantially widens the measuring range and improves the accuracy of humidity variable calculations.
- *new:* Humidity variable Absolute humidity in g/m³
- Temperatures are measured using A/D converter incorporated in the ALMEMO® D6 plug.
- The humidity variables are calculated from the three primary measuring channels (real measurable variables):
  Dry temperature, wet temperature, atmospheric pressure
- Freely selectable measurable variables
  Four measuring channels are programmed (at our factory):
  dry temperature (°C, TT, t), wet temperature (°C, HT, tw), relative humidity (%H, RH, Uw), atmospheric pressure (mbar, AP, p)
  Other humidity variables can also be selected:
  dewpoint (°C, DT, td), mixture (g/kg, MH, r), absolute humidity (g/m³, AH, dv), vapor pressure (mbar, VP, e), enthalpy (kJ/kg, En, h)
  This device can be configured directly on a PC using USB adapter cable ZA 1919 AKUV. (see chapter „Networking").

Recommendations for calibration laboratories and quality assurance

ALMEMO® 1036-2

Reference measuring instrument ALMEMO® 1036-2 is ideally suited for use in calibration laboratories and quality assurance procedures. When measuring atmospheric humidity the combination of reference measuring instrument ALMEMO® 1036-2 and precision psychrometer FPA-836-3P3 ensures very high levels of resolution, precision, and linearity. Resolution parameters: temperature Pt100 0.001 K, relative humidity 0.01%, dewpoint 0.01K The measuring instrument incorporates a digital atmospheric pressure sensor for compensation purposes. These devices are offered in a set including the sensor and a DAkkS calibration certificate : Calibration points temperature/humidity at 25 °C / 30 % r.h. and 25 °C / 75 % r.h. and air pressure in the range 700 ... 1100 mbar.
For general description and technical data see Chapter „ALMEMO® reference measuring instruments".

Digital stationary psychrometer FPAD 36-3

Technical data

Operating temperature	0 to +90 °C (no ice)
Humidity measuring range	10 to 100% RH
Measuring system	psychrometric
Accuracy	±1 % RH under nominal conditions
Accuracy in measuring range	10... 100 % r. h.: typ. ±1 % r. h. at 25°C ±3K, 1013 mbar
Nominal conditions	+25 °C ±3 K, 1013 mbar, 50 % RH
Temperature sensors	2 x Pt100
Accuracy	ALMEMO® adjusted at 0°C and 85 °C
Ventilator power supply	12 VDC via mains unit, cable approx. 1.5 meters and extension cable 5 m (included in delivery)
Housing	Plastic PMMA
Dimensions	175 x 50 x 75 mm (LxWxH)
Weight	approx. 890 g
ALMEMO® connecting cable	2 Cables, FEP / Wire Shielding, 5 meters to 1 ALMEMO® D6 plug

Digital atmospheric pressure sensor
(integrated in ALMEMO® D6 plug)

Measuring range	700 to 1100 mbar
Accuracy	±2.5 mbar (at 23 °C ±5 K)

A/D converter incorporated in ALMEMO® D6 plug

Inputs	2 inputs, range Pt100
Resolution	0.01 K
Measuring current:	1 mA
Linearization	Calculation procedure (no approximations)
Accuracy	±0,07 K ±2 digits
Nominal temperature	23 °C ±2 K
Temperature drift:	0,003 %/K (30 ppm)
Calculated humidity variables	Analytic equation (not an approximation)
Refresh rate	0.3 seconds for all four channels
Supply voltage	6 to 13 VDC
Current consumption	approx. 9 mA

Accessories	**Order no.**
Spare wicks (2 pieces)	**ZB98462ED**

| **Variants**	**Order no.**
Digital psychrometer with Pt100 sensors Psychrometer, fitted cable, with ALMEMO® D6 plug, integrated digital atmospheric pressure sensor, mains unit, Extension cable for power supply unit, water bottle, two wicks, carry case	**FPAD363**

DAkkS or factory calibration KH91xx, temperature, humidity, for digital sensor (see chapter „Calibration certificates").
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

Air humidity

Digital psychrometers, FNAD 46 and FNAD 46-3 with ALMEMO® D6 plug
with integrated atmospheric pressure sensor, for automatic pressure compensation
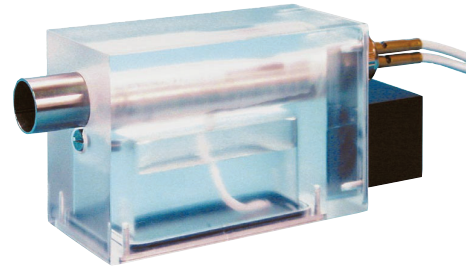
General features,
ALMEMO® D6 sensors
see page 01.08

- *new:* A digital atmospheric pressure sensor integrated in the ALMEMO® D6 plug itself provides automatic pressure compensation for all pressure-dependent humidity variables.
- *new:* Humidity calculation on the basis of formulae as per Dr. Sonntag and the enhancement factor as per W. Bögel (correction factor fw(t,p) for real mixed gas systems) This substantially widens the measuring range and improves the accuracy of humidity variable calculations.
- *new:* Humidity variable Absolute humidity in g/m³
- High-precision NTC sensors for dry temperature and wet temperature
- Temperatures are measured using a A/D converter incorporated in the ALMEMO® D6 plug.
- The humidity variables are calculated from the three primary measuring channels (real measurable variables): Dry temperature, wet temperature, atmospheric pressure
- Freely selectable measurable variables
  Four measuring channels are programmed (at our factory): dry temperature (°C, TT, t), wet temperature (°C, HT, tw), relative humidity (%H, RH, Uw), atmospheric pressure (mbar, AP, p)
- Other humidity variables can also be selected: dewpoint (°C, DT, td), mixture (g/kg, MH, r), absolute humidity (g/m³, AH, dv), vapor pressure (mbar, VP, e), enthalpy (kJ/kg, En, h)
  This device can be configured directly on a PC using USB adapter cable ZA 1919 AKUV. (see chapter „Networking").

Technical data, FNAD 46 and FNAD 46-3

Digital atmospheric pressure sensor
(integrated in ALMEMO® D6 plug)

Measuring range	700 to 1100 mbar
Accuracy	±2.5 mbar (at 23 °C ±5 K)

A/D converter incorporated in ALMEMO® D6 plug

Inputs	2 NTC sensors (clamped connection in plug)
Resolution	0.01 K

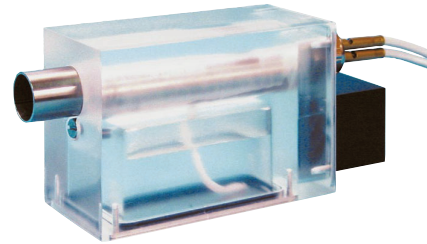|	
Linearization	error-free computing method according to Galway Steinhart (no approximations)
Accuracy	±0.05 K
Nominal temperature	23 °C ±2 K
Temperature drift:	0,004 %/K (40 ppm)
Calculated humidity variables	Analytic equation (not an approximation)
Refresh rate	0.4 seconds for all four channels

08.20

Hand-held digital psychrometer FNAD 46

For test measurements

General description and common technical data
FNAD 46 (see page 08.18)

Technical data

Operating temperature	0 to +60 °C (no ice)
Humidity measuring range	10 to 100% RH
Measuring system	psychrometric
Accuracy	±1 % RH under nominal conditions
Accuracy in measuring range	10... 100 % r. h.: typ. ±1 % r. h. at 25°C ±3K, 1013 mbar
Nominal conditions	+25 °C ±3 K, 1013 mbar, 50 % RH
Temperature sensors	2 x NTC type N
Accuracy	±0,2 K at 0 to 60 °C
Ventilator power supply	via ALMEMO® D6 plug
Housing	Plastic
Dimensions	Ø 50 mm, length 245 mm
Weight	approx. 300 g
Sensor connector	Built-in plug
ALMEMO® connecting cable	coupling, 1.5 meters, PVC cable with ALMEMO® D6 plug
Supply voltage	9 to 13 VDC
Current consumption	20 mA

Accessories — Order no.

Extension pipe, 200 mm long	**ZB9846VR**
Plastic suction hose, 300 mm long	**ZB9846PS**
Spare wicks (2 pieces)	**ZB9846ED**

Variants — Order no.

Hand-held digital psychrometer with NTC sensor
Hand-held psychrometer, connecting cable with ALMEMO® D6 plug, integrated digital atmospheric pressure sensor, water bottle, two wicks **FNAD46**

Stationary digital psychrometer FNAD 46-3

Version optimized for long-term measuring operations
Automatic humidification of the wick after filling the water tank.

General description and common technical data
FNAD 46-3 (see page 08.18)

Technical data

Operating temperature	0 to +90 °C (no ice)
Humidity measuring range	10 to 100% RH
Measuring system	psychrometric
Accuracy	±1 % RH under nominal conditions
Accuracy in measuring range	10... 100 % r. h.: typ. ±1 % r. h. at 25°C ±3K, 1013 mbar
Nominal conditions	+25 °C ±3 K, 1013 mbar, 50 % RH
Temperature sensors	2 x NTC type N
Accuracy	±0,2 K at 0 to 70 °C, ±0,4 K at 70 to 90 °C
Ventilator power supply	12 VDC via mains unit, cable approx. 1.5 meters (included in delivery)
Housing	Plastic PMMA
Dimensions	175 x 50 x 75 mm (LxWxH)
Weight	approx. 890 g
ALMEMO® connecting cable	Cable, FEP / silicone, 5 meters with ALMEMO® D6 plug
Supply voltage	6 to 13 VDC
Current consumption	4 mA

Accessories — Order no.

|	
Extension cable for mains units, 3-pin bayonet coupling, length 5 meters	**ZB5090VK05**
Spare wicks (2 pieces)	**ZB98462ED**

Variants — Order no.

Digital psychrometer with NTC sensor
Psychrometer, fitted cable, with ALMEMO® D6 plug, integrated digital atmospheric pressure sensor, mains unit, water bottle, two wicks, carry case **FNAD463**

DAkkS or factory calibration KH91xx, temperature, humidity, for digital sensor (see chapter „Calibration certificates").
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

Air humidity

Digital temperature / humidity transmitter MH8D46C with double analog output V or mA
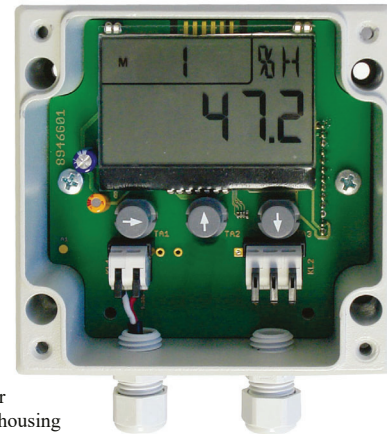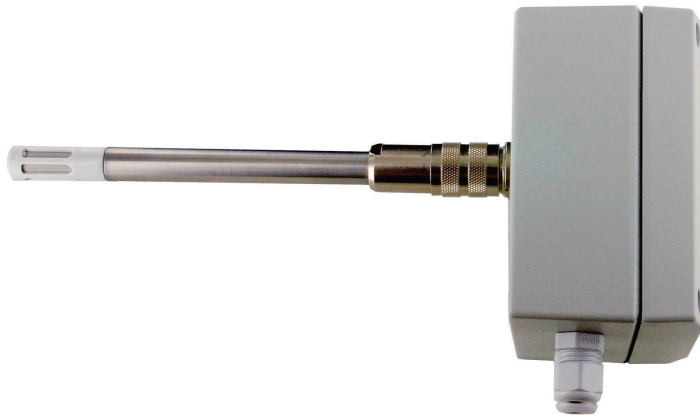
Transmitter
with open housing

- Digital sensor element for humidity, temperature, air pressure All key sensor characteristics, settings, and adjustment data are saved in the sensor element itself.
- Plug-in sensor element: Spare elements are inexpensive; a replacement can be fitted on site quickly and easily by virtually anyone; it will be fully accurate straight away needing no special adjustment.
- Digital transfer of measured values from the sensor element to the transmitter
- Factory or DAkkS calibration is erformed on the sensor element alone. Fully accurate - irrespective of connecting cable and transmitter
- Four climate variables can be measured: Double analog output for temperature and one humidity variable relative humidity /

dewpoint / mixture ratio. The air pressure dependent humidity values are automatically compensated for air pressure (the air pressure is measured directly at the measuring point in the sensor tip).
- The transmitters can be configured via the internal display and the keypad.
- The analog output type (10 V or 20 mA) can be selected (via the keypad); the analog output range can be programmed.
- Display of measured value, channel, units, humidity range, analog start, analog end, and analog type
- The sensor tube can be connected either directly by plugging onto the transmitter itself or via a connecting cable.
- Suitable for conduit mounting or wall mounting

Technical data

Operative range	Sensor -20 to +80 °C, 5 to 98 % RH		Output type	0 to 10 V, 0 to 20 / 4 to 20 mA, selectable
	Electronics -10 to +50 °C, IP65		Resolution	16 bit
			Accuracy	0.1 % of final value
Humidity sensor			Temperature drift	10 ppm / K
Measuring range	0 to 100 % RH		Time constant	100 µs
Sensor	CMOSens® technology		Connection	Cable, via screwless clamp connector,
Fixed measuring period /	output period approx. 3 seconds			with cable bushing
Accuracy	±2.0 % RH in range 10 to 90 % RH			Cable diameter 2 to 5 mm
	±4.0 % RH in range 5 to < 98 % RH			
	at nominal temperature		Standard equipment	
			Display, internal	2-row LCD 7 segments
Hysteresis	typical ±1 % RH			4 1/2 and 5 characters 2 digits
Nominal temperature	+23 °C ±5 K			16 segments
Sensor operating pressure	Atmospheric pressure		Operation, internal	3 keys
Response time T_{63}	typical 8 seconds at +25 °C, 1 m/s			
	(without filter)		Power supply	
			DC voltage	9 to 30 VDC
Temperature sensor			Current consumption	37 mA + 1.5·IOut
Sensor	CMOSens® technology		Connection	Cable, via screwless clamp connector,
Fixed measuring period /	output period approx. 3 seconds			with cable bushing
Accuracy	typical ±0.2 K at 5 ... 60 °C,			Cable diameter 2 to 5 mm
	max. ±0.4 K at 5...60°C			
	max. ±0.7 K at -20...80°C		Mechanical design	
Reproducibility	typical ±0.1 K		Sensor tube	Stainless steel, diameter 12 mm
Response time T_{63}	typical 20 seconds (without filter)		Protective cap	SK7, metal-mesh filter
Outputs			Housing	Die-cast aluminum, closed cover
Double analog output	Digital-to-analog converter (DAC) electr. isol.		Dimensions	100 x 100 x 60 mm (LxWxH)
	0 to 10 V, load >100 kilohms		Protective class	IP65 (with sensor tube and connecting
	0 to 20 mA, load <500 ohms			cable plugged in)

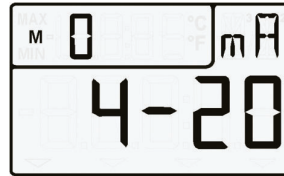## Display of measured values and programming (housing open)
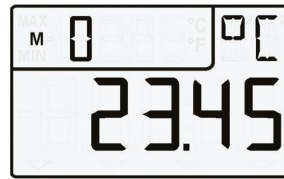
Measured value
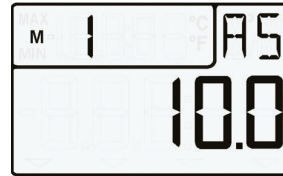display, channel M0, temperature
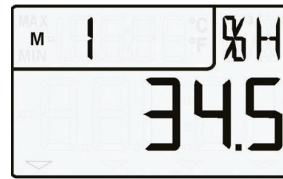
Measured value display, channel M1, humidity variable, e.g. relative humidity
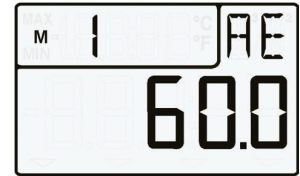

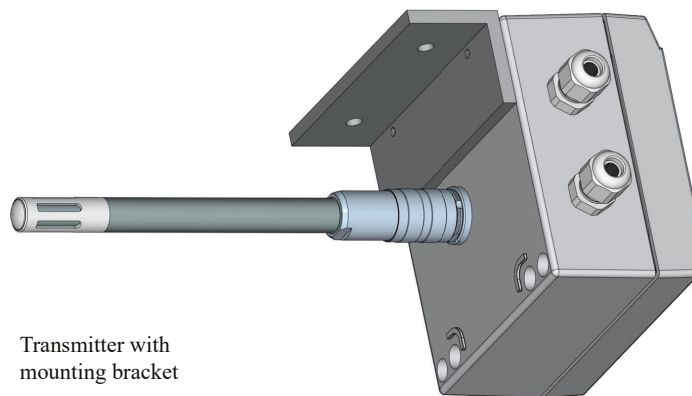Selecting the humidity variable, e.g. relative humidity, % RH

Selecting the analog output type, e.g. 4 to 20 mA

Programming the analog start

Programming the analog end

Transmitter with
mounting bracket

Accessories	Order no.		
Angle bracket for wall mounting	ZB8D00W	Connecting cable between sensor tube and transmitter	
Rubber gasket (mat) for mounting the housing		Length = 2 meters	ZH9D46VK02
directly on a conduit wall (immersion depth = sensor length + approx.		Same as above Length = 5 meters	ZH9D46VK05
42 mm plug length)	ZB8D00GD	Same as above Length = 10 meters	ZH9D46VK10
Movable brass screw with plastic sealing ring		Spare sensor, complete Sensor element inside sensor tube	
(see page 08.09)	ZB9600KV20	including protective cap SK7	
Connecting flange for screw connection,		Sensor length = 125 mm	FH9D46C1K1
pitch circle diameter 38 mm (see page 08.09)	ZB9600F20	Same as above Sensor length = 265 mm	FH9D46C1K2
Protective caps (see page 08.09)		Same as above Sensor length = 525 mm	FH9D46C1K3
Mains plug, 100 to 240 VAC, 12 VDC, 2 A	ZB1012NA10	Replacement sensor element, digital, adjusted, plug-in	FH0D46C

Variants including manufacturer's test certificate — Order no.

Digital transmitter for temperature and humidity

with double analog output, 10 V or 20 mA (selectable via keypad), internal display, 3 keys,
aluminum housing, IP65, with plug-in digital sensor, sensor length = 125 mm — **MH8D46C1K1**
Same as above Sensor length = 265 mm — **MH8D46C1K2**
Same as above Sensor length = 525 mm — **MH8D46C1K3**

DAkkS or factory calibration KH9xxx, temperature, humidity, for digital sensor (see chapter „Calibration certificates").
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.