HUMIDITY / TEMPERATURE TRANSMITTER

Series AFK-E

MANUAL

We do not accept warranty and liability claims neither upon this publication nor in case of improper treatment of the described products.

The document may contain technical inaccuracies and typographical errors. The content will be revised on a regular basis. These changes will be implemented in later versions. The described products can be improved and changed at any time without prior notice.

USA
FCC notice:

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. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the installation manual, 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.

Caution:
Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this device.

CANADIAN
ICES-003 notification:

This Device B digital apparatus complies with Canadian ICES-003.
Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

TABLE OF CONTENTS

HARDWARE

1. GENERAL

The manual is a part of the scope of supply and serves to ensure proper handling and optimum functioning of the instrument. For this reason, the manual must be read before start-up.
In addition, the manual is for all personnel who require knowledge concerning transport, setup, operation, maintenance and repair.
The manual must not be used for the purpose of competition without a written consent and must also not be forwarded to third parties. Copies for personal use are permitted. All information, technical data and illustrations contained in these instructions are based on information available at the time of publication.

1.1 Symbol assertion

This symbol indicates a safety instruction.
These safety instructions should always be followed carefully. By not following these instructions injuries of persons or material damage could happen. We do not accept liability.

This symbol indicates a note.
These notes should be observed to achieve optimum functioning of the equipment.

1.2 Safety instructions

General Safety Instructions

- Excessive mechanical loads and incorrect usage should always be avoided.
- Take care when unscrewing the filter cap as the sensor element could be damaged.
- The sensor is an Electro Static Discharge sensitive component (ESD). When touching the sensor element, ESD protective measures should be followed.
- Grip sensors only at the lead wires.
- Installation, electrical connection, maintenance and commissioning should be performed by qualified personnel only.

Safety instructions for use of the alarm module with voltages >50V

- To insulate the alarm module from the low-voltage side of the transmitter, the partition provided for this purpose must be fitted in the lower section.
- During operation of the instrument the modular housing must be completely closed.
- The protection class of an opened housing corresponds to IP00 and direct contact with components carrying dangerous voltages is therefore possible. In general, work on live components should be avoided and when absolutely necessary, should be performed by qualified personnel only.

1.3 Environmental aspects

The equipment is developed with due consideration to all resultant environmental issues. When you dispose the equipment you should avoid environmental pollution.
For disposal of the transmitter the individual components must be sorted with care. The housing consists of recyclable polycarbonate or metal (aluminium, Al Si 9 Cu 3). The electronics must be collected as electronic scrap and disposed of according to the regulations in force.

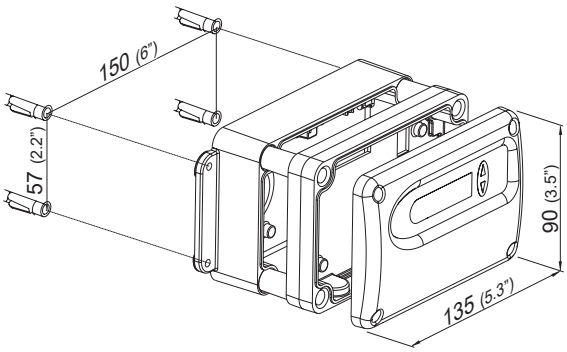
2. PRODUCT DESCRIPTION

The humidity/temperature transmitters provide multifunctionality, highest accuracy and simple installation and maintainance. The modular housing enables a user-friendly operation and a fast replacement of the sensor unit for service purposes. By selecting a suitable housing version the transmitters can be used for the entire range of humidity measurement applications:

- Model 2S with remote sensing probe
- Model 2D with remote sensing probe for pressure-tight applications up to 20bar (300psi)

dimensions in mm (“)

3. INSTALLATION



Mounting of housing

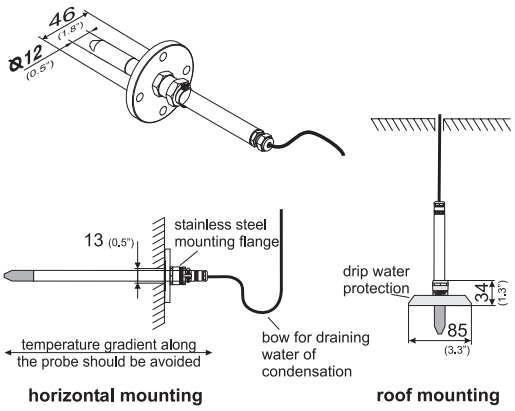
1. Drill the mounting holes according to the mounting template.

2. The bottom part of the housing is mounted with 4 screws (screw diameter: < 4.2mm (0.2") ; not included in the scope of supply).

3. Connection of the transmitter (see Hardware, chapter 4 "Electrical connections").

4. Mounting of the middle part and cover with 4 screws (included in the scope of supply).

3.1 Mounting of model 2S



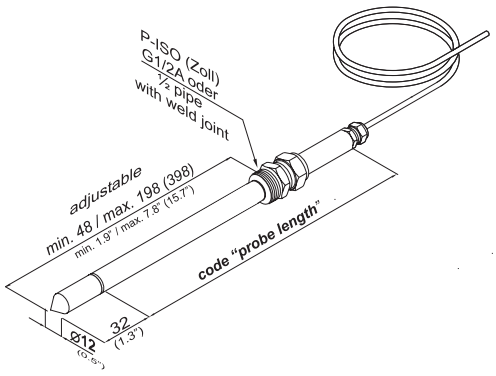
Working range of sensor probe: -40...180°C (-40...356°F)
Working range of electronics: -40...60°C (-40...140°F)
with display: -20...50°C (-4...122°F)

Mounting of the remote sensing probe - model D (12mm):

Using the stainless steel mounting flange (refer to accessories) it is possible to mount the probe on the outer wall of the measuring chamber.
The depth of immersion is adjustable.
For roof installations use the drip water protection (refer to accessories) to protect the sensor head and elements against condensed water.

The sensor probe must be mounted horizontally or vertically, pointing downwards. When possible, a drip sheet should be fitted for each mounting.

3.2 Mounting of model 2D

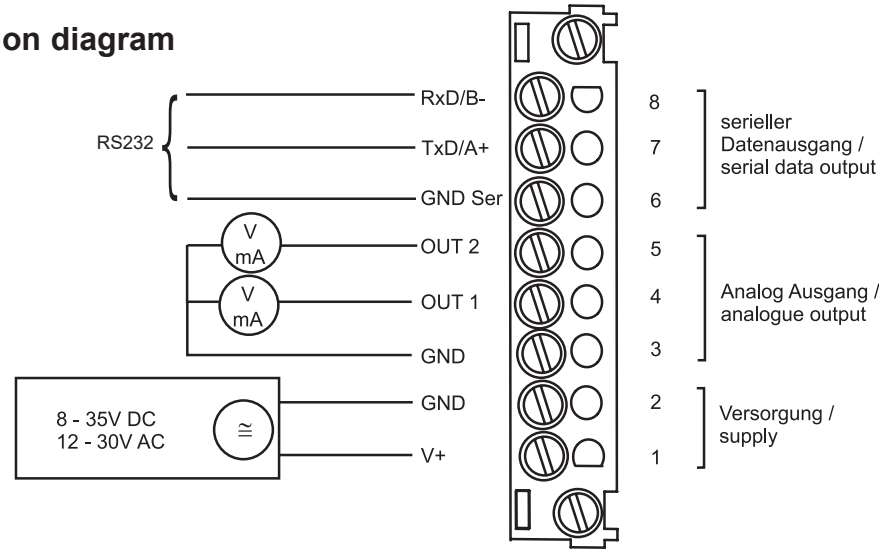


Working range temperature: -40...180°C (-40...356°F)
pressure: 0.01...20 bar (0.15...218psi)
Working range of electronics: -40...60°C (-40...140°F)
with display: -20...50°C (-4...122°F)

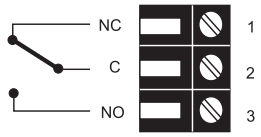
The sensor probe must be mounted horizontally or vertically pointing downwards. Where possible, a drip sheet should be fitted for each mounting.

4. ELECTRICAL CONNECTIONS

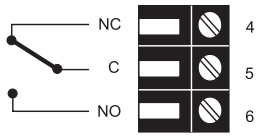
4.1 Connection diagram



4.2 Alarm module connection diagram



Rel 1

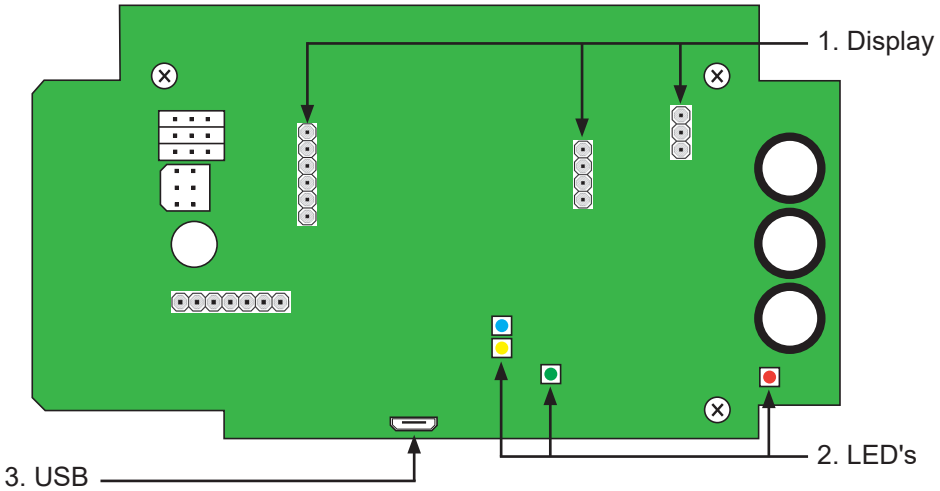


Rel 2

5. OPERATING COMPONENTS

5.1 Circuit board

After removal of the housing cover, the following operating components on the circuit board may be accessed for adaptation of the transmitter to the desired configuration.



1. Display: These pinboards are determined for connecting the display module.
2. Diagnosis LEDs: see chapter 7.3 "Self diagnosis and error messages"
3. USB-Interface: USB-Interface for service use

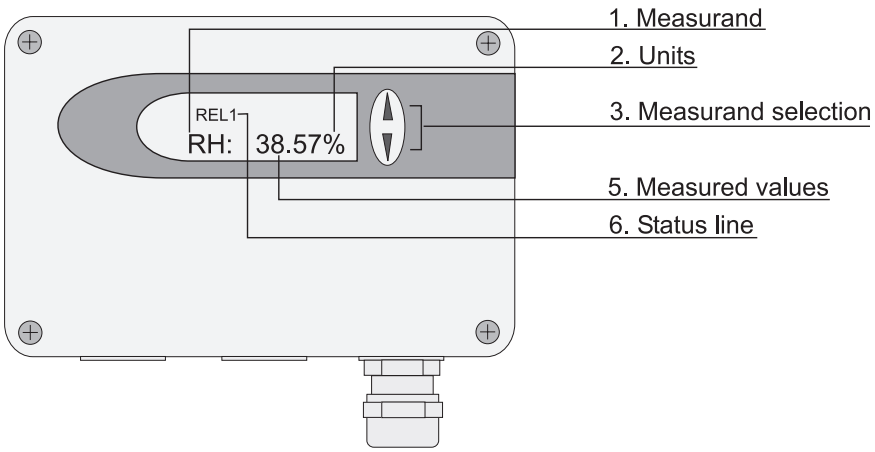
5.1.1 Configuration interface (USB)

The Micro-USB connector is located in the center of the PCB as shown in the figure under section 5.1. By removing the housing cover the configuration interface can be used.

The USB configuration cable is not included in the scope of supply.

The configuration software can be downloaded from our homepage www.kobold.com using the product search for "AFK-E".

5.2 Display module / Option:



1. MEASURAND: **2. UNITS:** **3. MEASURAND SELECTION:**

SI		SI	US
RH	Rel. humidity	%	%
T	Temperature	degC	°F
h	Enthalpy	kJ/kg	ftlbf/lb
r	Mixture ratio	g/kg	gr/lb
dv	Absolute humidity	g/m³	gr/ft
Tw	Wet-bulb temperature	degC	°F
Td	Dew-point temperature	degC	°F
e	Water vapour partial pres.	mbar	psi

Press the Δ or ∇ button to select the desired physical quantity.

5. MEASURED VALUES:

The dominant value of the appropriate quantity is displayed in this field. For the factory configuration, the measured values may fall between the measurement ranges shown below.

		from	up to	units
Humidity	RH	0	100	% RH
Temperature	T	-40 (-40)	180 (356)	degC (°F)
Dew-point temperature	Td	-40 (-40)	100 (212)	degC (°F)
Frost-point temperature	Tf	-40 (-40)	0 (32)	degC (°F)
Wet-bulb temperature	Tw	0 (32)	100 (212)	degC (°F)
Water vapour partial pressure	e	0 (0)	1100 (15)	mbar (psi)
Mixture ratio	r	0 (0)	999 (9999)	g/kg (gr/lb)
Absolute humidity	dv	0 (0)	700 (300)	g/m^3 (gr/f^3))
Specific enthalpy	h	0 (0)	2800 (999999)	kJ/kg (lbf/lb)

The measurement ranges indicated above can be set to individual requirements using the configuration software.

6. STATUS LINE:

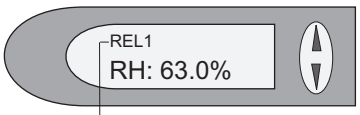
- REL1 / REL2: Status Relay
- "ERROR 01....10": see Hardware, chapter 7.3 “Self-diagnosis and error messages”

6. ALARM MODULE

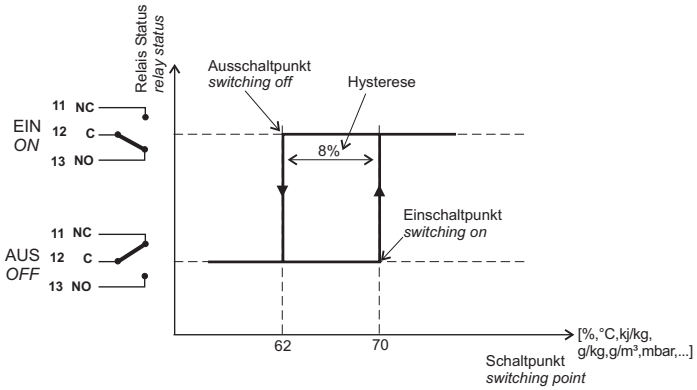
The alarm module can be used for alarm and error issues and other simple control functions. This module can be configured using the configuration software.
The user thus has the option of setting the measurand to be monitored (RH, T, Td,...) and the threshold hysteresis for each relay. (For the procedure, see the Configuration sofware, chapter 5.2 “Relay”)

max. switched voltage / max. switched current: 250 VAC / 6A
28 VDC / 6A
Minimum load: >100mA / 12V

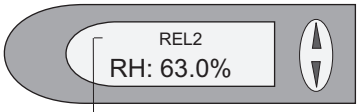
Switching relay 1:



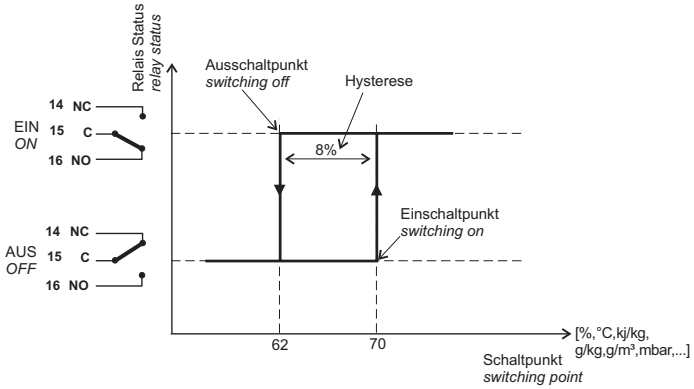
If relay 1 has tripped (ON), then REL1 is displayed.



Switching relay 2:



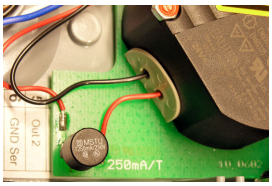
If relay 2 has tripped (ON), then REL2 is displayed.

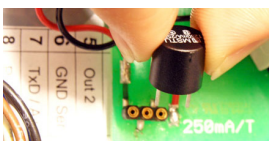


7. MAINTENANCE

7.1 Fuse replacement

If the green LED on the PCB is not flashing with the supply voltage switched on, check the fuse and replace if required.





Fuse secondary:	250mA / T UL248-14	
Nominal voltage:	250V	
Replacement types:		
Series: MSTU 250	Manufacturer: Schurter	Order No.: 0034.7109
Series: 374	Manufacturer: Littelfuse	Order No.: 374 0250

7.2 Cleaning

The sensing elements are highly robust which makes cleaning very easy. Shake the sensing elements for max. 2 min. in industrial Isopropyl alcohol and after that in water. Let them dry free. Do not touch or rub the active surface of the sensing elements!

7.3 Self diagnosis and error messages

Self diagnosis via LEDs on the circuit board:

- **Green LED**
  flashing ⇒ Supply voltage applied / Microprocessor is active

- **Red LED**
  constantly lit ⇒ **Error category 1** = non-critical error, can be solved by the user
  flashing ⇒ **Error category 2** = critical error, return the device for service

- **Blue LED**
  constantly lit ⇒ analogue output is set to voltage.

- **Orange LED**
  constantly lit ⇒ analogue output is set to current.

Self diagnosis via display (where available):

Error description	Error code (display)	Error category	Recommended action
Voltage out short circuit - output 1 only*	ERROR: 01	1	Check wiring of outputs
Voltage out short circuit - output 2 only*			
Voltage out short circuit - both outputs*			
Current loop open - output 1 only	ERROR: 02		Check wiring of outputs
Current loop open - output 2 only			
Current loop open - both outputs			
RH sensor dirty	ERROR: 03		Cleaning sensor
Hardware error	ERROR: 05	2	Return the faulty unit for service
	ERROR: 06		
	ERROR: 08		
Temperature measurement failure	ERROR: 07		
Humidity measurement failure	ERROR: 09		
	ERROR: 10		

8. REPLACEMENT PARTS / ACCESSORIES:

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 cablel:** for direct connection to a supply voltage of 100...240 V_{AC}.

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

9. TECHNICAL DATA

Measurement values

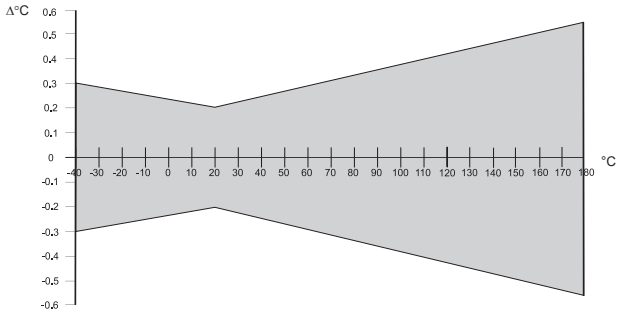
Relative humidity

Working range[1]	0...100% RH	
Accuracy *) (including hysteresis, non-linearity and repeatability)		
-15...40°C (5...104°F)	<90% RH	± (1.3 + 0.3%*mv) % RH
-15...40°C (5...104°F)	>90% RH	± 2.3% RH
-25...70°C (-13...158°F)		± (1.4 + 1%*mv) % RH
-40...180°C (-40...356°F)		± (1.5 + 1.5%*mv) % RH
Temperature dependence of electronics		typ. ± 0.01% RH/°C (0.0055% RH/°F)
Response time with metal grid filter at 20°C / t_{90}		< 15 s

Temperature

Temperature sensor element	Pt1000 (Tolerance class A, DIN EN 60751)
Working range sensing head	-40...180°C (-40...356°F)

Accuracy (typ.)



Temperature dependence of electronics	typ. ± 0.005°C/°C

Outputs [2]

Two freely selectable and scaleable analogue outputs 0...100% RH / xx...yy°C respectively	0 - 5V	-1mA < I_L < 1mA
	0 - 10V	-1mA < I_L < 1mA
	4 - 20mA	R_L < 500 Ohm
	0 - 20mA	R_L < 500 Ohm
Alarm outputs	2 x 1 switch contact	
	250V AC / 6A	28V DC / 6A
Serial interface	RS232C	

Max. adjustable measurement range [2][3]

		from		up to		units
Humidity	RH	0		100		% RH
Temperature	T	-40	(-40)	180	(356)	degC (°F)
Dew-point temperature	Td	-40	(-40)	100	(212)	degC (°F)
Frost-point temperature	Tf	-40	(-40)	0	(32)	degC (°F)
Wet-bulb temperature	Tw	0	(32)	100	(212)	degC (°F)
Water vapour partial pressure	e	0	(0)	1100	(15)	mbar (psi)
Mixture ratio	r	0	(0)	999	(9999)	g/kg (gr/lb)
Absolute humidity	dv	0	(0)	700	(300)	g/m³ (gr/ft³)
Specific enthalpy	h	0	(0)	2800	(999999)	kJ/kg (lbf/lb)

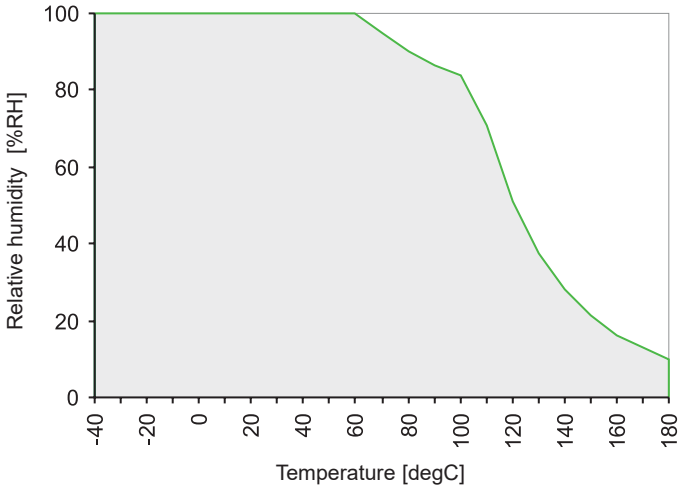
General

Supply voltage	SELV 8...35V DC	SELV = Safety Extra Low Voltage
	SELV 12...30V AC	(optional 100...240V AC, 50/60Hz)
Current consumption - 2x voltage output	for 24 V DC/AC:	typ. 30 mA
- 2x current output		typ. 70 mA
	for 100-240VAC:	typ. 2 VA
Pressure range for pressure tight probe	0.01...20bar (0.15...300 psi)	
System requirements for software	WINDOWS XP or later; USB interface	
Housing / protection class	AlSi9Cu3 / IP65; NEMA 4	
Cable gland	M16 x 1.5	cable Ø 4.5 - 10 mm (0.18 - 0.39")
Electrical connection	screw terminals up to max. 1.5mm² (AWG 16)	
Working and storage temperature range of electronics	-40...60°C (-40...140°F)	
	-20...50°C (-4...122°F) - housing with display	
Electromagnetic compatibility according to	EN61326-1	EN61326-2-3
	Industrial Environment	
	FCC Part15 ClassB	ICES-003 ClassB

1) Refer to the working range of the humidity sensor. 2) Can be easily changed by software. 3) Refer to accuracies of calculated values

*) The accuracy statement includes the uncertainty of the factory calibration with an enhancement factor k=2 (2-times standard deviation). The accuracy was calculated in accordance with EA-4/02 and with regard to GUM (Guide to the Expression of Uncertainty in Measurement).

Operating range humidity sensor



The gray area shows the allowed measurement range for the humidity sensor.

Operating points outside of this range do not lead to destruction of the element, but the specified measurement accuracy cannot be guaranteed.

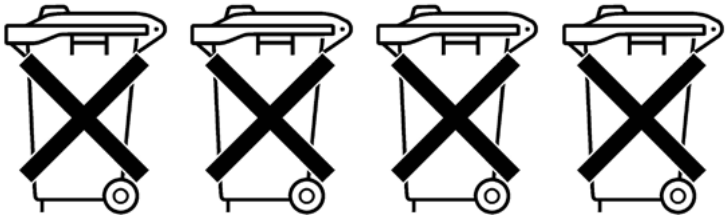
10. DISPOSAL

Notice!

- Avoid environmental damage caused by media-contaminated parts.
- Dispose of the device and packaging in an environmentally friendly manner.
- Comply with applicable national and international disposal regulations and environmental regulations.

Batteries

Batteries containing pollutants are marked with a symbol consisting of a crossed-out garbage can and the chemical symbol (Cd, Hg, Li or Pb) of the heavy metal that is decisive for the classification as containing pollutants:



Cd[1] Hg[2] Pb[3] Li[4]

1 "Cd" stands for cadmium.

2 "Hg" stands for mercury.

3 "Pb" stands for lead.

4 "Li" stands for lithium

Electrical and electronic equipment

11. DECLARATION OF CONFORMANCE

We, KOBOLD Messring GmbH, Hofheim-Ts, Germany, declare under our sole responsibility that the product:

Humidity/Temperature Transmitter Model: AFK-E

to which this declaration relates is in conformity with the standards noted below:

EN 61326-1:2013 Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements

EN 61326-2-3:2013 Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 2-3: Particular requirements - Test configuration, operational conditions and performance criteria for transducers with integrated or remote signal conditioning

EN IEC 63000:2018 Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

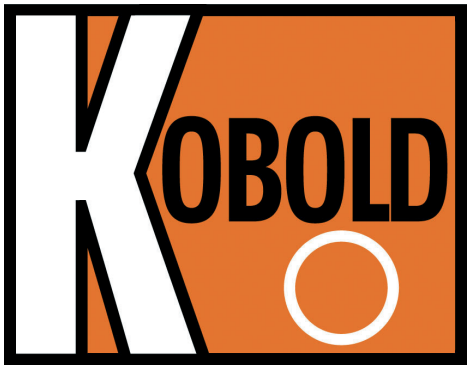
Also, the following EC guideline is fulfilled:

2014/30/EU	**EMC Directive**
2011/65/EU	**RoHS** (category 9)
2015/863/EU	Delegated Directive (RoHS III)

Hofheim, 27 April 2021

H. Volz
General Manager

M. Wenzel
Proxy Holder



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