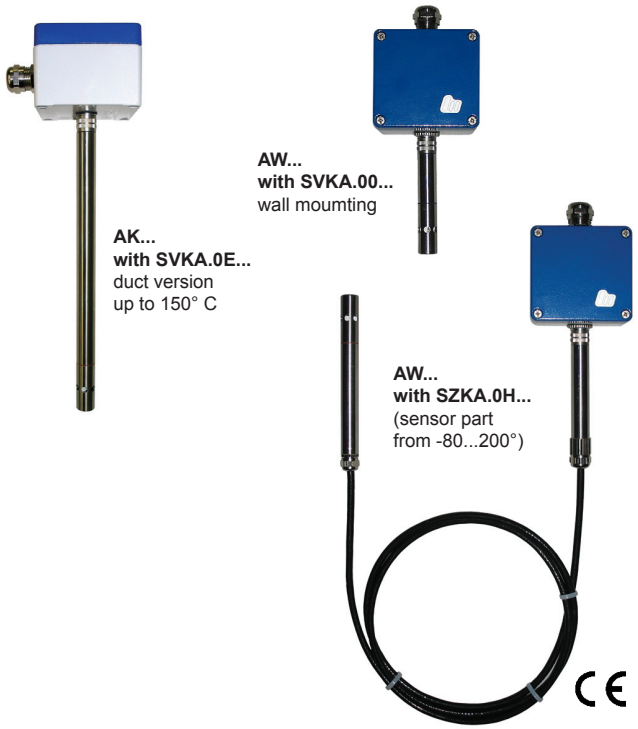


A and B Series

Sensors for humidity and temperature for digital transfer RS485 / MODBUS-RTU or RS232

for industrial application -80°C up to 200°C up to 25 bar

The sensors of the A and B series measure humidity by means of a humidity-dependant condenser. The capacitive Mela® humidity measuring element, produced using thinfilm technology, consists of a base plate, on which the electrodes are housed and a hygroscopic polymer layer above it. The hygroscopic polymer layer absorbs water molecules from the medium to be measured (air) or releases them, thereby altering the capacity of the condenser.

Galltec+Mela® sensors in the A series combine the digital measured value processing with the advantages of our robust industrial sensors which can be used at temperatures up to -80...200°C resp. at pressures up to 25 bar. They are ideally suited for demanding industrial applications.

The **A series** with exchangeable sensor part consists of a calibrated sensor part with 4-pin plug and a transmitter with digital output. Sensor part and transmitter can be combined and matched with each other, according to the physical and mechanical requirements. The measured humidity and temperature values are calculated in the calibrated sensor part with the calibration values stored there, and are passed on as digital measurement values.
In the **B series**, sensor part and transmitter are firmly connected.

The sensors in this series have got either a RS485-interface and are suitable for data transfer via MODBUS-RTU protocol or they have got a RS232-interface and are suitable for data transfer via ASCII protocol.
The transmitters with RS485-interface for data transfer of a **MODBUS-RTU protocol** are equipped with an **hx processor** that uses the values of the relative humidity and the temperature to calculate the dew point temperature, the enthalpy, the mixing ratio, the absolute humidity or the wet-bulb temperature, in accordance with the laws of physics [1].

The scope of delivery includes the sintered high-grade steel filter ZE13. If a better dynamics should be required, we recommend to use the filter type ZE04 together with a PTFE filter which protects the humidity sensing element directly. We recommend to do so in particular at low air speeds and also its increased service life, even under more challenging operating conditions (pollutant impact or permanent humidity > 95 %rh). The use of different filters is not possible. The sensors are designed for unpressurised systems (except the ...0D, ED, HD... version), the measurement medium is non-aggressive air.
Please consult „**application instructions for the sensing elements**“ (product info sheet no. A 1) or check with the manufacturer for further information which you need to bear in mind when using humidity sensors with capacitive sensing elements.

Humidity

Sensing element		FE09
Output range		0...100 %rh
Accuracy		
10...90 %rh	at 23°C	±1.5 %rh
< 10 %rh or > 90 %rh		±2 %rh
Temperature influence	at 23°C	<0.02 %rh/K
Hysteresis		< 1%rh
Response time t_{63} at v=2m/s		< 10 s

Temperature

Measuring element (ref. DIN IEC 751)		Pt1000 1/3-DIN cl.B
Accuracy	at 23°C	±0.2 K
Temperature influence	at 23°C	<0.005 K/K

General

Power supply, external		5...30 V DC
Max. transfer distance RS232/RS485		15m/1000 m
Ambient temperature transmitter		-40...85°C
Degree of protection of measuring head depends on applied filter (see page 2)		
IP rating	transmitter	IP65
	measuring head	(see table)
	connector sensor part ---> transmitter	IP67
Power consumption transmitter		<0.88 mA
Power consumption transmitter + sensor part		<1.95 mA
Power consumption transmitter + sensor part + display		< 2.10 mA
Directive about electromagnetic compatibility **2014/30/EU**		
DIN EN 61326-1		issue 07/13
DIN EN 61326-2-3		issue 07/13

[1] The accuracy of the calculated values depends on both the operating point in accordance with the hx diagram and on the primary values measured. The hx processor operates in the range -30 °C < T < +70 °C, 5 % rh<F<95 % rh. Values outside this range are not calculated, the last valid value is displayed. Normal atmospheric pressure of 1013.25 mbar is used when calculating the hx values.

Order designations for fixed sensor parts

Series	**B Series**	B
Design	duct version	K
	wall mounting	W
	two-piece design	Z
Physical output	humidity dependant variable of the hx diagram and temperature	K
Output signal	RS485 MODBUS RTU protocol	M
	RS232 ASCII	R
Special version	operating temperature -40 up to 85°C (standard)	00
	pressure-proof 20mbar...10bar at -40 to 85°C	0D
	ammonia resistant -40...85°C	11
	vibration protected sealing -40...85°C	0V
	operating temperature -50...150°C (duct version)	0E
	pressure-proof 20mbar...10bar at -50...150°C	ED
	ammonia resistant -50...150°C (duct version)	1E
	operating temperature -80...200°C (2-piece design)	0H
	design thermally decoupled -80...200°C	TH
Output range 1	see table below and page 6	
Output range 2	see table below and page 6	
Voltage supply	5...30 VDC	5
Filters for K- and Z-design (filter programme see product info F5.1)	sintered metal filter of stainless steel ZE13 (standard), IP65	13
	stainless steel filter with PTFE membrane ZE26, IP65	26
	open filter of high-grade steel ZE04 and PTFE protection, IP00	94
	stainless steel filter with mounted PTFE filter ZE28	28
	PTFE filter Ø 15mm, IP65	29
Filters for W-design (filter programme see product info F5.1)	protective plastic basket, open, conductive metallized finish ZE16, IP30	16
	ZE16 with PTFE protection IP30	9G
	ZE16 with inserted filter gauze made of stainless steel (ZE17), IP30	17
	PTFE filter Ø 20mm, IP65	18
	membrane filter ZE20 IP54	20
	sintered filter of stainless steel ZE21, IP65	21
Type of connection and characteristics of design	with display (only MODBUS)	yDx
	cable length, sensor part ->transmitter 1.5m (standard)	1Kx
	special cable length in m rounded up [2]	yyx
	other specialities (special type)	YYY

[2] In 0.5m steps, for sensors with temperature range < -40 and > 85°C the maximum length is 5m

x Tube length depends on sensor type and special design

Order designations for transmitters of A Series

Series	**Transmitter**	A
Design	duct version	K
	wall mounting	W
Physical output	humidity dependant variable of the hx diagram and temperature	K
Output signal	RS485 MODBUS-RTU protocol	M
	RS232 ASCII	R
Special version	none	00
Output range 1	see table on page 6 „Modbus register“	0000
Output range 2		
Voltage supply	5...30 VDC	5
Filter	none	00
Characteristics of design	with display (MODBUS only)	0D0
	specialities of design	Yxx

Order des. for exchangeable sensor parts of S Series

Series	**S Series**	S
Design	stainless steel Ø 15 mm	V
	stainless steel Ø 15 mm, two-piece	Z
Physical output	rel. humidity active +temp. active	K
Output signal	digital ASCII Galltec-Mela protocol	A
Special version	operating temperature range -40 up to 85°C (standard) [1]	00
	pressure-proof 20mbar...10bar at -40 to 85°C	0D
	ammonia resistant -40...85°C	11
	operating temperature range -40 up to 85°C sealing against vibrations	0V
	operating temperature range -50 up to 150°C (duct version)[1]	0E
	pressure-proof 20mbar...10bar at -50 to 150°C	ED
	ammonia resistant -50...150°C (duct version)	1E
	operating temperature range -80 up to 200°C (two-piece) [1]	0H
	operating temperature range -60 up to 160°C [1] and admissible ambient pressure up to 25 bar	HD
	module with fixed values of humidity and temperature	FW
Output range H	0...100 % r.h.	F1
Output range T		[1]
Voltage supply	3.0 VDC	3
Filter	open filter of stainless steel ZE04 and PTFE protection, IP00	94
	sintered metal filter of stainless steel ZE13 (standard), IP65	13
	stainless steel filter with PTFE membrane ZE26, IP65	26
	PTFE filter Ø 15mm, IP65	29
Connection and characteristics of design	cable length 2-piece design 1.5 m (standard)	1Kx
	special cable length 2-piece design [2]	yyx
	specialities of design	YYY

[1] Operating temperature range = output range of temperature
[2] In 0.5m steps, for sensors with temperature range < -40 and > 85°C the maximum length is 5m
x Tube length depends on sensor type and special design

Output ranges of B series with fixed sensor part resp. exchangeable sensor parts of the S series

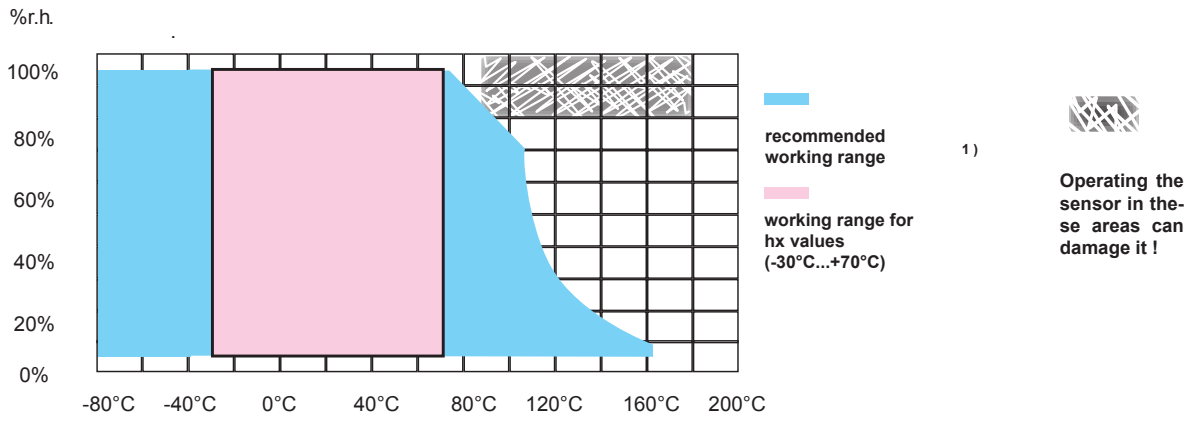
The following physical output parameters are calculated from the humidity and temperature values measured. The tolerances to be expected therefore result from the tolerance limits of the measured values.

	Output range	Special versions	Code
Humidity	0...100 % r.h.	all codes	F1
Temperature	-60...160 °C	HD	66
	-80...200 °C	0H, TH	82
	-50...150 °C	0E, 1E, 0D, ED	59
	-40...85 °C	00,11	48

Mounting and user information

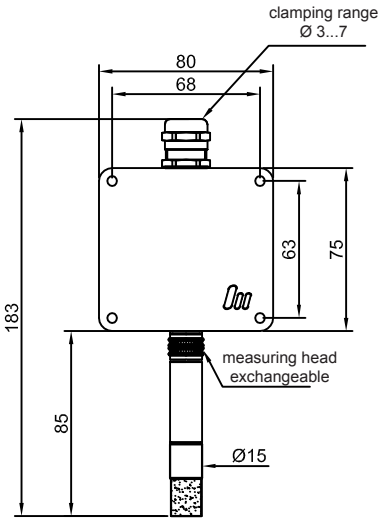
Mounting position	Install the sensor at a place where characteristic levels of humidity occur. Avoid installation next to heaters, doors or on outer walls. Avoid places exposed to the sun. The position the sensor is mounted in (horizontal, vertical) does not matter. However, it should be mounted in such a way that no water can get into it. We recommend that you lay the connection lines in a loop so that any water that may be present can run off. Please note the maximum permissible ambient temperature for the sensor part and transmitter when installing it.
Connection	The electrical connection must be carried out by qualified personnel only.
	The transmitters of the AB-Series contain components, which can be damaged by the effects of electrical fields or by charge equalisation when touched. Protective measures must be taken when mounting them (ESD).
	Pay attention to the load according to the operating voltage when using sensors with a current output.
	Lines to and from the sensor must not be installed parallel to strong electromagnetical fields.
	If there is any chance of an electrical surge, please install surge protection devices.
Dew formation	Dew formation and splashes do not damage the sensor, although corrupted measurement readings are recorded until all the moisture on and directly around the sensor element has dried up.
Dust	Dust and other solid particles do not damage the humidity sensor element, however, if there is an accumulation of dust on it, the dynamic behaviour could be impaired.
Cleaning the filters	Contaminated filters and protective baskets can be carefully unscrewed for cleaning. Do not refit the filter attachment unless it is completely dry, to avoid measuring errors. Take care not to touch the sensitive humidity sensor element. Please note that the sensor is only able to measure accurately once the filter and the sensor element are fully dry.
Cleaning the sensing element	Loose dirt can be removed from the moisture sensor element by careful blowing or rinsing with distilled water. Take care not to touch the sensitive humidity sensor element.
Damaging influences	Depending on their type and concentration, aggressive media containing solvents can cause incorrect readings or cause the sensor to fail. Substances deposited on the sensor element (e.g. fats, oils, resin aerosols, paint aerosols, smoke deposits etc.) are harmful as they eventually form a water-repellent film or deteriorate the dynamic behaviour of the sensor. This also applies for the contamination of the PTFE filter for the sensing element (9G) with these substances.
Check functioning	In order to check functioning in the place of installation, we recommend that you use our *ZE31/1-x type humidity standards* (accessories).

Working range for humidity and temperature

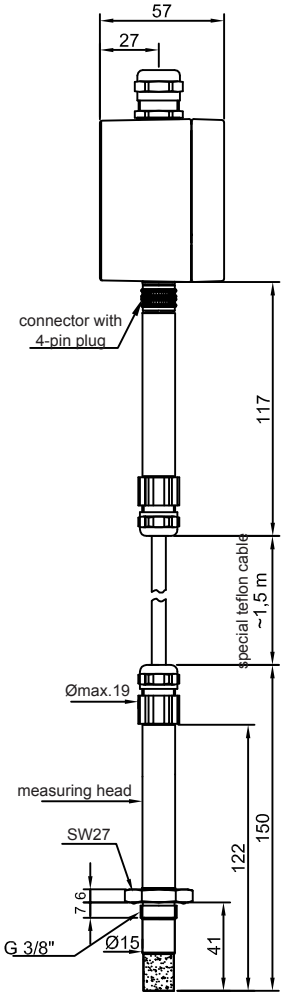


[1)] In continuous operation mode, the elements should be used up to an absolute humidity level which corresponds to a dew-point temperature not exceeding 60°C. The elements can be used at dew-point temperatures of up to 90°C during short work cycles (e.g. in a control process).

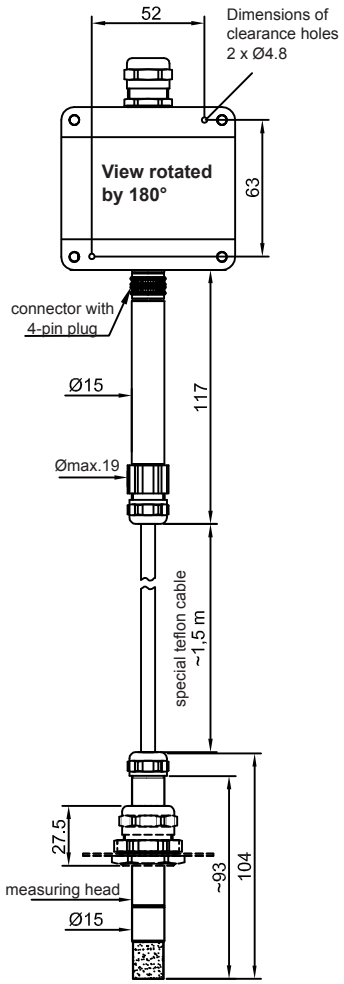
Dimensions A Series



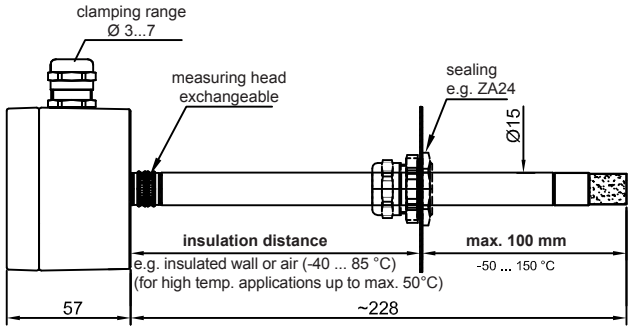
AWK...
with SVKA.00...
for wall mounting
-40...85 °C



AWK...
with SZKA.HD...
sensor part up to
160 °C and 25 bar

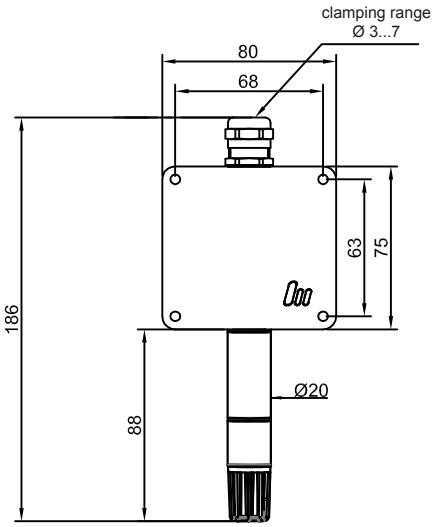


AWK...
with SZKA.0H...
sensor part up to
200 °C

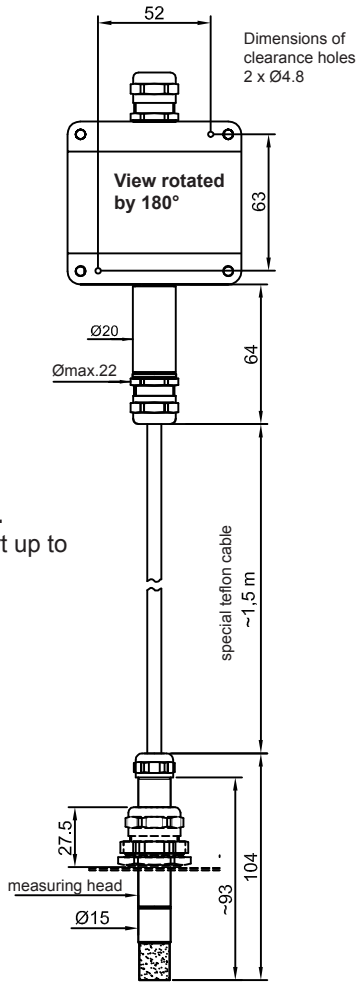


AKK...
with SVKA.0E...
for duct mounting
up to 150 °C

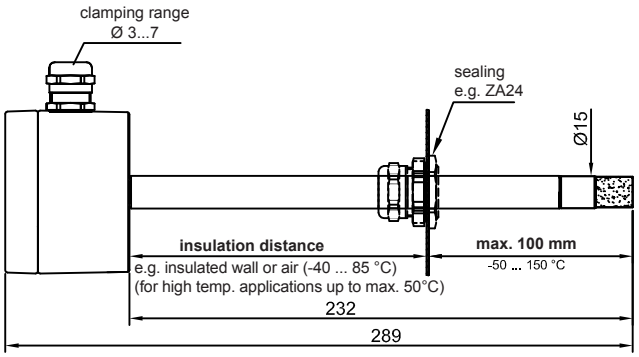
Dimensions B Series



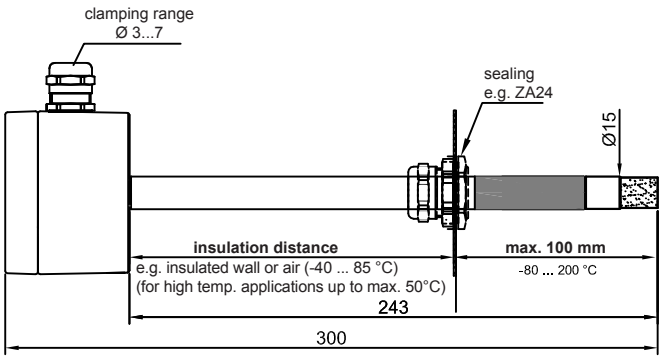
BWxx.00...
for wall mounting
-40...85 °C



BZxx.0H...
sensor part up to
200 °C



BKxx.0E...
for duct mounting
up to 150 °C



BKxx.TH...
for duct mounting
up to 200 °C

Notes on sensors with MODBUS-RTU

Serial interface

The following parameters are possible for data transfer via the RS485 interface :

- Baud rate: 38400 / 19200 / 9600 / 4800 / 2400 / 1200 / 600
- Data bits: 8
- Parity: N / E / O
- Stop bits: 1 / 2

Modus 19200@8N2 is pre-defined.

Register	Datentyp	Value	Permission
0	FLOAT32	temperature (°C)	readable
1			
2	UNIT16	alarm code temperature	
3	FLOAT32	relative humidity (%RH)	
4			
5	UNIT16	alarm code humidity	
6	UNIT32	serial number sensor part	
7			
8	UNIT32	serial number transmitter	
9			
10	FLOAT32	wet-bulb temperature (°C)	
11			
12	FLOAT32	enthalpy (kJ/kg)	
13			
14	FLOAT32	mixing ratio (g/kg)	
15			
16	FLOAT32	absolute humidity (g/m³)	
17			
18	FLOAT32	wet-bulb temperature (°C)	
19			
20	UNIT16	alarm code hx processor	
205	UNIT16	modbus address	read and writeable

Table 1 - Modbus register

The word order of data types which extend over several Modbus registers is Little Endian. This means that the low byte word is in the lower register and the high byte word is in the higher register.

Operation

The measured values for relative humidity, temperature and the corresponding alarm codes, along with the probe serial number, are transferred continuously to the transmitter and saved in registers 0…7. Sensors with a screen show both measured values. If one of the two alarm codes is not working correctly, the screen display will begin to flash. If the probe and transmitter are not permanently linked, the display will again flash to signal a missing or faulty sensor. Instead of the measured value, the screen will then display „----“. If the devices are permanently linked, a faulty probe will be signalled in the same way. Registers 8 and 9 contain the transmitter‘s fixed serial number. In the case of one-piece sensors, both serial numbers are identical. If an hx value is scanned from registers 10…19, this is recalculated at the time of the scan, based on the current temperature and the relative humidity. The hx processor emits an alarm code if the values for temperature or relative humidity are outside the permissible input range. No calculation is made in this case, and the register displays the last valid value for each variable.

Table 2 lists all the possible alarm register values when measuring temperature (reg. no. 2).

Alarm code	Meaning
0	no alarm, the temperature value is within the limits
1	temperature range of the measuring head exceeded
2	below temperature range of the measuring head
3	Wire break or no sensor element detected
4	short circuit at PT1000 (resistance < 500 Ohm)

Table 2 - alarm codes temperature

Table 3 lists all the possible alarm register values when measuring humidity (reg. no. 5).

Alarm code	Meaning
0	no alarm, the humidity value is within the limits
1	humidity range of the measuring head exceeded
2	below humidity range of the measuring head
3	Wire break or no sensor element detected
4	humidity element defective

Table 3 - alarm codes humidity

Table 4 lists all the possible alarm register values of the hx processor (reg. no. 20).

Alarm code	Meaning
0	no alarm, input values are within the limits
1	one or more input values exceeded
2	one or more input values below limit
3	hx processor deactivated

Table 4 - alarm codes hx processor

The Modbus address can be modified at any time via write access to the address register (reg. no. 205). Permissible slave addresses are within the 1...247 range. Using address 0 as a slave address is not permissible. Addresses within the 248…255 range are reserved for special Modbus services and their use as a slave address is not permissible either. Address 1 is pre-defined.

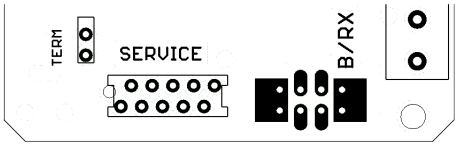
Configuration of Modbus parameters

In standard mode (and in the network if required), the Modbus address for all sensors can be modified by entering an appropriate write command. The write command will still be acknowledged using the old address. The sensor can then be accessed immediately via the new address.
Further configuration of Modbus parameters, such as address, baud rate, parity and stop bits is only possible with a suitable setup cable for the relevant sensor type (see accessories on p. 10). These settings are then made from a PC via the ***ModSens-Setup*** software available for download. For this, the sensors must not be in the network.

Aligning the sensors

The sensors can also be aligned, thing which is made from a PC using the ***UserCalib-Wizard*** software, which is available as a free download. To connect the sensors to a PC you need the same cable set as described in „configuration of modbus parameters“.

The above mentioned software is available on our Homepage as a free download (http://melasensor.de/download/).



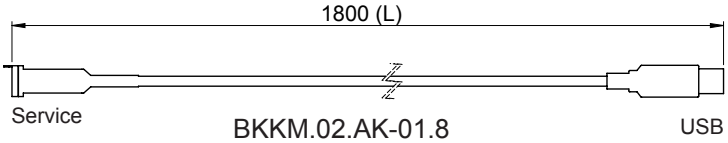


Fig. 1

Operation

To connect directly to a PC, all you need is an integrated RS485 interface or an external adaptor. Mains power can also often be supplied in this way. A software program such as Modbus Poll will then assume the role of the master

Further measures must be taken for more challenging applications in the network, for long distances and/or in environments with electromagnetic interference. The bus must be designed in a daisy chain structure without spurs. The data line must be designed as a screened and twisted pair. The first and the last bus nodes must be terminated. If DC termination is sufficient, the integrated resistance of 135Ω can be switched between A and B – provided this is available on the relevant model. To do this, switch the TERM jumper in the appliance (see Fig. 1 on page 7) to the corresponding position. If you have to use transmission line polarisation, we advise against using DC termination. Instead you should use AC termination. The required series connection for the resistor and the capacitor can then be switched between A and B on the second data line pair of the connection cable.
A Mela Modbus sensor according to the RS485 standard represents 1/8 unity load. If the network only contains sensors in this impedance category, 256 bus nodes are theoretically possible instead of 32. However, due to the available address space, in practice the number reduces to 247.

The scanning interval should not exceed 2 seconds across the entire network.

For further informationen see http://www.modbus.org/ .

Notes on sensors with RS232

Serial interface

The data transfer via the RS232 interface is effected with the following parameters:

- Baud rate: 9600
- Data bits: 8
- Parity: N
- Stop bits: 1

If power is also supplied to the sensor via the interface, the RTS and DTR signals must also be permanently enabled.
ASCII protocol
Approximately every 3 seconds (approx. 5 sec in case of an error), the sensor transmits a character string containing the measured values for relative humidity, temperature and the corresponding alarm codes and serial numbers. A checksum ensures the validity. The output character string has a constant length of 41 characters in the following format:

@T;<Sign>;<Temperature>;<Alarmcode>;F;<Humidity>;<Alarmcode>;<Serialnumber>;<Sum>\r\n

The individual characters and fields have the following meanings:

„@“	Begins a protocol frame
„T“	Marks the temperature value
„F“	Marks the humidity value
„;“	Separator
„\r“	Carriage Return
„\n“	Line Feed
<Sign>	Temperature plus/minus sign, „+“ or „-“
<Temperature>	5 characters, two integer places, two decimal places from „0“ … „9“, Comma symbol is „.“
<Alarmcode>	3 characters, „A00“ … „A04“
<Humidity>	6 characters, three integer places, two decimal places from „0“ … „9“, comma symbol is „.“
<Serialnumber>	8 characters from „0“ … „9“
<Sum>	2 characters from „0“ … „9“ or „A“ … „F“

Examples:
1: @T;+021.37;A00;F;038.92;A00;12345678;38\r\n
2: @T;+018.97;A00;F;099.54;A00;00251979;0A\r\n

Table 1 lists all the possible values when measuring temperature

Alarm code	Meaning
A00	No alarm, the temperatur value is within the limits
A01	Temperature measuring range of the measuring head exceeded
A02	Below temperature measuring range of the measuring head
A03	Wire break or no sensor element detected
A04	Short circuit at PT1000 (resistance < 500 Ohm)

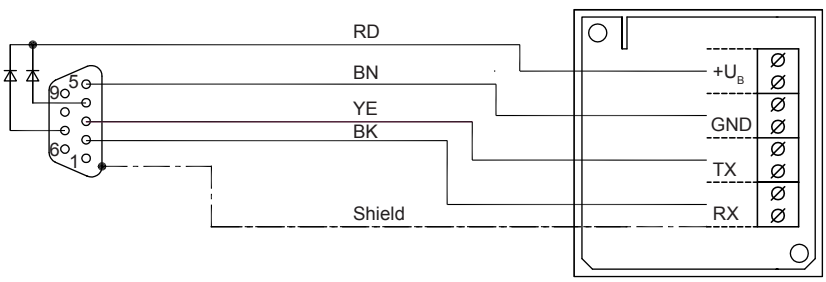
Table 2 lists all the possible values when measuring humidity

Alarm code	Meaning
A00	no alarm, the humidity value is within the limits
A01	humidity range of the measuring head exceeded
A02	below humidity range of the measuring head
A03	Wire break or no sensor element detected
A04	humidity element defective

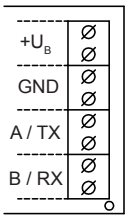
The checksum is calculated according to the following algorithm with reference to example 1:

1. Add up the decimal representation of all ASCII characters from "@" to the final „;"
   64 („@") + 84 („T") + 59 („;") + 43 („+") + 48 („0") + 50 („2") + … + 54 („6")+ 55 („7")+ 56 („8") + 59 („;") = 1991
2. Divide this sum by 256 to find the remainder
   1991 % 256 = 199
3. Subtract the remainder from 255
   255 – 199 = 56
4. Interpret the decimal result as a hexadecimal number
   $56 = 38_{hex}$
5. Compare the individual hexadecimal numbers with the transmitted ASCII characters of the checksum
   38_{hex} → „3" & „8" √

Connection diagram RS232 and RS485



AW(K)KR... with data line AWKR.02.00-xx.x



AW(K)KM...

Accessories

Designation	Order reference	Info sheet	Description	
Sub-D-data line RS232	AWKR.02-00-xx.x	-	Sub-D-data line up to max. 15 m for direct connection to serial PC interface; (e.g. 15m: AWKR.02-00-15.0) *Note: jack of data line IP30 / -10...50°C !*	
USB adapter RS232->USB	USB adapter	-	USB adapter for Sub-D-data line *To connect up the Sub-D-data line to a USB interface on the PC or Laptop*	to configurate and adjust the sensors/probes
setup cable UART -> USB	BKKM.02.AK-01.8	-	Connecting cable sensor --> PC, suitable for all sensors in the A and B series.	to configurate the Modbus parameters and adjust the sensors/probes
ZA24	as designation	F5.1	Attachment plate for mounting sensors in ducts or wall bushings, for sensor tubes 15 mm	
ZA25	as designation	F5.1	Attachment plate for mounting sensors in ducts or wall bushings, for sensor tubes 15 mm for use in gases containing ammonia	
ZA27	as designation	-	Pressure-tight feed-through fitting with non-cutting removable locking ring, pressure-tight up to 6 bar, for temperatures up to 180 °C, thread G 1/2“ x 12, material: brass, outside diameter 15 ± 0.1 mm	
ZA28	as designation	-	Pressure-tight feed-through fitting, pressure-tight up to 10 bar, for temperatures up to 150 °C thread G 3/4“ with locking ring, material: 1.4571 stainless steel, outside diameter 15 ± 0.1 mm	
ZA 161/1 with mounting sleeve 00.502	as designation	F5.1	Weather protection *recommended for outside use to protect from rainfall and sunlight* with adapter sleeve 00.502 also suitable for rod sensors 15 mm	
ZE 31/1-12 ZE 31/1-33 ZE 31/1-75 ZE 31/1-84 ZE 31/1-97	as designation	F5.2	Standard humidity to check the accuracy of the sensors at 12 %rh and 25°C Standard humidity to check the accuracy of the sensors at 33 %rh and 25°C Standard humidity to check the accuracy of the sensors at 75 %rh and 25°C Standard humidity to check the accuracy of the sensors at 84 %rh and 25°C Standard humidity to check the accuracy of the sensors at 97 %rh and 25°C	
ZE33	as designation	F5.2	Adapter for humidity standard ZE 31/1	
SVKA.FW.xxxx.300.002		-	module with fixed values of humidity and temperature for static calibration. When orderung please specify the desired humidity and temperature value.	

„UserCalibWizzard“ calibration and adjustment software

This software is a PC application for Windows which can be used to calibrate and adjust A- and B series sensors easily.
The program is designed as a wizard with simple navigation to guide users through the required steps to adjust sensors, verify measurements digitally, save data and print results. Required reference values can be obtained from a sensor used as reference, or entered directly at all measurement points.
Connecting the sensors to the PC requires a suitable setup cable (BKKM.02.AK-01.8) which is available from Galltec+Mela (see accessories on this page).

The program is available as a download from www.galltec-mela.de/download and requires hardware-specific activation by Galltec+Mela

„VisualPMU“ Freeware for RS232

This simple and very clear visualisation software supports the data output of a sensor via a serial interface on the PC or laptop without an additional power supply.
To use this, it is necessary to install the accessory *Sub-D data line* (refer to accessories and connection diagrams).
For USB connections, a *USB adapter* can be supplied (see accessories).
The relative humidity, the dew point and the temperature (°C or °F) can be displayed and can be depicted as a graph. Apart from that, the programme has a simple data logger function. Recorded data can be exported to other programmes.
This freeware version can be found on our Homepage as a free download (http://melasensor.de/download/).

This information is based on current knowledge and is intended to provide details of our products and their possible applications. It does not, therefore, act as a guarantee of specific properties of the products described or of their suitability for a particular application. It is our experience that the equipment may be used across a broad spectrum of applications under the most varied conditions and loads. We cannot appraise every individual case. Purchasers and/or users are responsible for checking the equipment for suitability for any particular application. Any existing industrial rights of protection must be observed. The quality of our products is guaranteed under our General Conditions of Sale. Data sheet A- und B-Serie_digital_EN. Issue: July 2017. Subject to modifications.