



I Series

Compact Sensors for Humidity and Temperature

For digital data transfer

RS485 / MODBUS RTU or RS232

Description

Mela®-humidity/-temperature sensors in the I series are compact sensors in a rod-type design with cable, connecting head or plug-in connection to measure relative humidity and temperature with high precision in air and other non-aggressive gases. They can be used for a wide range of applications.

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.

All the sensors in this series are supplied with a ZE17-type gauze filter. We recommend to use a version with other filters (filter programme see product info sheet no. F 5.1) and a higher degree of protection if the sensor is used in meteorology, at high wind speeds or if the sensor is exposed to salt mist, sand or dust (near the sea, industrial estates etc.).

Technical Data

Humidity

sensing element	calibrated sensor chip calHT	
output range	0...100 %rh	
accuracy		
10...90 %rh	at 23°C	±1.5 %rh
< 10 %rh or > 90 %rh		±2 %rh
influence of temperature	at 23°C	<0.05 %rh/K
influence Vcc (basis 18V)(MODBUS) with ZE17		0.04 %rh/V

Temperature

measuring element (ref. DIN IEC 751)	Pt1000 1/3-DIN cl.B
accuracy	at 23°C ±0.2 K
influence of temperature	at 23°C <0.005 K/K
influence Vcc (basis 18V)(MODBUS) with ZE17	<0.01 K/V

General

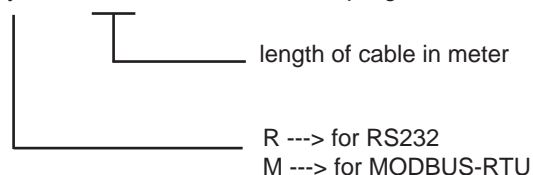
power supply, external	5...30 V DC
max. transfer distance RS232/RS485	15m/1000 m
ambient temperature	-40...85°C
degree of protection	
tip of measuring head	IP30
	(IP54 filter ZE 20/21/22)
connector	IP67
consumption of electronics (idling)	< 1.95 mA
electromagnetic compatibility	ref. EN 61326-2-3

Order designation sensors

Series	I Series	I
design	tube Ø 20 mm alu with plug-in connection	A
	tube Ø 20 mm alu with robust head	R
	tube Ø 15 mm stainless steel with robust head	T
phys. output	humidity and temperature active	K
	temperature	T
output signal	RS232 with ASCII protocol	R
	RS485 MODBUS-RTU protocol	M
special edition	none	00
	vibration protected sealing	0V
	pressure-proof	0D
measuring range 1 F	0...100% r.h.	F1
	none	00
measuring range 2 T	-40...85 °C	48
operating voltage	5...30 VDC	5
filter	ZE16	16
	ZE17	17
	ZE18	18
	ZE20	20
	ZE21	21
	ZE22	22
	ZE16 + element filter PTFE	9G
type of connection and characteristics design	5-pin plug-in connection (RS232 ASCII)	5S8
	7-pin plug-in connection (RS485 ModBus)	7S8
	robust head	007

Order reference cable for sensors with plug-in connection (optional)

IAKy.02.40-xx.x ---> with coupling IP40
IAKy.02.67-xx.x ---> with coupling IP67



Order reference for service cable ModBus-sensors (optional)

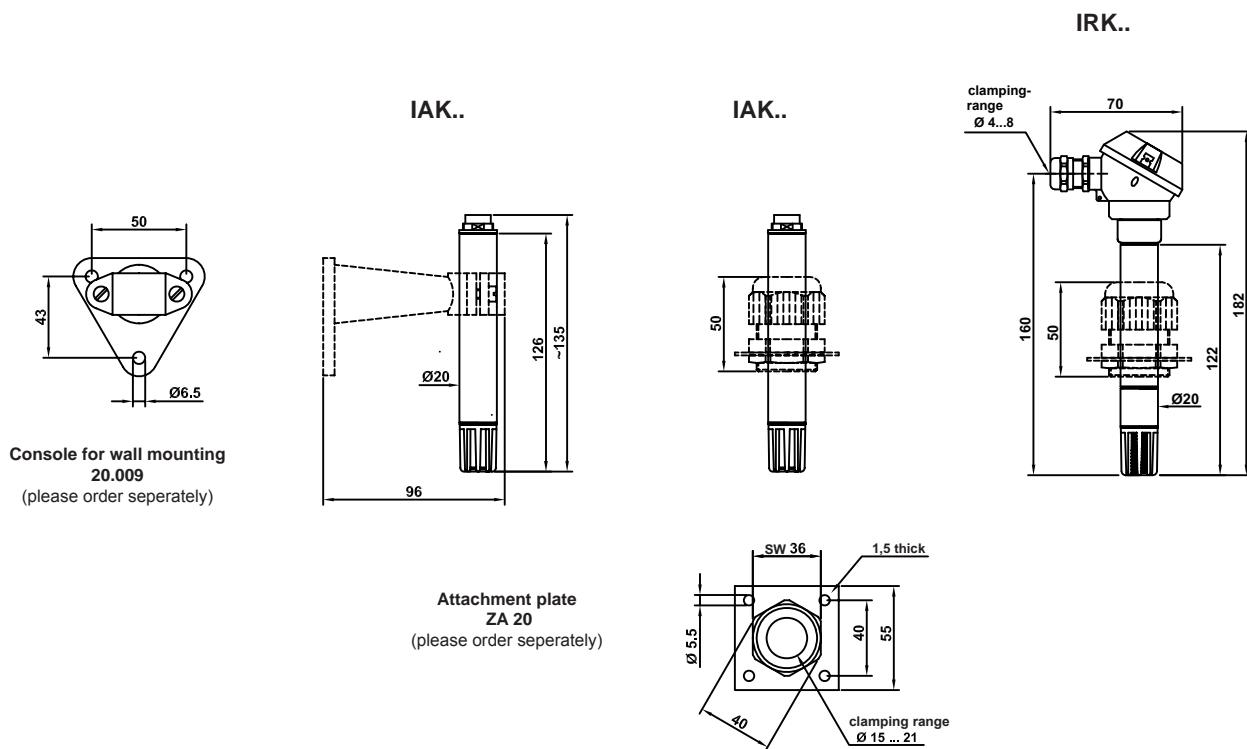
lyKM.02.SK-01.8

A ---> for sensors with plug-in connection
R ---> for sensors with robust head

Accessories

Designation	Order reference	Info sheet	Description
Sub-D adapter cable for sensors with RS232 output	IAKR.02.40-02.5 (standard) IAKR.02.40-xx.x IAKR.02-67-xx.x (Ready-made cable if required)	-	connecting cable with 5 pin binder plug and 9 pin SUB-D jack for direct connection to serial PC interface max. permissible ambient temperatures: binder plug and cable -40...+85°C / IP40 (IP67) SUB-D jack (PC connection) -10...+50°C / IP30 (when connected)
Connecting cable for sensors with MODBUS output	IAKM.02.40-xx.x IAKM.02-67-xx.x (Ready-made cable if required)		connecting cable with 7-pin binder plug, end of cable open with end sleeves for strands max. permissible ambient temperatures: 40...+85°C / IP40 (IP67) <i>Electrical connections see connection diagram !</i>
USB adapter serial -> USB	as description	-	USB adapter for Sub-D-data line <i>To connect up the Sub-D-data line to a USB interface on the PC or Laptop</i>
Service cable ModBus --> USB	IAKM.02.SK-01.8 IRKM.02.SK-01.8	-	Version with plug-in connection Version with robust head
ZA 161/1	as description	F5.1	weather guard for rod-shaped sensors <i>recommended for outside use to protect from rainfall and sunlight</i>
ZE 31/1-12 ZE 31/1-33 ZE 31/1-75 ZE 31/1-84	as description	F5.2	humidity standard to check the accuracy of the sensors 12 %rh at 25°C humidity standard to check the accuracy of the sensors 33 %rh at 25°C humidity standard to check the accuracy of the sensors 75 %rh at 25°C humidity standard to check the accuracy of the sensors 84 %rh at 25°C
ZE33	as description	F5.2	adapter for humidity standard ZE 31/1

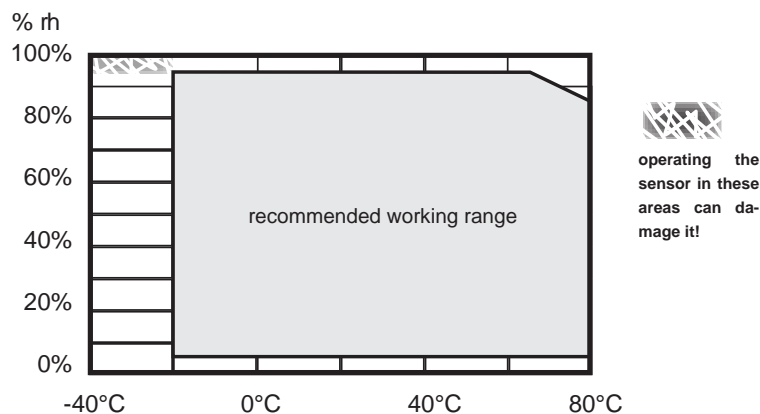
Dimensions



User information

Position	<p>The sensors are to be attached in a position representative for the climate measurement. 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.</p> <p>Please note the maximum permissible ambient temperature when installing the sensor. The sensors always have to be installed in such a way that the plugs are not exposed to an increased ambient temperature either ($>85^{\circ}\text{C}$).</p>
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	<p>If it should become necessary to clean it, the filter can carefully be unscrewed and rinsed. Loose dirt can also be removed from the measuring element by blowing it off or rinsing it carefully with distilled water.</p> <p>Please bear in mind, that the sensor will not measure accurately again until all the moisture on and directly around the sensor element has dried up</p>
Damaging influences	Agents that are corrosive and contain solvents, depending upon the type and concentration of the agent, can result in faulty measurements and cause the measuring element to break down. Substances deposited on the sensor are damaging as they form a water-repellent film (resin aerosols, lacquer aerosols, smoke deposits etc.).
check functioning	In order to check functioning in the place of installation, we recommend that you use our <i>ZE31/1-x type humidity standards</i> (accessories).

Working range of humidity and Temperature



Notes on sensors with MODBUS-RTU

Serial interface

The following parameters are possible for data transfer via the EIA-485 interface on the ModBus sensors made by Mela®:

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

Modus 19200@8N1 is pre-defined.

Access to Modbus registers

To ensure compatibility with all Modbus masters, all available registers can be read both with function code 03_{hex} (read holding register), as well as with function code 04_{hex}. Registers with additional write permission can be modified with function code 06_{hex} (write holding register). All registers available with Modbus sensors by Mela are listed in table 1.

Register-no.	Format	Value	Permission
0-1	FLOAT32	temperature in °C	readable
2	UNIT16	alarm code temperature	
3-4	FLOAT32	humidity in % r.h.	
5	UNIT16	alarm code humidity	
6 - 7	UNIT32	serial number sensor	
205	UNIT16	modbus address	read and writeable

Table 1 - Modbus register

The memory organisation for the temperature and air humidity readings, as well as for the serial number, 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.

Alarm codes:

<i>Temperature channel (reg. no.2):</i>	<i>Humidity channel (reg no.5):</i>
0 = no alarm, the temperature value is within the limits	0 = no alarm, the humidity value is within the limits
1 = temperature measurement range exceeded	1 = humidity measurement range exceeded (=100% rh)
2 = below temperature measurement range	2 = below humidity measurement range (= 0% rh)
3 = no sensor signal	3 = no sensor signal
4 = short circuit at PT1000 (resistance < 500 Ω)	4 = humidity sensor defective

Table 2 - alarm codes humidity and temperature



Configuration of Modbus address

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. Address 0 can be used to send broadcasts across the network (all slaves with the relevant broadcast functions will execute these, but will not acknowledge successful execution). 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.

Any change to the Modbus address is effective immediately and the sensor will acknowledge the command already using the new address.

It is recommended to select a scanning interval no shorter than 2 seconds, as the internal reading update also only works at that cycle duration, and power consumption would otherwise increase unnecessarily. An expedient and energy efficient scanning setup would be:

1. Temperature scan (reg. no. 0 and 1)
2. 20ms pause
3. Air humidity scan (reg. no. 3 and 4)
4. 20ms pause
5. Serial number scan (reg. no. 6 and 7)
6. 5 sec pause
7. Continue with 1.

Parallel to the above

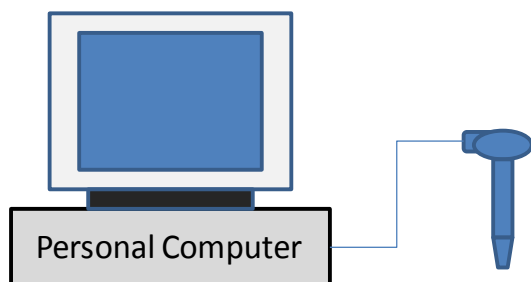
1. Temperature alarm code scan (reg.no. 2)
2. 20ms pause
3. Air humidity alarm code scan (reg.no. 5)
4. 20ms pause
5. Serial number scan (reg.no. 6 and 7)
6. 1min pause
7. Continue with 1.

If the link between serial number and sensor address is known, the cyclical serial number scan should be omitted.

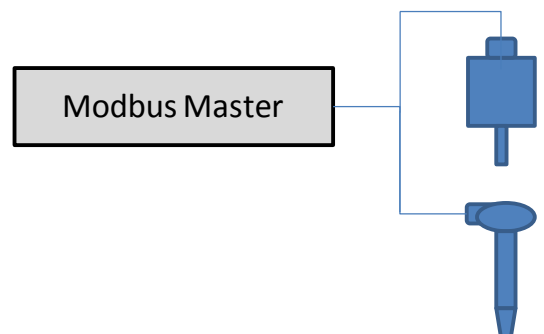
Operation of the Sensor

PC

- Recommended during incoming goods inspection
- requires PC with RS485 interface and Modbus master software (e.g.: Modbus Poll) or a Modbus master system



Net work



Sensor configuration

In the factory setting, the address on the Modbus sensors by Mela can be set as described above.

Further configurations can be made by using the correct service cable for the respective sensor. The settings are then made with the software ModSens-Setup (<http://melasensor.de/download/>), which is available as a download. Fig. 1 shows the user interface during operation. The service cable is first connected to an USB interface on the PC. The driver is then automatically installed via Windows 7. In Windows XP the current FTDI driver must be downloaded from the manufacturer's homepage (<http://www.ftdichip.com/ftdrivers.htm>) and installed. The service cable is then available as a virtual COM interface (in Fig. 1 COM31) and can be correspondingly selected in ModSens-Setup. The "Connect" / "Disconnect" button respectively connects or separates the interface. The sensor configuration comprises the baud rate, parity, number of stop bits and the Modbus address. After modifying a parameter, use the "Apply" button to adopt the parameter into the sensor. All available readings, the serial number and the firmware version of the sensor are also displayed.

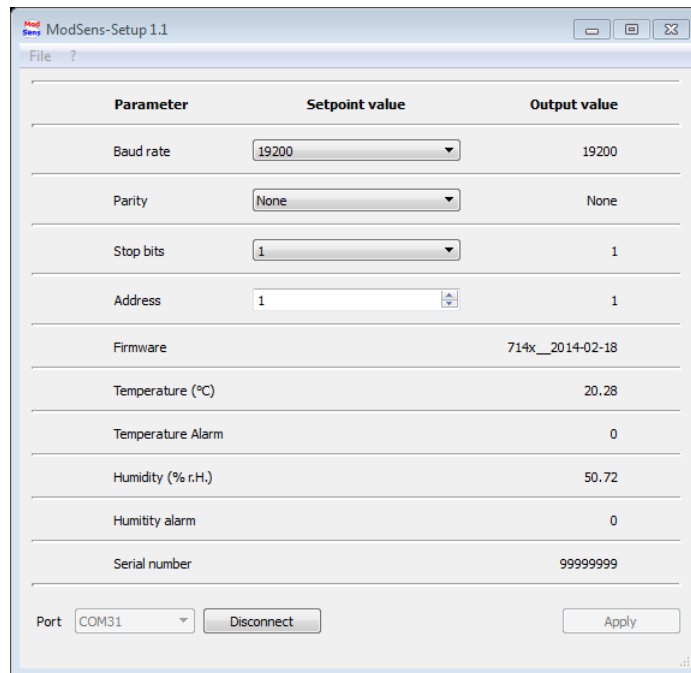


Fig. 1: User interface of ModSens-Setup

Termination

In order to keep any heating up of the sensor and the resulting measuring errors to a minimum, the use of external termination is recommended. With IAKM... sensors, the terminal resistor required for this can be attached to the 2nd data line pair of the connecting cable (available as option). With IRKM sensors, the terminal resistor should be attached outside the sensor housing if possible, again to the 2nd pair of data lines.

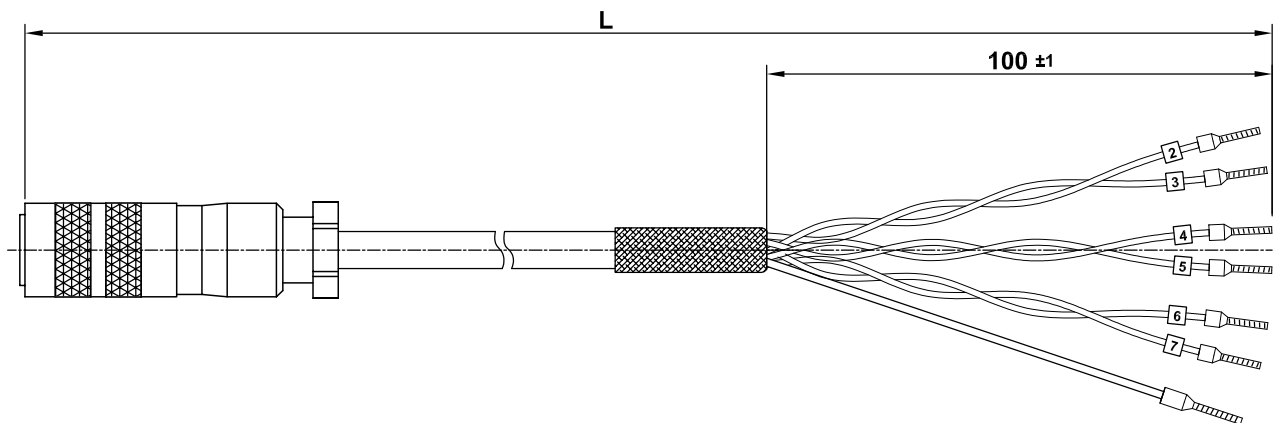
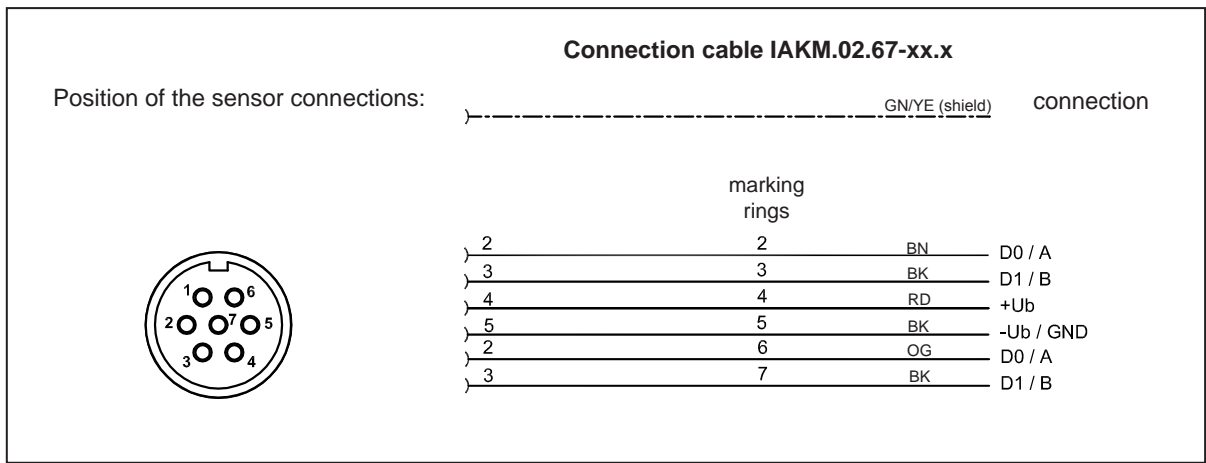
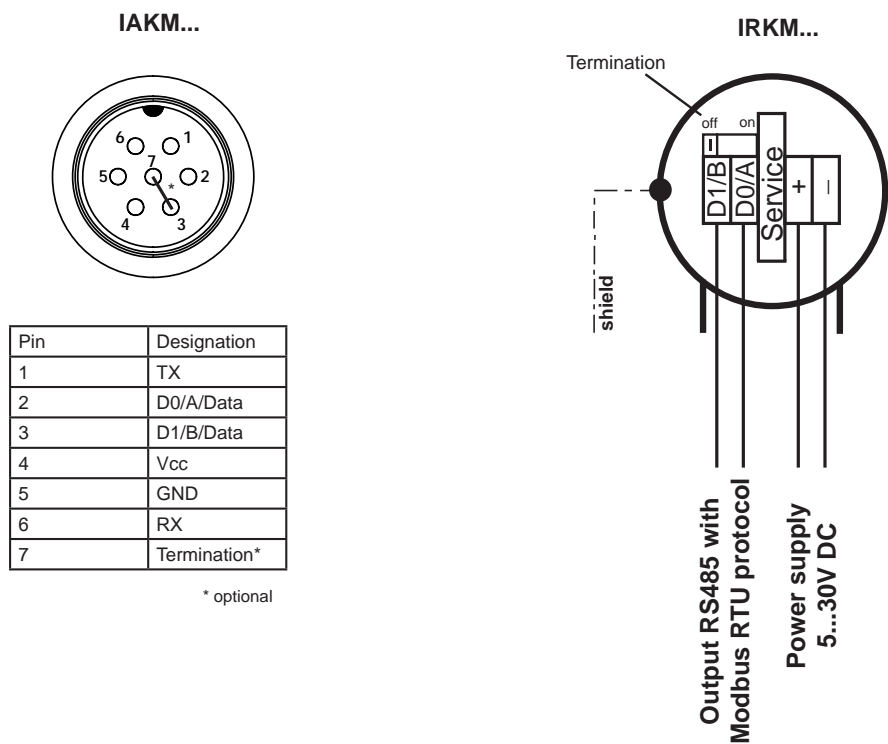
With Modbus sensors from MELA Sensortechnik GmbH, the internal DC termination of 135 Ω can be used if external termination is not possible. With IAKM rod sensors, the terminal can be activated by bridging Pin3 and Pin7 in the threaded connector of the connecting cable. With IRKM models this is achieved by setting the relevant jumper.

Further recommendations

- Set up your network in line with the general recommendations for RS485 networks. This means, for example:
 - Use a linear structure for the BUS (no branches).
 - Terminate the first and last BUS subscribers.
 - Use a screened and twisted core for the data cables.
- Maintain a scanning interval above 2 seconds across the entire network.
- If the last BUS subscriber is an IAKM sensor, termination on the second data line pair of the connecting cable is preferable to internal termination.
- Select a suitably slow baud rate (the smaller the baud rate the greater the energy demand).



Connection diagrams RS485 ModBus

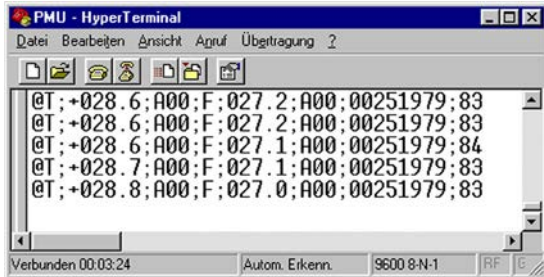


Notes on sensors with RS232 interface

Freeware

HyperTerminal (Windows)

The sensors in the lyKR series can be read via the Hyper Terminal programme from Windows. The picture below shows the character string of the data issued by the sensor.



Connection settings



Notes on ASCII protocol

start of protocol	end of protocol	separation sign
@	"CR" and "LF"	","

The measurement data is sent in the measurement phase as ASCII-protocol on the RxD-pin:

@T	<sign>	<temperature>	<alarm-code>	F	<humidity>	<alarm-code>	<serial number>	<check-sum>	<CR>	<LF>
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Example

@T; + 21.37; A00; F; 038.92; A00; 12345678; 38 control character control character
Carriage Return Line Feed

The check sum is calculated as follows:

$$\text{check sum} = 255 - (\sum_{\text{dez}} \% 256) = \text{check sum}_{\text{dez}} = \text{check sum}_{\text{hex}}$$

Example:

$$\text{check sum} = 255 - (1991 \text{ Modulo } 256) = 255 - 199 = 56 = 38_{\text{hex}}$$

The check sum is not transmitted as a hexadecimal character with 1 byte, but is translated into readable digits with 2 bytes. Through the comparison of the transmitted check sum with a check sum calculated at the read-out point, the user has the opportunity to check whether the transmission of the data is error-free.

Alarmcodes:

Temperature channel:

A00 = no alarm, the temperature value is within the limits
A01 = temperature measurement range exceeded
A02 = below temperature measurement range
A03 = no sensor signal
A04 = short circuit at PT1000 (resistance < 500 Ω)

Humidity channel:

A00 = no alarm, the humidity value is within the limits
A01 = humidity measurement range exceeded (=100% rh)
A02 = below humidity measurement range (= 0% rh)
A03 = no sensor signal
A04 = humidity sensor defective

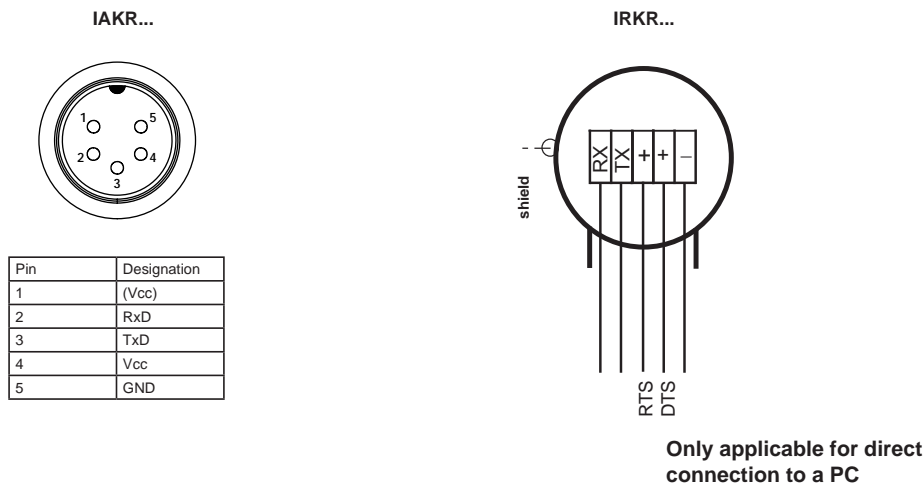
VisualPMU Freeware for RS232

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.

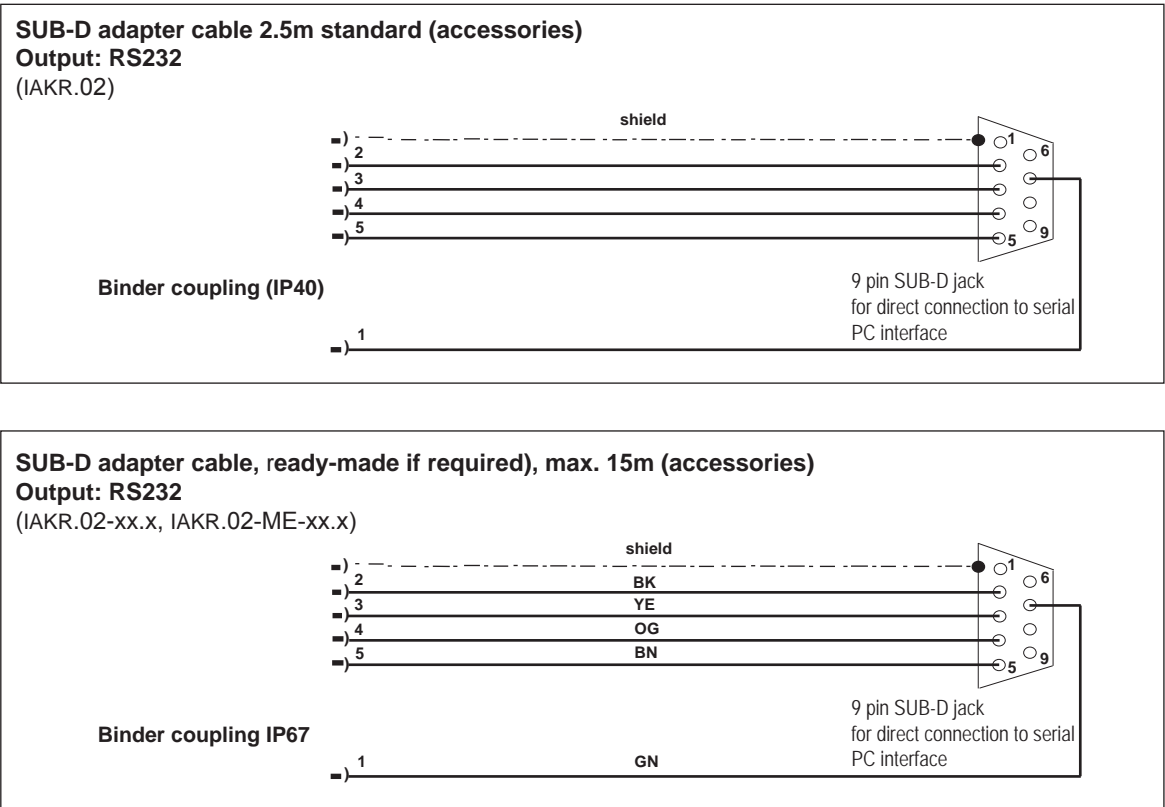
To use this, it is necessary to install the accessory *Sub-D data line* (refer to accessories and connection diagrams). For USB connections, a *USB adapter* can be supplied (see accessories).

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/>).

Connection diagrams RS232



Pin assignment of cables for sensors of the series IAKR



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