Users guide for KPH 300, Humidity, dewpoint and temperature.

The sensor is designed for measuring relative humidity, temperature and dewpoint in harsh environments.

It is a compact robust sensor which is very vibration resistant and suited for very harsh electrical environment.

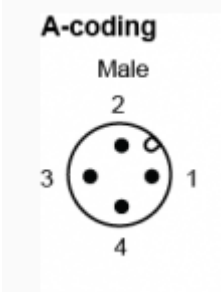
Due to the compact design the sensor is compensated to work with at burden of 50Ω and a supply voltage of 20-28 VDC. The sensor works best without fast temperature fluctuations. The sensor needs to obtain same temperature as ambient to measure correct.

Technical Data:

Output appropriate: 0-100%RH Or -40-80°C. temperature Or -20-80°C. dewpoint	 4-20mA 4-20mA 4-20mA
Supply voltage	13,5-30Vdc
Burden@13,5V supply	<=250Ω
Temperature range: Operational Storage	 -40-80°C. -50-80°C.

Installation.

The sensor is a 4-20mA sensor. The loop voltage is 24V and the burden resistor is 50Ω.



Burden resistor can be calculated using this formula:

$$R_{burden} = \frac{V_{supply} - 8{,}5V}{20mA}$$

M12 connector coding: “A”.

M12 connector pin-out:
- o Pin 1: Operating voltage
- o Pin 2: Pin 4 output selector, see table below. Internally tied Low.
- o Pin 3: Pin 4 output selector, see table below. Internally tied Low.
- o Pin 4: Signal output 4…20 mA. Output value, see table below

PIN 2	PIN 3	Output value on PIN 4
Low	Low	0 – 100% Rh
High	Low	Temperature -40 - +80°C
Low	High	Dew point -20 - +80°C.
High	High	3,5mA out.

Buy adding the supply voltage to either PIN2 or PIN3 the output from the sensor can be changed according to table.
PIN1 still needs supply voltage.

Installation examples:

In this example a standard female M12 sensor cable is used.

Wires in cable:

Pin1	Brown.
Pin2	White.
Pin3	Blue.
Pin4	Black.

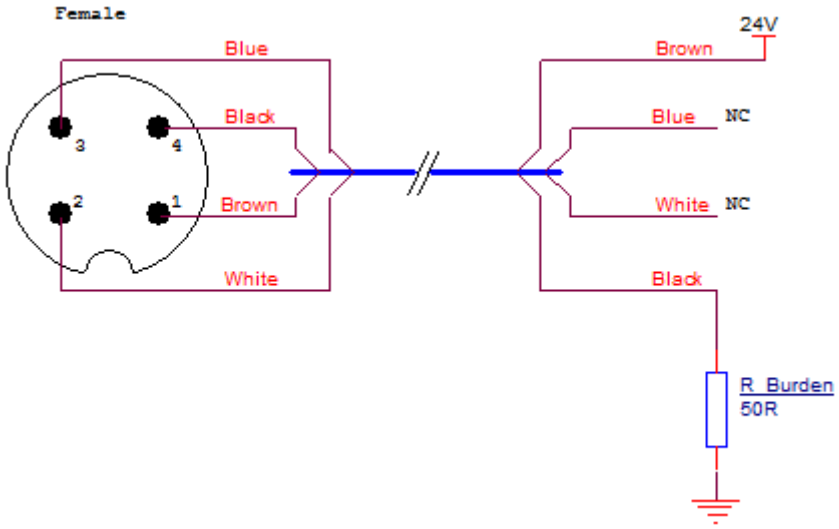


Figure 1 Humidity measurement.

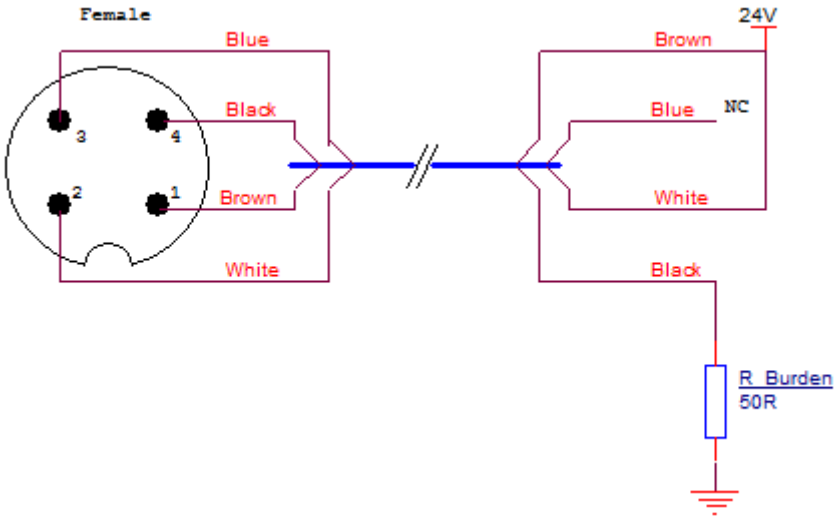


Figure 2 Temperature measurement

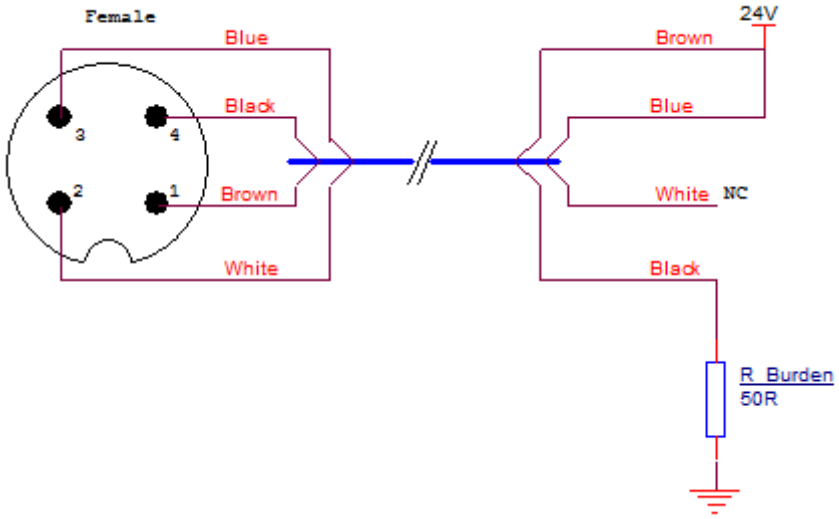


Figure 3 Dewpoint measurement.

Placement.

For best performance the sensor is mounted on good thermal conductor. The sensor should not be placed in a spot where it can be hit by the sun through a window. Avoid placing the sensor in a fast airflow.
The sensor must be placed with M12 connector facing downwards.

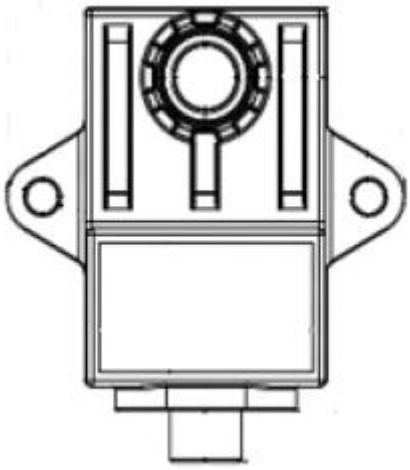


Figure 4 Proper placement.

If the sensor is placed outside it should be protected against rain and wind gusts. It is best if it can be placed in a protective cover.

Relative Humidity, RH.

Relative Humidity, RH, is the ratio of the partial pressure of water vapour to the equilibrium vapour pressure at a given temperature. RH is very temperature depended. Air at lower temperature can contains less water. This means that at lower temperatures, it requires less water vapour to attain higher RH. Rising the temperature in a room will lower the RH level. But the air will still contain the same amount of water vapour in g/m^3. And vice versa if you lower the temperature in a room, the RH level will rise.

A day with 25°C. and 80% RH the air will contain 18,5 g/m^3. Lowering the temperature below 21,4°C. will cause the RH to rise to 100%.

Temperature.

The temperature is measured in degrees Celsius.

Dewpoint.

The dewpoint is the temperature the air needs to be cooled down to, to achieve 100% relative humidity. At this temperature the air cannot hold more water vapor. If the air is cooled further the water vapor in the air starts condensing.

The sensor is specified and compensated to use 20-28V DC as supply and a burden resistor of 50Ω. The power dissipated internal in the sensor is depended on supply voltage and burden resistor.

If you want to measure with other voltage level as supply or other burden resistor dewpoint measurement can be used.

Setup the sensor to Dewpoint measurement by adding the supply voltage to PIN3 in the M12 connector. The output from the sensor will now be dewpoint.

If you want to calculate the relative humidity the ambient temperature is needed. Be aware you cannot use the temperature from the sensor.

Below is a small c-example showing how to calculate relative humidity from dewpoint and temperature.

```
/*****************************************************************************
 * Function:       double CalcRH_From_Dewpoint(double Dewpoint, double Temp )
 *
 * PreCondition:    include <math.h>
 *
 * Parameters:         Dewpoint, Temperature
 *
 * Return:        RH = Relative Humidity
 *
  *****************************************************************************/
double CalcRH_From_Dewpoint(double Dewpoint, double Temp )
{
   double H;
   H = 17.62*Dewpoint/(243.12+Dewpoint);
   return pow(10, (((H-((17.62*Temp)/(243.12+Temp)))*0.4343)+2));
}
```

The function can easily be adapted into other software systems or excel if needed.

The table below shows RH calculated from the dewpoint measurement.

Humidity measured with reference [%RH]	73,76
Temperature from reference [°C.]	25,31
Dewpoint from sensor [°C.]	20,25
H	1,35
RH calculated from Dewpoint [%RH]	73,59

The reference is a chilled mirror hygrometer.

The calculation for the data in the table is carried out in an Excel spreadsheet. The function proposed could also have been used.