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MANUAL FOR

HYGROCONTROL TYPE 85

TRANSMITTERS

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1. General Informations

1.1 Intention of this Manual

This manual describes the proper use of type 85 instrument, the maintenance and limits.

We want to beware any user from errative measurements and give examples for the usage.

Please be aware that these high precision electronic instruments for humidity and temperature must have very sensitive sensors and electronics which need some care.

Try to reduce the external mechanical and thermal stresses to a minimum to prolong the lifetime of the instruments.

If any malfunction or technical problems occur, please contact the manufacturer, representative or dealer of the instrument.

For our Humidity- and Temperature-Instruments we grant warranty according to the "Allgemeinen Lieferbedingungen für Erzeugnisse und Leistungen der Elektro-Industrie."

1.2 Before Using

1.2.1 Unpacking and Checking

Every instrument has been examined before dispatch in respect to its electrical and mechanical functions. After receipt of instrument, please check its operation. In case of any malfunction or damage, return the instrument with a detailed description of faults.

1.2.2 Setup for Operation

The instrument is to be connected to main powers either by a connector or by using the terminals inside the housing. The correct voltage is marked on the type label you find on one side of the housing. Do not use voltages other than the marked one! Severe damage would be the result of applying the wrong voltage.

If your instrument is equipped with screw terminals, the cross section of your conductors should meet the dimensions of 0.5 up to 1.5 mm^2 (AWG 16 to AWG 20). You will find these terminals on the ground PC-board after opening the housing by turning the four screws (quick-release types) with a screwdriver to the left. Please take care that cable diameter corresponds with cable gland dimension and so will guarantee a dense screwing.

If connectors are used for power supply and outputs, we always ship the neccessary connectors together with the instrument.

1.3 Instructions for Dispatch

If there are any problems you are not able to correct, we ask you to contact our technical department or to return the instrument with a short description of the fault. When returning please pack the instrument safely in a cardboard box and fill up holes with soft packing material to avoid damage.

2. Technical Data

2.1 Humidity Detection

Ranges are possible from 0-100 %RH as well as absolute Humidities, Dewpoints and Enthalpie, programed is a range of	.....
Resolution	0,1 % RH
Sensing Element (capacity type)	SE – 02
Influence of Temperature on the Humidity	± 0,01 % RH / °C
Repeatability	< 0,5 % RH
Hysteresis for 4 hours Cycle 10 % - 95 % - 10 % RH	< 0,5 % RH
Unlinearity of Electronics / Humidity	< 1 % RH

2.2 Temperature Detection

Ranges are possible from –50°C to +150°C, programed range is	.....°C
Resolution	0,1 °C
Temperature sensing Element	Pt - 1000
System Accuracy of Temperature	± 0,35 °C
Unlinearity of Electronics / Temperatur	< 0,15 °C

2.3 Power Supply

Standard Power Supply	90-240 VAC, 47-63 Hz
or Low Voltage Supply	10-30 VDC/9-25 VAC

2.4 Maximum Operational Temperatures

Transmitter Electronics	-20....+40 °C
Probe Tube with Sensors	-40....+120 °C

2.5 Power Consumption

Max. Power Consumption	approx. 5 VA

2.6 Electrical Connections

2.6.1 Screw Terminals

3 Terminals for AC-	X1/1 = L, X1/2 = PE, X1/3 = N
or DC-Power Supply	X1/1 = -, X1/2 = PE, X1/3 = +
3 Terminals for Output Humidity	X2/1 = + Humidity (mA), X2/2 = GND, X2/3 = + Humidity (V)
3 Terminals for Output Temperature	X2/4 = + Temp. (mA), X2/5 = GND, X2/6 = + Temp. (V)

2.6.2 Connector Options

7pol. round Plug according to DIN 43651 for Power (max. 42 V) and Outputs

or:

1 rectangular Connector 4 pol. for Power (95 - 230 VAC)
+ 1 rectangular Connector 6 pol. for Outputs analog
or 1 rectangular Connector 6 pol. for Outputs digital

or:

1 rectangular Connector 4 pol. for Power(10-30 VDC or 9-25 VAC)
+ 1 rectangular Connector 6 pol. for Outputs analog
or 1 rectangular Connector 6 pol. for Outputs digital

2.7 Options

LC-Display for Humidity and Temperature

3. Operation

Series 86-EX Humidity and Temperature Meters detect relative Humidity and Temperature. For this purpose the interchangeable probes are equipped with a capacity type humidity sensor of very small mass. The temperature detection is done by a RTD of type Pt-1000, which is placed very close to the humidity sensor to avoid differences in temperature between the two sensors. To assure rapid response to temperature changes, a thinfilm Pt-1000 on a substrate of ceramic was chosen.

The instruments have 3 operational modes which are:

„MEASURING", „CALIBRATION" and „CONFIGURATION“.

„MEASURING" means that values of temperature and humidity are detected, compensated, linearized, transfered into current or voltage outputs and - if display option is installed - shown on the display.

„CALIBRATION" allows the user to recalibrate the sensor characteristic at different fixpoints realized by unsaturated Lithium-Chlorid-Solutions (or any other humidity standards of known values) and stored in a memory of the probe. As the sensor characteristic normally is not a totally linear one, the accuracy of the probe can be improved, when you calibrate more fixpoints over the range of 0 to 100 %RH.

„CONFIGURATION“ is an instrument to change the ranges, output limits and dimensions of humidity and temperature.

The elements to operate the instrument and step into the modes „MEASUREMENT”, „CALIBRATION" and „CONFIGURATION“ are on the PC-board inside the transmitter housing. They are identified by „X4", „S1" and „H2/3/4". In the following chapters they are also named by an additional name:

- Code Switch "S1"
- Jumper "X4"
- LED’s "H2/3/4"

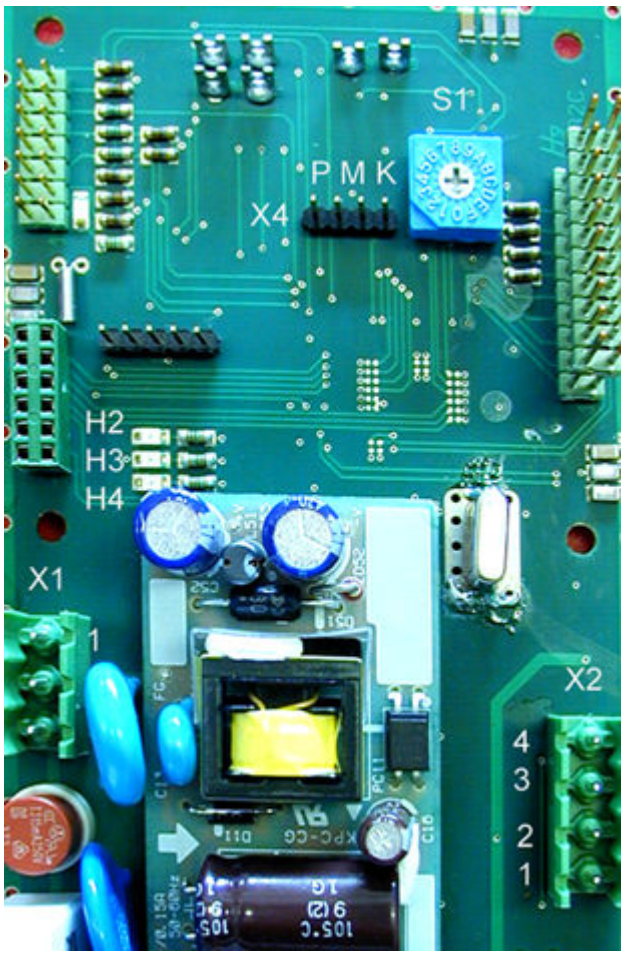
When arriving at your location, the instrument is setup by factory to „MEASUREMENT" mode. Therefore the jumper „X4" will be in position „M" and the Code Switch „S1" in position „0".

Transmitters are factory calibrated at 7 (Class „B”) or 8 points (Class „A”) - so They are set to highest possible accuracy after shipment. Instruments with display have their operating elements under the display (hidden by the cover of the housing). Operating is then done by means of 4 pushbuttons with help of a the microprocessor and a dialog oriented software.

3.1 Operational Mode „MEASURING"

As mentioned „MEASURING" mode is realized by :

- Code Switch „S1" in position „0"
- Jumper „X4" in position „M"
- Power is supplied to the transmitter



Now the instrument will detect values of temperature and relative humidity and send them to the outputs. To inform the user of instruments without display about this actual operation mode the LED's „H2" and „H4" are lightened alternating.

3.1.1 Analogue Outputs

The standard version of the 8 instruments has analogue outputs. Both types - current and voltage outputs - are provided.

Maximum load for the current outputs is 300 Ohms. Voltage outputs have a inner resistance of 100 Ohms. Voltage and current outputs are short- circuit protected. If a break or shortage of the sensors for humidity or temperature is detected, the corresponding output will go 1-2 mA (or

1-2 V) over the upper limit or under the lower limit of the output, to signalize the sensor defect to the user.

The current outputs may be set to be 0-20 mA or 4-20 mA. Normally your desired version is programed by the factory - if you want to change it please see chapter „CONFIGURATION" where you find how to do this.

3.1.2 Tables of analogue outputs

Following tables show some examples of relations between outputs and ranges for temperature and relative humidity.

3.1.2.1 Examples for outputs of relativ humidities (0 - 100 %)

% r. F.	0 ... 20 mA	4 ... 20 mA	0 ... +1 V	0 ... +2 V	0 ...+5 V	0 ... +10 V
0	0,00	4,00	0,00	0,00	0,00	0,00
5	1,00	4,80	0,05	0,10	0,25	0,50
10	2,00	5,60	0,10	0,20	0,50	1,00
15	3,00	6,40	0,15	0,30	0,75	1,50
20	4,00	7,20	0,20	0,40	1,00	2,00
25	5,00	8,00	0,25	0,50	1,25	2,50
30	6,00	8,80	0,30	0,60	1,50	3,00
35	7,00	9,60	0,35	0,70	1,75	3,50
40	8,00	10,40	0,40	0,80	2,00	4,00
45	9,00	11,20	0,45	0,90	2,25	4,50
50	10,00	12,00	0,50	1,00	2,50	5,00
55	11,00	12,80	0,55	1,10	2,75	5,50
60	12,00	13,60	0,60	1,20	3,00	6,00
65	13,00	14,40	0,65	1,30	3,25	6,50
70	14,00	15,20	0,70	1,40	3,50	7,00
75	15,00	16,00	0,75	1,50	3,75	7,50
80	16,00	16,80	0,80	1,60	4,00	8,00
85	17,00	17,60	0,85	1,70	4,25	8,50
90	18,00	18,40	0,90	1,80	4,50	9,00
95	19,00	19,20	0,95	1,90	4,75	9,50
100	20,00	20,00	1,00	2,00	5,00	10,00

3.1.2.2 Examples for outputs of different Temperature Ranges (Analogue Output of 0 - 20 mA)

°C	-50..+150	-30...+70	-25...+75	-20...+80	-20...+50	-10...+40	0...+50	0...+100	0...+150	50...+150
-50	0,00									
-40	1,00									
-30	2,00	0,00								
-20	3,00	2,00	1,00	0,00	0,00					
-10	4,00	4,00	3,00	2,00	2,85	0,00				
0	5,00	6,00	5,00	4,00	5,71	4,00	0,00	0,00	0,00	
10	6,00	8,00	7,00	6,00	8,57	8,00	4,00	2,00	1,33	
18	6,80	9,60	8,60	7,60	10,85	11,20	7,20	3,60	2,39	
19	6,90	9,80	8,80	7,80	11,14	11,60	7,60	3,80	2,53	
20	7,00	10,00	9,00	8,00	11,42	12,00	8,00	4,00	2,66	
21	7,10	10,20	9,20	8,20	11,71	12,40	8,40	4,20	2,79	
22	7,20	10,40	9,40	8,40	12,00	12,80	8,80	4,40	2,93	
30	8,00	12,00	11,00	10,00	14,28	16,00	12,00	6,00	3,99	
40	9,00	14,00	13,00	12,00	17,14	20,00	16,00	8,00	5,33	
50	10,00	16,00	15,00	14,00	20,00		20,00	10,00	6,66	0,00
60	11,00	18,00	17,00	16,00				12,00	7,99	2,00
70	12,00	20,00	19,00	18,00				14,00	9,33	4,00
80	13,00			20,00				16,00	10,66	6,00
90	14,00							18,00	12,00	8,00
100	15,00							20,00	13,33	10,00
110	16,00								14,66	12,00
120	17,00								16,00	14,00
130	18,00								17,33	16,00
140	19,00								18,66	18,00
150	20,00								20,00	20,00

All given values are in mA.

3.1.2.3 Examples for different Outputs of Temperature Ranges (Analogue Output 4 - 20 mA)

° C	-50..+150	-30..+70	-25..+75	-20..+80	-20..+50	-10..+40	0...+50	0...+100	0...+150	50..+150
-50	4,00									
-40	4,80									
-30	5,60	4,00								
-20	6,40	5,60	4,80	4,00	4,00					
-10	7,20	7,20	6,40	5,60	6,28	4,00				
0	8,00	8,80	8,00	7,20	8,57	7,20	4,00	4,00	4,00	
10	8,80	10,40	9,60	8,80	10,85	10,40	7,20	5,60	5,06	
18	9,44	11,68	10,88	10,08	12,68	12,96	9,76	6,88	5,92	
19	9,52	11,84	11,04	10,24	12,91	13,28	10,08	7,04	6,02	
20	9,60	12,00	11,20	10,40	13,14	13,60	10,40	7,20	6,13	
21	9,68	12,16	11,36	10,56	13,37	13,92	10,72	7,36	6,24	
22	9,76	12,32	11,52	10,72	13,60	14,24	11,04	7,52	6,34	
30	10,40	13,60	12,80	12,00	15,42	16,80	13,60	8,80	7,20	
40	11,20	15,20	14,40	13,60	17,71	20,00	16,80	10,40	8,26	
50	12,00	16,80	16,00	15,20	20,00		20,00	12,00	9,33	4,00
60	12,80	18,40	17,60	16,80				13,60	10,40	5,60
70	13,60	20,00	19,20	18,40				15,20	11,46	7,20
80	14,40			20,00				16,80	12,53	8,80
90	15,20							18,40	13,60	10,40
100	16,00							20,00	14,66	12,00
110	16,80								15,73	13,60
120	17,60								16,80	15,20
130	18,40								17,86	16,80
140	19,20								18,93	18,40
150	20,00								20,00	20,00

All given values are in mA.

3.1.3 Display

As an option a digital display is available. The display is arranged under the cover of the transmitters housing. It will be connected by one of the two 20-pol. female sockets in the PC-Board in the direction the user wants and is to be seen through the window in the cover.

Humidity values are shown in the upper line of the display, values of temperature in the lower line. Both are displayed with a resolution of 0,1 and together with their actual dimension.

3.1.4 Digital Output

Digital outputs may be included as another Option. The Hardware therefore may be a RS 232 (V24) bus or a RS 485 bus. Digital outputs are sending values of humidity and temperature together with the serialnumber of the probe.

It is possible to have digital and analogue outputs in the same instrument - but then either the analogue or the digital output must be realized with fixed cable connection. There is no space on the PC-Board for having as much screw terminals as would be neccessary for both types of outputs.

3.2 Operational Mode "CALIBRATION"

There is a lack of international standards for rel. Humidity calibrations, therefore, different countries may have different methods of calibrations. Since the users of humidity meters need a simple method to check the accuracy of their instruments, we are supplying accessories for calibration or testing. As a standard method we have chosen unsaturated salt solutions to create rel. humidities of known amount - but saturated salt solutions may also be used.

The accuracy of our calibration solutions is proved by comparison with international standards (UKAS certified). Under laboratory conditions and carefully avoiding of any possible causes for errors you may reach an accuracy of ± 0,5 % RH.

Series 81,82 instruments are to be calibrated with rel. humidity - since their sensors respond to relative, not to absolute, humidity values.

To allow the changing of probes without any further calibration, the values are stored in a memory inside the transmitter.

The solutions we supply for calibration create rel. humidities from 0 to 95%. We are using the following:

0% - drying granulate
10% - mixed LiCl and ZnCl2 solution

20, 35, 50, 65, 80, 95% - unsaturated LiCl solutions

The marked rel. humidities relate to a temperature of 22°C and do have a temperature dependency. The accuracy of the solutions at 22°C is +/-0.5%, they are not toxic and are not dangerous to the environment.

To assure the easiest handling and highest accuracy, the solutions are enclosed in glass ampoules, which should be opened only before usage. Opening is simplified by the weakened middle part of the ampoules. Once opened the solutions may catch humidity from or give humidity to their environment - so the time of usage is restricted and they should be used for one calibration only.

3.2.1 General Notes about Calibration

Due to the temperature dependency of rel. humidity over salt solutions, you should assure a constant temperature of 22°C with deviations of not more than 1°C. Before a check or calibration of a probe is initiated, take care for thermal equilibrium between probe, calibration chamber and calibration solution. This can be done by placing the probe in an area free from draughts, direct sunlight, radiators and any other factor that might cause temperature fluctuations. Place the instrument on an insulating base such as polystyrene and assure that the instrument, calibration chamber and solutions are conditioned to the same temperature before starting the calibration.

The cover of the probes housing should be closed during a calibration, the cover of the transmitter may be open to operate the code switch or jumper.

Do not shut down the power supply during a calibration.

3.2.2 Mounting the Calibration Device

First remove the filter from the tip of the probe. The chamber may now be screwed to the thread of the probe. The bottom of the chamber is removeable and it is here that the textile pad and the solution are to be placed. To avoid improper humidity values, always clean the bottom of the chamber thoroughly, use new pads, and new solutions.

Ensure that the calibration chamber faces downwards, to avoid direct contact of the solution with the sensor. Before inserting the bottom into the chamber, unscrew the chamber slightly, to help escaping air, when you close the chamber. Tighten the chamber again after closing!

3.2.3 When makes a Calibration Sens?

If you decide to do a recalibration, you first should detect the deviation which arised from the last recalibration. Our probes are calibrated at 7 points at least, to get a very close fit to the real sensor characteristic. If you see a deviation of more than 5%RH when trying to recalibrate a point, you should stop the calibration and delete the calibration memory totally.Otherwise you migth generate a characteristic with different encreases from point to point. After a successfull delete of the memory, you should now calibrate 0 and 80%RH values, which result in a linear characteristic which has mostly less than 2%RH deviation from the sensors real characteristic.

3.2.4 Calibrating more Fixpoints

To come to even more accurate values more points should be calibrated. With 7 or 8 points a deviation of ± 0,5 % r. F. may be reached over the total range. At Instruments without display Calibration is managed by Code switch „S1" and Jumper „X4". LED „H3" gives informations about the state of the calibration procedure.

3.2.5 Calibration Procedure

Proceed as follows:

- Mount the calibration chamber as described before
- Remove the bottom of the chamber to fill it with the desired solution
- Break the neck of the ... %RH ampoule and fill its content into the bottom
- Close the calibration chamber thoroughly in vertical position to avoid contact of the liquid with the sensor
- Place code switch "S1" to a position according to the choosen value given in table 1 and code bridge "X4" to position "P"

Table 1

Position of Code Switch „S1"	0	1	2	3	4	5	6	7
Calibration Solution (% RH)	0	10	20	35	50	65	80	95
Colour Code of Calibration Solution	Granulate	white	blue	red	yellow	green	magenta	brown

- The LED „H3" starts blinking now slowly as long as unstable humidities are detected - the display (if present) shows the actual value of humidity and the humidity to be calibrated

- After stability of humidity is detected, the LED „H3" and the display (if present) show a steady signal - the ... %RH calbration is finished and may be stored.

- If you now remove the code bridge „X4" out of position „P", the new value will be stored and this is shown by the lightning of LED's „H2", „H3" and „H4".

- If you don't want to store the new value, you must turn the code switch „S1" to another position before removing the code bridge „X4"

- Place code switch „S1" into position "0" - LED will turn dark and the humidity output will show the calibrated ... %RH value with a deviation of max. 0,5%RH.

- Place code bridge „X4" into position „M" now, to return to normal measuring mode.

If more calibrations are to follow, proceed as described before, using the solution you want to calibrate with.

Never forget to clean the bottom of the chamber and dry it thoroughly before starting the next calibrating procedure!

If no further calibrations are wanted, replace the calibration chamber now by the filter of the probe.

3.2.6 Escape the running Calibration

If you want to interrupt the calibration procedure after the LED „H3" is already in a steady state, turn the code switch „S1" in any other position and put the code bridge „X4" to „M" position. Now you may turn the code switch „S1" back to „0".

If you want to interrupt the calibration procedure during the LED „H3" is still blinking put the code bridge „X4" to „M" position. Now you may turn the code switch „S1" back to „0".

3.2.7 Delete all stored Calibration Values

A special software named "DELETE" is installed which allows you to cancel an old calibration totally, before recalibrating a probe. This procedure must be done, when tests show a deviation of standards of more than 5% rel. Humidity. In this case, check the sensor by visual inspection. If no mechanical defects occured, and no layer of dust or other contamination is found, a new calibration is required.

To erase all calibration points with function "DELETE", turn the code switch „S1" to position „F" and put the code bridge „X4" to „P" position. Now the LED „H3" is blinking fast. To verify the delet function you now must change the code bridge quickly to „P", then „K" and then again to „P" position. Only after that the calibration data in the memory will be deleted.

3.3 Operational Mode „CONFIGURATION"

To allow the test of all functions of the instrument and to change the configuration of dimensions, outputs and ranges, a software called „CONFIGURATION" is provided. To activate this software the code switch „S1" must be turned to a position according to table 2, and the code bridge "X4" is then to be put into position „K". Depending on the „S1" position different actions will be possible - LED „H3" indicates the activation.

Table 2

Code Switch „S1" Position	Activated Function	Signal Output	Jumper K M P
0	Measuring Mode	Measuring Values	"M"
1	Adjustment of Humidity Output at **lower** Limit	Humidity-**min.** Output Temperature stays as before	„K" 1)
2	Adjustment of Humidity Output at **upper** Limit	Humidity-**max.** Output Temperature stays as before	„K" 1)
3	Adjustment of Temperature Output at **lower** Limit	Temperature-**min.** Output Humidity stays as before	„K" 1)
4	Adjustment of Temperature Output at **upper** Limit	Temperature-**max.** Output Humidity stays as before	„K" 1)
5	Adjustment of Humidity Range at **lower** Limit	Humidity-**min**. Value Temperature stays as before	„K" 2)
6	Adjustment of Humidity Range at **upper** Limit	Humidity-**max**. Value Temperature stays as before	„K" 2)
7	Adjustment of Temperature Range at **lower** Limit	Temperature-**min**. Value Humidity stays as before	„K" 2)
8	Adjustment of Temperature Range at **upper** Limit	Temperature-**max**. Value Humidity stays as before	„K" 2)
9	Adjustment of Dimension **Humidity**	See Table 3	„K"
A	Adjustment of Dimension **Temperature**	See Table 3	„K"
B	Calibration of Temperature „**low**"	Adjust to Value according to your Reference Temperature	„K"
C	Calibration of Temperature „**high**" (not yet realized)	Adjust to Value according to your Reference Temperature	„K"
D-E	no action		
F	Delete all Calibration Values	LED „H3" is blinking Quickly	„P"„K" „P"

Note 1) The corresponding output is encreased as long as the code switch „S1" is turned slowly to right (LED „H2" is lightened), and is lowered as long as the code switch „S1" is turned slowly to left (LED „H4" is lightened). Values are stored if code bridge „X4" is pulled out of Position "K". During storage all 3 LED's are lightened.

Note 2) If you adjust the lower limits of the ranges of Humidity or Temperature, 0% of the corresponding output is equivalent a value

of -100, 50% of the corresponding output is the equivalent for a value of 0, and 100% of the corresponding output is the equivalent for a value of 100. (Example: the corresponding output may be set to 4 to 20 mA - and the ranges should be set to 0 to 100%rF und –50 to +150°C, then the lower limit 0%RH is set by an output of 12 mA and the lower limit –50°C is set by an output of 8 mA).

If you adjust the upper limits of the ranges for Humidity or Temperature, 0% of the corresponding output is equivalent a value of 0, 50% of the corresponding output is the equivalent for a value of 100, and 100% of the corresponding output is the equivalent for a value of 200. (Example: the corresponding output may be set to 4 to 20 mA - and the ranges should be set to -50°CTd to +50°CTd and –20 to +80°C, then the upper limit 50°CTd is set by an output of 8 mA and the upper limit +80°C is set by an output of 10,4 mA (= 0,08x80 + 4,0)).

Table 3: Adjustment of Dimensiones

Code Switch „S1”	0	1	2	3	4	5	6	7	8	F
Dimension Humidity	**% rF**	**% RH**	**°C Td**	**°F Td**	**g/kg**	**g/m³**	**Grains /m³**	**Grains /feet³**	**Enthalpie**	**%rF open**
Dimension Temperature	**°C**	**°F**	**K**	-	-	-	-	-	-	-

Note 3) If code switch „S1” is turned to a position according to table 3 the new dimension will be activated if the code bridge "X4" is torn out of position „K” - but be aware, that the lower and upper limit of the range which you changed its dimension are still the same as they were before! You have to adjust them separately!

Example: was the dimension of humidity %RH with a range of 0 to 100%, so now, after a change of dimension to g/kg, the range will be 0 to 100 g/kg if you don’t change this!

You may quit the „CONFIGURATION” software by putting the code bridge „X4” back to „M” and turning the code switch „S1” back to position „0”.

4. Practical Instructions and Limits

Besides the temperature limits specified for all our transmitters, probe heads and sensors, you should observe the following rules when using our instruments:

4.1 Contact with Liquids

Avoid in any case direct contact between the humidity sensor and any liquid. The sensor may only detect the humidity in the atmosphere over the surface of a liquid or a solid material.

Even if the sensor will not be changed in his characteristic by direct contact with water and will measure correct values after being dryed, you should avoid immersion or condensation. Some gases in the atmosphere could form acids and corrosional attack will cause damages of the sensor with time.

4.2 Filters

4.2.1 Protection against high Air Velocities

As our humidity sensor has a very tiny mass together with a great surface area, it is necessary to protect him against high gas velocities. Different filters are available which give protection according to the list below:

- Protection Basket (SS-316):	Up to 1 m/sec
- Sinterfilter (SS-316):	Up to 30 m/sec
- Teflonfilter (sintered PTFE)	Up to 50 m/sec
- Axialfilter (SS-316 with PTFE Membrane):	Up to 30 m/sec (axial flow)
	Up to 50 m/sec (tangential flow

4.2.2 Protection against Dust and Aerosoles

Normally the Sinterfilter (SS-316) - which has pores of approx. 18/1000 mm - will be used for protection against dust and particles. If quick response time of the sensor is needed, an Axialfilter is preferable, but then no particles of high speed should be able to hit the PTFE Membrane. As this membrane is only 65/1000 mm thick - with pores of 1/1000 mm only - it could be destroyed.

If humidity measurements are done in atmospheres containing Aerosoles like solvents, oils or greases, a Teflonfilter (pores are approx. 1/1000 mm) should be used for protection of the sensor. The smooth surface of the PTFE will not be contaminated so fast as other filters. High concentration of Aerosoles will predict a cleaning of the Teflonfilter from time to time. This may be done easily with an Ultrasonic Bath.

4.3 Withstanding Chemical Attack

Our sensors are wellknown for their resistance against most chemical attacks. To give the user some informations over the additional errors which are arising from some chemicals, we listed our experiences over the last 10 years. (See the table at the end of this manual).

Be aware, that the given concentrations are valid for a single chemical in normal atmosphere (room temperature) only. As temperature has to be taken into consideration too, you cannot expect to get proper predictions out of the table - please contact our technical staff for more informations.

4.4 Protection of Transmitter Electronics

To give highest protection against the surrounding atmosphere, our transmitter housings are according to IP 65. Avoid atmospheres of more then 80 %RH, as condensation could occur with rapid temperature changes.

4.5 Influence of Temperature on Humidity

To detect rel. Humidity, the sensor has to be in equilibrium with the atmosphere - this cannot be done spontaneously! It is up to you, to choose a position of the sensor, where the equilibrium may be reached as quick as possible. Take into consideration that also Temperature has a great influence on rel. Humidity! At Room Temperature and 50 %RH, a temperature change of 1°C will cause a change of rel. Humidity by 3%. This is the reason, why all instruments use a combination of Humidity and Temperature Sensors for detection of rel. Humidities. Only if Temperature has stabilized, proper values of rel. Humidity may be expected.

Different tube materials of sensors have an influence on temperature stabilisation by their different thermal mass and conductivity. SS-316 tubes predict higher times to achieve equilibrium of temperature as PTFE or PP tubes - be aware of this problem and choose a proper material.

Avoid errors by unproper installation of the sensor as for example:

- Influence by Heat: direct Sun, Heaters, unknown Air Streems etc.
- Influence by Water: Vapors, dropping or spraying Water etc.
- Influence by Pollution: Dust, Aerosoles, Chemicals etc.

4.6 Humidity Measurements over Ice

Don't forget that our sensors are calibrated for conditions of vapor pressure over liquid water. If you are measuring rel. Humidities over ice, you will get an error which is strictly dependent on the difference of saturation pressure of vapor over ice compared with the saturation pressure of vapor over chilled water. The following table shows the results of a measurement of saturated vapor over ice at different temperatures below zero.

Table 3: Display at 100% RH over Ice at different Temperatures

Temperatur (°C)	PSF (mbar)	PSE (mbar)	M (%RH)
0	6,11	6,11	100
- 5	4,22	4,02	95,3
- 10	2,87	2,60	90,6
- 15	1,91	1,66	86,9
- 20	1,26	1,03	81,7
- 25	0,81	0,64	79,0
- 30	0,49	0,37	75,5

PSF = Saturated Vapor Pressure over Chilled Water
PSE = Saturated Vapor Pressure over Ice
M = Rel. Humidity displayed by HYGROMESS Instruments.

4.7 Measurements under Pressure or Vaccuum

All probes can be used at pressures of 0,9 to 1,3 bar. Only special probes with a glas feed-through (which predicts SS - 316 tube material) may be used under pressures of 0,03 to 30 bar. As rel. Humidity is directly proportional to the pressure (f.E.: increase of pressure by factor 2 also increases rel. Humidity by factor 2, when temperature and content of water remain constant!) you shoud take care of a place with constant pressure values, when mounting the probe. Be aware that pressure may change, when diameters of tubes change - and air streams may be turbulent at these places.

Table 4: Gas Concentrations with Humidity Error < 2.5 %RH

Chemical	MAK-Concentration 1) according to SUVA		maximum Concentration at continuous load		at 50 % load		Expl.-limit
	ppm	g/m³	ppm	g/m³	ppm	g/m³	g/m³
Ethanol (Alkohol)	1000	1,90	3500	6,00	7000	12,00	57
Isopropanol	400	0,98	4800	12,00	10000	25,00	67
Toluol + Xylol	100	0,38	1300	5,00	3000	12,00	53
Gasoline (pure)	300	1,1-1,4		150,00		200,00	51
Gasoline super (Auto)				100,00		150,00	32
Ethylenglycol	100	0,26	1200	3,00	1200	3,00	80
Acetone	1000	2,40	3300	8,00	6500	16,00	56
Ethylacetat	400	1,40	4000	15,00	8000	30,00	79
Acetic Acid	10	0,03	800	2,00	1200	3,00	107
Ammoniumhydroxid	25	0,02	5500	4,00	11000	8,00	-
Chlorine Acid (HCl)	5	0,01	300	0,50	500	0,75	-
Sulfurhydrogen (H_2S)	10	0,01	350	0,50	700	1,00	-
Sulfurdioxid (SO_2)	5	0,01	5,00	0,01	5	0,01	-

1) MAK = max. Concentration at Labor (at 1 bar and 20 °C)

2) ppm = g/m³ x 24,04/MOL MOL = Molweight of Material