

# HYGROCONTROL TYPE 86-EX TRANSMITTER



## MANUAL

Version 06 / 05

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## 1. General Informations

### 1.1 Intention of this Manual

This manual describes the proper use of type 86-EX instruments, their 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 / Safe Operation under EX-Conditions

#### 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.

Series 86-EX instruments are normally combined by 3 parts, which are „Transmitter“, „Probe“ and „Connecting Cable“. The Transmitter has to supply an intrinsic safe power supply for the probe. The probe is sending sensor signals which are temperature compensated and are transfered into linearized analog or digital outputs by digital electronics in the transmitter. We use a microprocessor for the control of all internal functions. Using the probe under EX-conditions you only should use an intrinsically safe cable to connect the probe to the transmitter. These blue 4-wire cables are shielded and confirm with EN 90079-14. The intrinsically safe power supply and signal wires are not connected to earth-potential but the cable shield, the housing of the probe and the SS-316 tube of the probe are connected to earth.

#### 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<sup>2</sup> (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 necessary connectors together with the instrument.

### 1.2.3 On-Site Preparations to fulfill Ex-Regulations

**During operation the housing of the instrument should be closed and the connections between transmitter and probe may not be opened as long as the cable is in a hazardous area of dust explosion type. Make sure that before the power supply is activated, an intrinsically safe cable is used to connect the probe to the transmitter and that all plugs are thoroughly tightened to assure safe contacts.**

**User of the instrument have to take care, that not only the power supply, but also any instrumentation connected to the transmitter is protected by a fuse of max. 16A, which has a shut-down current of at least 1500A. If all other instrumentation connected to the transmitter is powered by the same line, this allows to use one single fuse for this protection.**

**Whatever supply is used for the instrument, the PE-contact of the transmitter must be connected to PE! This is also true, if low voltage or DC voltage is applied! The tube of the probe has to be connected to the local potential of the machinery.**

**Our probes are secure against pressure and vacuum by a glass feed-through which is specificated from 30 mbar to 30 bar. Use compression fittings of SS-316 material if applications may have pressures of more than 1,5 bar.**

### 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
Nonlinearity 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
Nonlinearity 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 Electronics	-40....+60 °C
Probe Tube with Sensors	-40....+120 °C

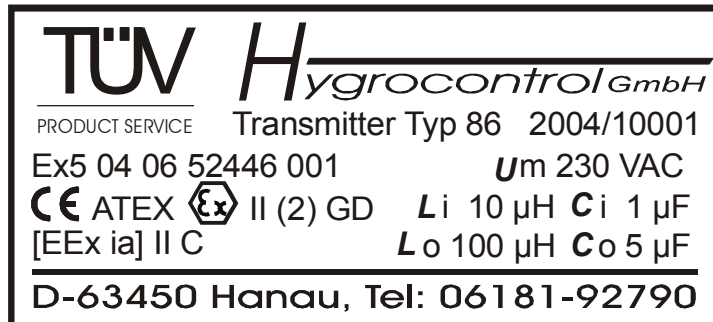
**2.5 Power Consumption**

Max. Power Consumption	approx. 5 VA
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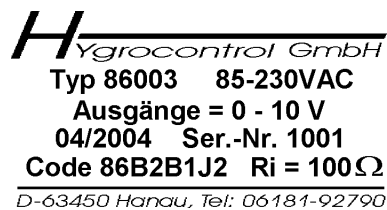
## 2.6 EX-Labels and Fabrication Labels

Transmitter and probe have a fabrication label and an EX-label as shown on this page:

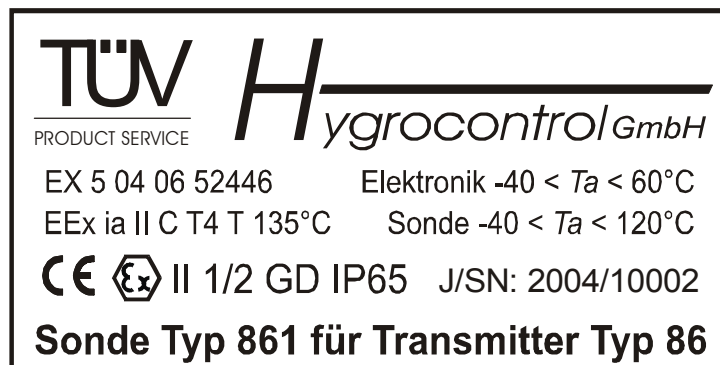
EX-Label of the Transmitters



Fabrication Label of the Transmitters:



EX-Label of the Probes:




Fabrication Label of the Probes:



Explanation of EX-Labels

**TÜV** *H* Hygrocontrol GmbH  
PRODUCT SERVICE

EX5 04 06 52446      Elektronik -40 < Ta < 60°C  
 EEx ia II C T4 T<135°C      Sonde -40 < Ta < 120°C


**CE**  II 1/2 GD IP65      J/SN: 2004/10002

**Sonde Typ 861 für Transmitter Typ 86**

EX-Class of Instrument Ex-Zone + Temp.-class Number of Certificate Proving Authority	Year of Production/Serialnumber Environmental Temperatures of Electronics and Probe Tube
---	--

**TÜV** *H* Hygrocontrol GmbH  
PRODUCT SERVICE      Transmitter Typ 86      2004/10001

EX5 04 06 52446 001       $\mu$ m 230 VAC

**CE** ATEX  II (2) GD      Li 10  $\mu$ H Ci 1  $\mu$ F  
 [EEx ia] II C      Lo 100  $\mu$ H Co 5  $\mu$ F

**D-63450 Hanau, Tel: 06181-92790**

Class of intrinsic Safety EX-Class of Instrument Number of Certificate Proving Authority	Max. Inner Capacity/Inductivity Max. Inner Capacity/Inductivity Max. Power Supply Year of Production/Serialnumber
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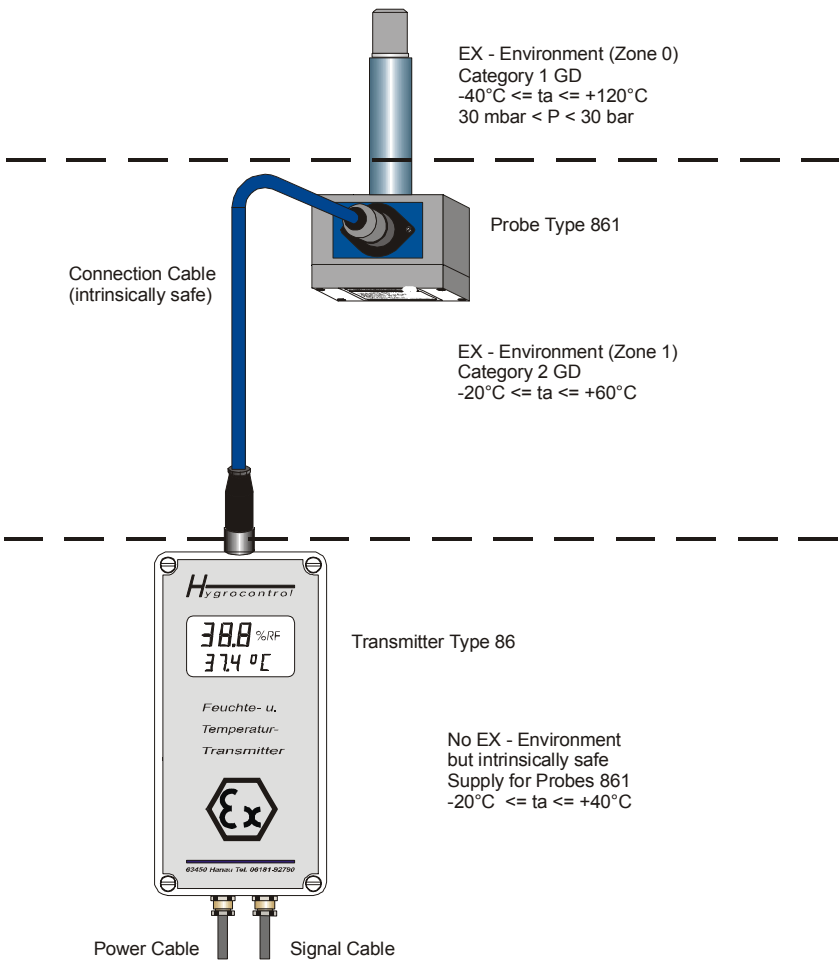




Transmitter: Transmitters built according to EN 50020 as intrinsically safe supply instruments. Intrinsically safeness is given by Zener Barriers which are encapsulated together with the connector for the cable to the probe and therefore may not be manipulated by a user. These Barriers separate the intrinsically safe power supply for the probes from the internal and external current and voltage loops which are not intrinsically safe.

Concept of Realisation

Conception for Humidity Detectors Type 86-EX



### 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, transferred 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"

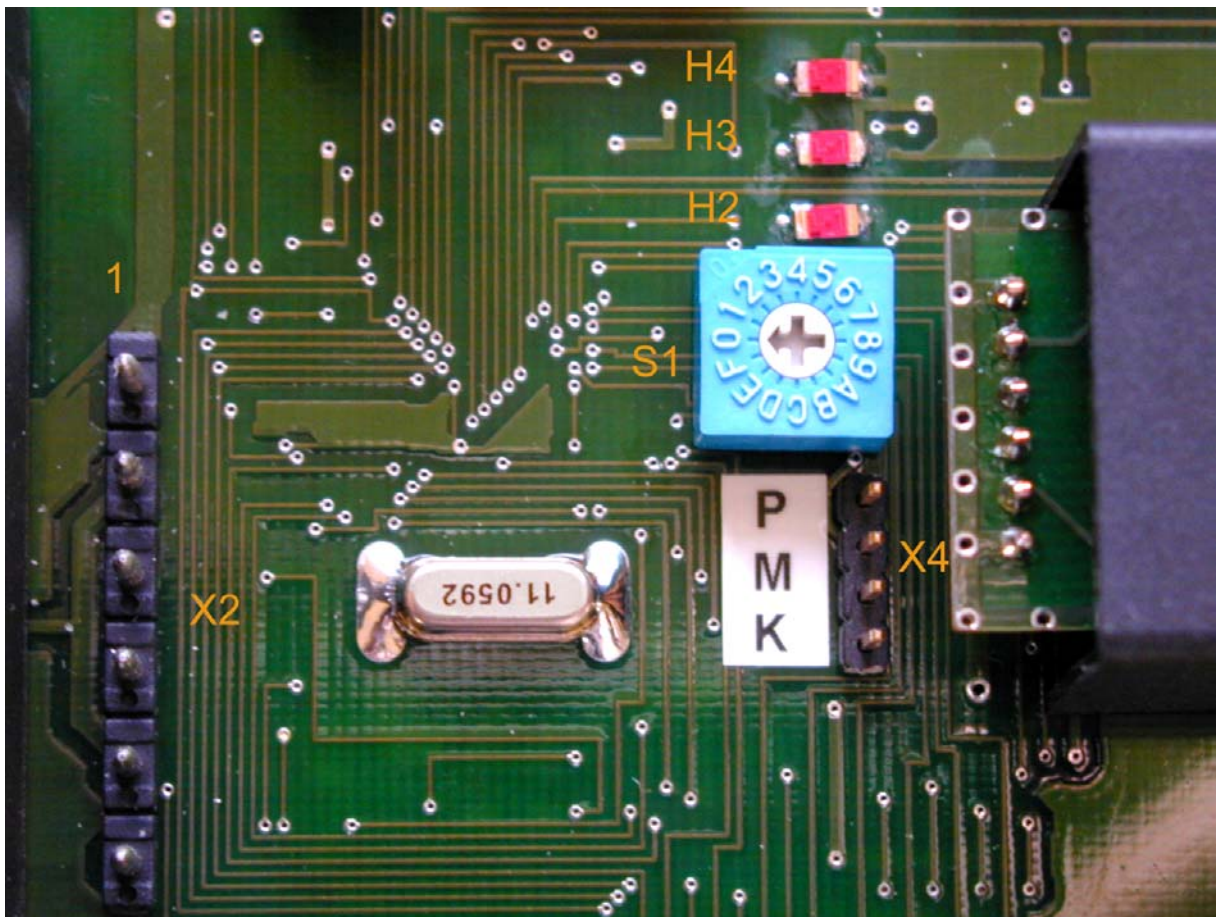
When arriving at your location, the instrument is setup by factory to „MEASUREMENT“ mode. Therefore the jumper „X4“ will be in position „M“ and the Code Switch „S1“ in position „0“.

Humidity probes are factory calibrated at 7 (Class „B“) or 8 points (Class „A“) - so it is 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 86-EX instruments has analogue outputs. Both types - current and voltage outputs - are provided.

Maximum load for the current outputs is 300 Ohms. Voltage outputs have an 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 programmed 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 necessary 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  $\pm 0,5$  % RH.

Series 86-EX 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 probe electronics. Therefore it is possible to calibrate a type 861 probe with any type 86-EX transmitter. The length of the connection cable has no influence on the calibration - only digital signals are transferred.



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 ZnCl<sub>2</sub> 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 - otherwise errors could occur. The cover of the transmitter may be open to operate the code switch or jumper and may stay open during the calibration.**

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 might 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  $\pm 0,5$  % 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 chosen 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 calibration 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.

### 3.2.5 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”.

### 3.2.6 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 occurred, 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 delete 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 <b>lower</b> Limit	Humidity- <b>min.</b> Output Temperature stays as before	„K” 1)
2	Adjustment of Humidity Output at <b>upper</b> Limit	Humidity- <b>max.</b> Output Temperature stays as before	„K” 1)
3	Adjustment of Temperature Output at <b>lower</b> Limit	Temperature- <b>min.</b> Output Humidity stays as before	„K” 1)
4	Adjustment of Temperature Output at <b>upper</b> Limit	Temperature- <b>max.</b> Output Humidity stays as before	„K” 1)
5	Adjustment of Humidity Range at <b>lower</b> Limit	Humidity- <b>min.</b> Value Temperature stays as before	„K” 2)
6	Adjustment of Humidity Range at <b>upper</b> Limit	Humidity- <b>max.</b> Value Temperature stays as before	„K” 2)
7	Adjustment of Temperature Range at <b>lower</b> Limit	Temperature- <b>min.</b> Value Humidity stays as before	„K” 2)
8	Adjustment of Temperature Range at <b>upper</b> Limit	Temperature- <b>max.</b> Value Humidity stays as before	„K” 2)
9	Adjustment of Dimension <b>Humidity</b>	See Table 3	„K”
A	Adjustment of Dimension <b>Temperature</b>	See Table 3	„K”
B	Calibration of Temperature „ <b>low</b> “	Adjust to Value according to your Reference Temperature	„K”
C	Calibration of Temperature „ <b>high</b> “ (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 increased 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  $-50^{\circ}\text{CTd}$  to  $+50^{\circ}\text{CTd}$  and  $-20$  to  $+80^{\circ}\text{C}$ , then the upper limit  $50^{\circ}\text{CTd}$  is set by an output of 8 mA and the upper limit  $+80^{\circ}\text{C}$  is set by an output of 10,4 mA ( $= 0,08 \times 80 + 4,0$ )).

**Table 3: Adjustment of Dimensiones**

Code Switch „S1”	0	1	2	3	4	5	6	7	8	F
Dimension Humidity	% rF	% RH	$^{\circ}\text{C}$ Td	$^{\circ}\text{F}$ Td	g/kg	$\text{g}/\text{m}^3$	Grains / $\text{m}^3$	Grains / $\text{feet}^3$	Enthalpie	%rF open
Dimension Temperature	$^{\circ}\text{C}$	$^{\circ}\text{F}$	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 dried, 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)<br>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 Streams 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 Vacuum

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 should 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				Expl.- limit g/m <sup>3</sup>
	ppm	g/m <sup>3</sup>	continuous load		50 % load		
			ppm	g/m <sup>3</sup>	ppm	g/m <sup>3</sup>	
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 <sub>2</sub> S)	10	0,01	350	0,50	700	1,00	-
Sulfurdioxid (SO <sub>2</sub> )	5	0,01	5,00	0,01	5	0,01	-

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

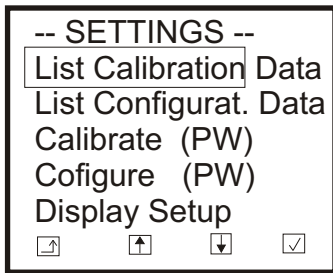
2) ppm = g/m<sup>3</sup> x 24,04/MOL

MOL = Molweight of Material

5. Operating the Instrument with Display-Option

From normal display of Humidity and Temperature you get into the menus for Configuration and Calibration by pressing one of the 4 buttons on the display-board.

The display now shows the different submenus you may choose:



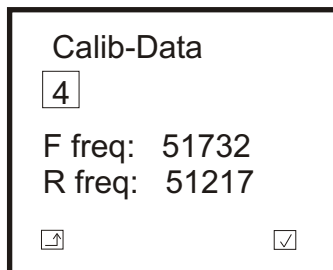
= letters are white on black background and this is the submenu chosen.

(PW) = for these submenus a Password is necessary.

With the buttons under the arrows you may choose the function you want and with -button the submenu is opened. You will find the different submenus as follows:

5.1 Calibration Data

This menu shows stored values of calibration data, but values cannot be changed!



= increasing as long as sensors frequency is detected

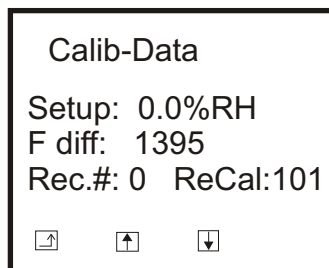
F freq: 51732 = actual Frequency of the Humidity sensor  
R freq: 51217 = actual Frequency of the Reference



= brings the next value into the display



= also brings the next value into the display



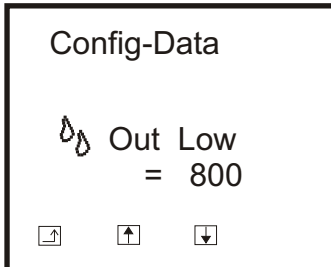
Any pressing of the "arrow"-buttons brings the next calibration point and the corresponding difference frequency into the display


Rec.# = Number of values in the memory,  
20 and 21 are first 2 values of factory calibration  
ReCal: 101 means: 1. Digit = deleted by customer  
2. and 3. Digit = 1x recalibrated by customer



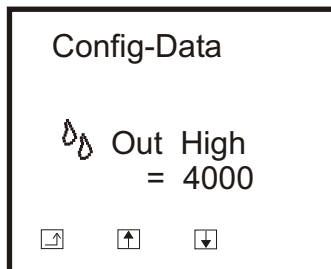
= Stops display of calibration data


5.2 Configuration Data:

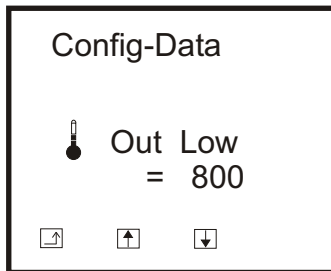



 = Symbol for Humidity  
= 800 Digits = 4 mA

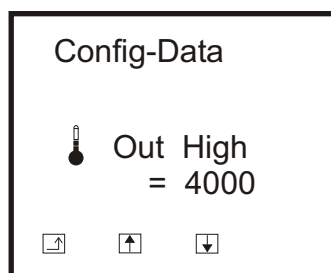
With the “arrow”-buttons you come to other Config-Data. These are:




 = Symbol for Humidity  
= 4000 Digits = 20 mA

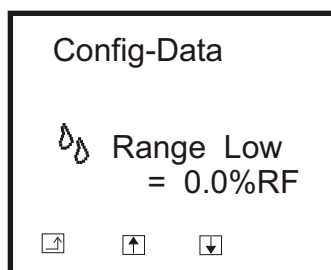



 = Symbol for Temperature  
= 800 Digits = 4 mA

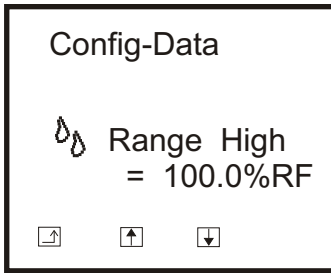



 = Symbol for Temperature  
= 4000 Digits = 20 mA

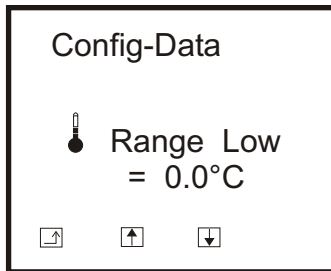
Now the scales for Humidity and Temperature are shown




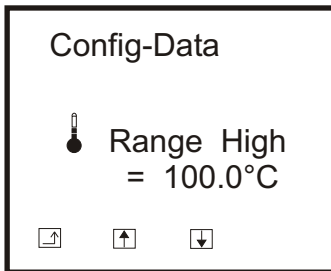
 = Symbol for Humidity  
= Scale is starting at 0%RF




 = Symbol for Humidity  
= Scale ends at 100%RF

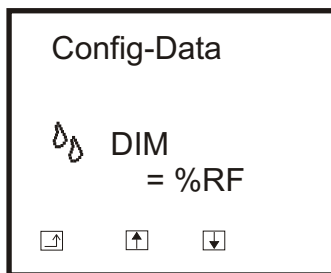


 = Symbol for Temperature  
= Scale starts at 0°C

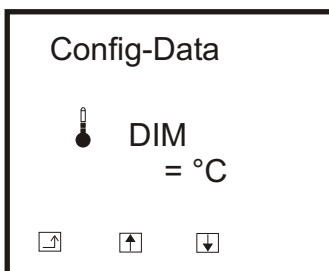



 = Symbol for Temperature  
= Scale ends at 100°C

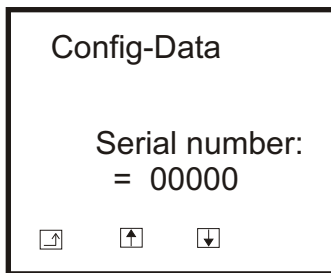
Now the display shows the Dimensions of Humidity and Temperature



 = Symbol for Humidity

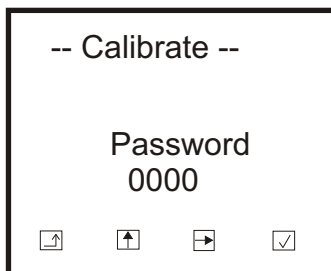


 = Symbol for Temperature



At least you will see the Ser.-No. of the Transmitter

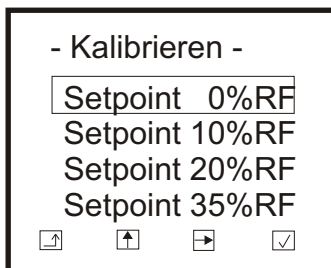
### 5.3 Calibration



If there was chosen Calibrate (PW) in the main menu and was acknowledged by button , the Password must now be typed in. You get the first 2 digits of the 4-digit Password by the sum of the first 3 digits of the Serial number of the Transmitter. (Leading 0 must be included). Last 2 digits of the Password you will get by the sum of the last 2 digits of the Serial number of the Transmitter. (Leading 0 must be included)

The blinking digit may be increased by button . Button  switches over to the next digit. If the Password is completed, button  brings you into the calibration menu.

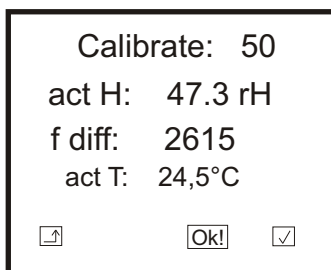
Example: Ser.-No. Transmitter = 30453 results in Password 0708



After the suggested fixed Humidities from 0% to 95%RF you may also choose "Other Humidity", "Delete Memory" and "Ambient Temp".

If you choose "Other Humidity" you may change the value of the blinking digit in the same way as you did with the Password. If the value of the Humidity is the one you want, you get into the calibration by button .

The display will now show for example:



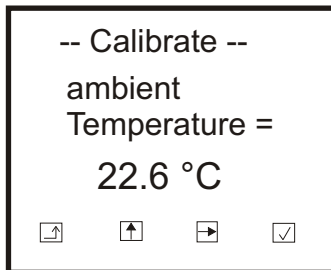
= this is the Humidity value to be calibrated

= Humidity value shown with the old calibration memory.

= actual value of Temperature

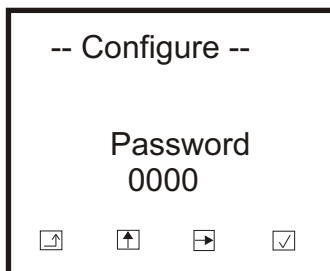
button ok keeps the actual value of F diff. steady and button  will write this as a new value into the memory.

If your choice was "ambient Temp" the display shows after the acknowledgement:

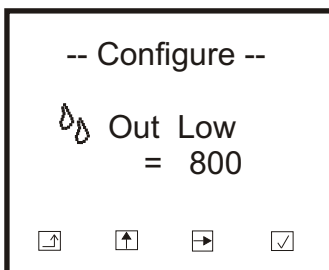


The blinking digit may be changed by button . Button goes to the next digit. If the value of the ambient Temperature is typed in correct, it will be stored by pressing button . You may not change the indicated temperature value by more than 5°C!

#### 5.4 Configuration



If your choice was “Configure (PW)” in the main menu and was acknowledged with button , you have to use the same Password as was described by “Calibrate”.

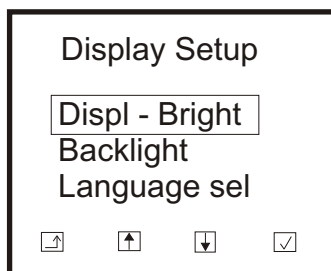


One after the other Data are shown in the same order as in the submenu Config-Data - but now they may be changed. To change a value of any chosen Data, you press button and now you may change the blinking digit with button and step to the next digit by button . With button the changed data will be stored.

Only the Serial Number of the Transmitter will not be shown in the Configuration menu - this number cannot be changed by the user.

#### 5.5 Display Setup

If your choice was “Display Setup” in the main menu and was acknowledged by button , the display will show:



The buttons or are used to choose the desired operation and has to be acknowledged by button . “Language sel” has only 2 possibilities until now - “Deutsch” and “English”. If you choose “Backlight”, you will see the symbol of a bulb. With button or you may switch on or off the backlight. If you choose “Displ-Bright” you may may change the Brightness by buttons or . To judge the brightness you will see 2 graphs - a circular and a linear one.

Button will bring you back to the upper menu level.



# EG-Baumusterprüfbescheinigung

Nr. EX5 04 07 52446 001

**Zertifikatsinhaber:** **Hygrocontrol GmbH**  
**Feuchte- u. Temp.-Meßtechnik**

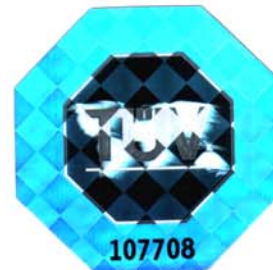
Hospitalstr. 26  
63450 Hanau  
Deutschland

**Produkt:** **Sensoren und Meßsystemen der Gruppe II,**  
**Kategorien 1 und 2**  
**Feuchte- / Temperaturmeßsystem**

Diese EG-Baumusterprüfbescheinigung bestätigt die Übereinstimmung des umseitig bezeichneten Produktes mit den einschlägigen Vorschriften gemäß Anhang III der Richtlinie des Rates Nr. 94/9/EG für Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen (ATEX). Prüfgrundlage ist ausschließlich das zur Prüfung und Zertifizierung vorgestellte Prüfmuster sowie dessen technische Dokumentation. Umseitige Hinweise sind zu beachten.

**Prüfbericht Nr:** 70067968-1

**Datum,** 2004-07-12



TÜV PRODUCT SERVICE GMBH ist benannte Stelle gemäß der Richtlinie des Rates Nr. 94/9/EG für Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen mit der Kennnummer 0123.

Seite 1 von 2



EG-Baumusterprüfbescheinigung  
Nr. EX5 04 07 52446 001



Modell(e):  **Hygrocontrol  
Typ: 86 Ex**

**Kenndaten:**

Temperatur- / Feuchtemeßgerät bestehend aus Sonde mit Rohrstück und Sensoren sowie dem zugehörigen Transmitter (optional mit Display).

Transmitter Typ 86 :  
Nennspannung : 85-240VAC bzw. 9-25VAC/10-36VDC  
Nennaufnahme : ca. 5VA  
Umgebungstemp.: -20°C bis +40°C  
Ex II (2) G/D, [EEx ia] IIC  
(zur Installation außerhalb des Ex-Bereiches)

Sonde Typ 861 :  
nur zum Anschluß an den Transmitter Typ 86  
Schutzart : IP65  
Umgebungstemp. für  
Kabel und Sondenkopf : -20°C bis +60°C  
Sensor : -40°C bis +120°C  
Ex II 1/2 G/D, EEx ia IIC T4 T 135°C  
(Installation des Sensors in Zone 20 bzw. Zone 0  
und des Sondenkopfes/-elektronik in Zone 21 bzw.  
Zone 1)