

# HYGROPHIL DTP

## Operating Instructions

Model 1500-50



BA 080530



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Schulstraße 30,  
D-94239 Gotteszell

Document: BA 080530  
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Authors: W. Binder, G. Rothe  
Translation: Peter Coote

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# 1 System Description

## 1.1 Function and Applications

The optical Dew Point sensor HYGROPHIL DT is conceived for use in compressed air networks. It works in the completely new, patented procedure of Total Internal Reflection. Thus, many disadvantages of conventional optical dew point sensors are avoided. The sensor can be built directly into the air supply line and therefore can determine the accurate dew point under pressure.

The HYGROPHIL DTP can be used for the direct on-line measurement within the range of 0 to 16 bar of positive pressure. Since the sensor determines the Primary dew point under pressure directly, a conversion with varying pressure ratios is not necessary.

Because of its fast response time it can be used for monitoring Process Control tasks. The sensor can also be used in applications for simple data collection. The sensor can be inserted into a 'sensor change' armature, which ensures no break in the process.

An LC display shows the Measured Value. By the use of three keys the sensor is locally configurable. A Current Output (0/4 - 20 mA) as well as a RS232-Interface make the logging of the measured values of the process possible.

Two electrically isolated switching outputs are adjustable as limit value switches.

## 1.2 Measuring Principle

The dew point measurement takes place by the method of total internal reflection.

Light is linked over a screen onto a laminar glass substrate and steered to a photo detector on the opposite side. As long as no condensation or ice crystallization takes place in the detection range, the linked light is totally reflected and arrives at the detector. Via cooling of the surface by means of a Peltier element the temperature of the substrate drops until condensation or ice formation takes place. The light is now uncoupled. The radiation received by the photo detector decreases accordingly.

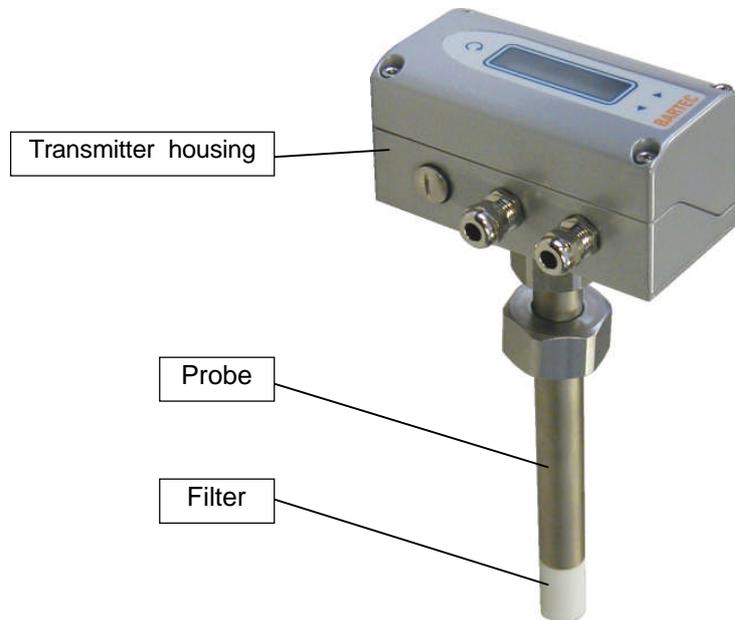
The associated dew point temperature is determined by a temperature sensor attached on the glass surface.

The sensor is constructed in a compact design. The small dew point sensors can now be integrated directly into the process. Contamination of the measuring gas or dust deposits on the sensor have no influence on the result of measurement.

## 1.3 Switching Outputs

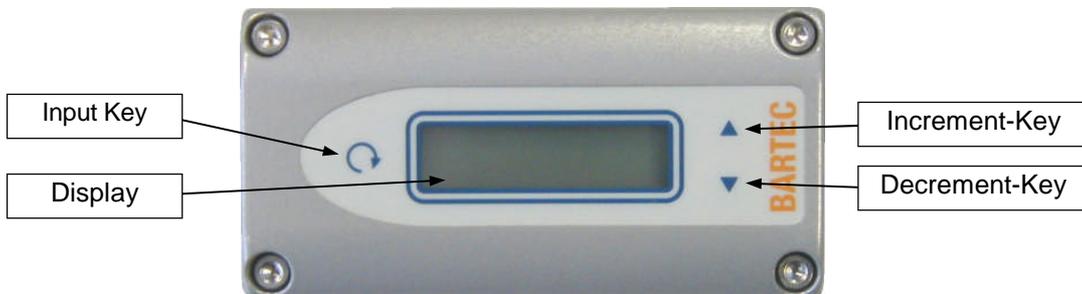
There are two electrically isolated switching outputs available which are protected from overload (OUT1, OUT2). These can switch DC voltages up to 30V with a maximum current of 200mA. Because of the galvanic separation, positive or negative switching is possible. Configuration of the function and the allocation of the outputs can be adjusted (s. section 5.7).

## 1.4 Construction



### 1.4.1 Keys and Display

The operation is done by three keys on the transmitter housing.



#### Key Functions



Input Key

Confirm a selection or a change



Increment-Key

Change the measured variable, In the configuration mode, "pages" of the menus, or increasing values.



Decrement-Key

Change the measured variable, in the configuration mode, "pages" of the menus, or reducing values.

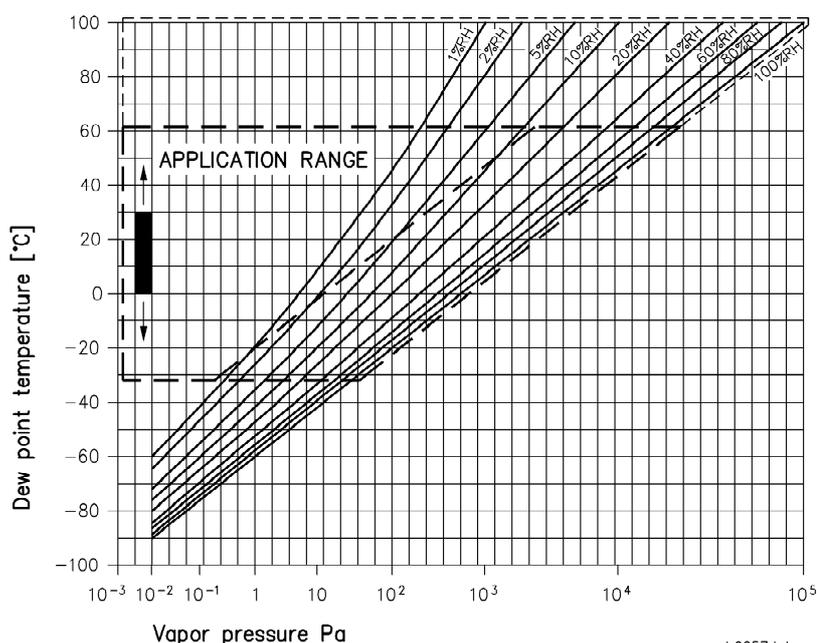
#### Display

For the representation of all announcements a LC display is used. In the configuration mode the input dialogue takes place with the help of the display.

## 1.5 Technical Data

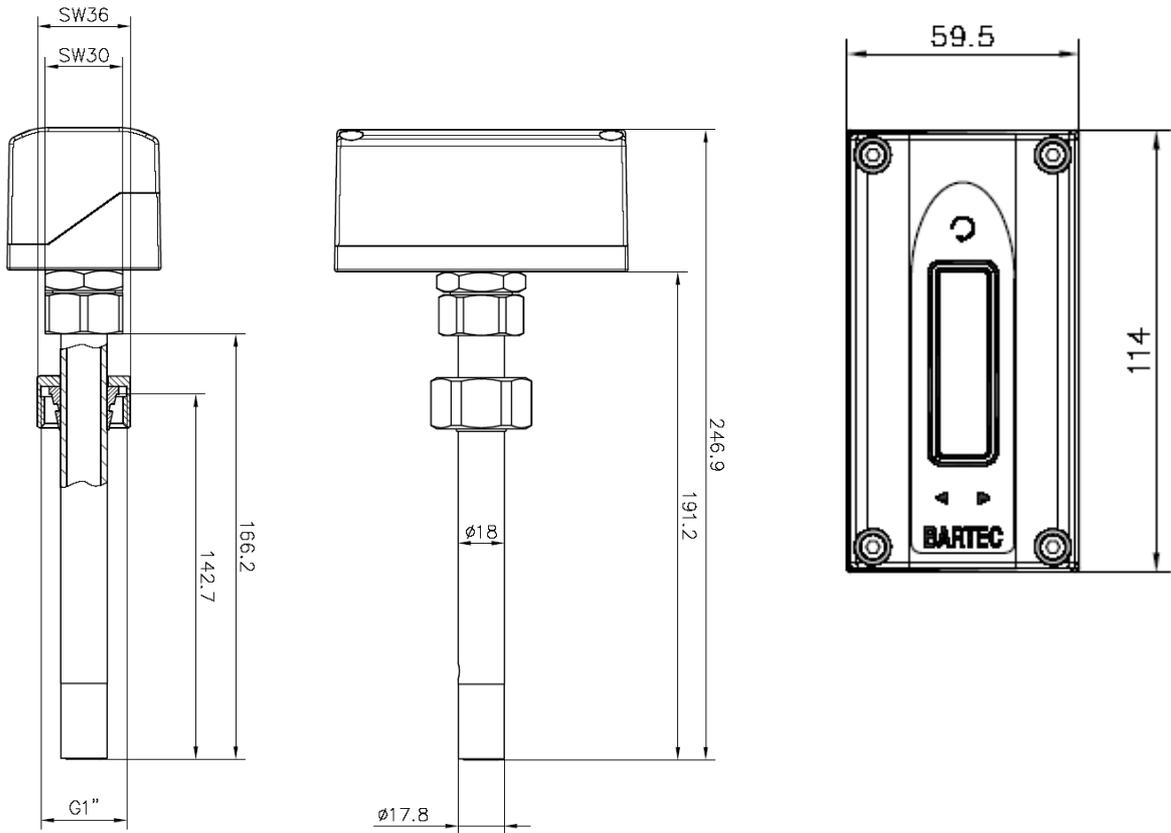
<b>Measuring Range</b>	
Range of DT application	-30...+60°C (with precooling)
Maximum cooling in relation to shaft temperature (Measuring gas temperature)	- 40K
Range RH	2%...100%
Accuracy DT	± 0,5°C
Settling time from +15°C DT to -10°C DT	ca. 60 sec (95%)
Settling time from -10°C DT to +15°C DT	ca. 90 sec (95%)
<b>Electrical Data</b>	
Power Supply	DC 12...24V, max. 250mA
Analog Output (can be configured to different calculated and measured values)	0/4...20mA active, Resolution 0.1% max. load: 400 Ω (DT, RH, TT, ΔT)
Interface	RS 232 9600 Baud, 8 bit, No Parity, 1 stop bit
Switching Output configurable	2x 0,2A , DC 30V passive
<b>Display</b>	
LCD reflective (can be configured to different calculated and measured values)	8 Digits 14 Segments (DT, RH, TT, ΔT)
<b>Keyboard</b>	
3 sealed touch keys	
<b>Ambient Conditions</b>	
Operating temperature of electronics	-20...+50°C
Operating temperature of sensor	-30...+60°C
Pressure range of sensor	0.2...16 bar
<b>Mechanical Data</b>	
Dimensions	See dimensional drawing
Material of casing	Aluminium coated
Material of sensor shaft	Copper, nickel-plated 10μ
Protection type of casing	IP 65

### Measuring Range



sch0257d.dwg

### Dimensional Drawing/Installation dimensions



## 2 Safety Precautions

The dew point sensors are thoroughly examined after construction. They leave the factory in perfect condition according to the valid regulations.

- The installation and maintenance of the dew point sensors have to take place using qualified technical personnel.
- Guarantee that the data and operating conditions indicated by BARTEC are followed.
- Read the operating instructions before the installation and start-up. If you should have questions on certain points, contact our personnel for expert information.
- Instruct your operating and maintenance staff thoroughly and make available all necessary information.
- The internal equipment fault signals do not replace the safety devices in your control system, into which the sensor is integrated.
- Please note that all regulations are kept, which are valid for the operation of your plant.
- Guarantee before connection of the operating voltage that this agrees with the operating voltage of the sensor.
- Note when upsets and errors are triggered in the Outputs and examine whether a recovery is possible. If no repair can be accomplished locally, send the sensor with exact failure data to be repaired at BARTEC.
- If it is assumed that it cannot be safely operated any longer, set the equipment immediately out of operation and protect it from restarting. (e.g. when there is visible damage).



All work, where the transmitter housing has to be opened, must be done only by trained technical personnel.

- Keep the measuring end of the sensor free of contamination due to oil and fat.

*Exclusion of liability*

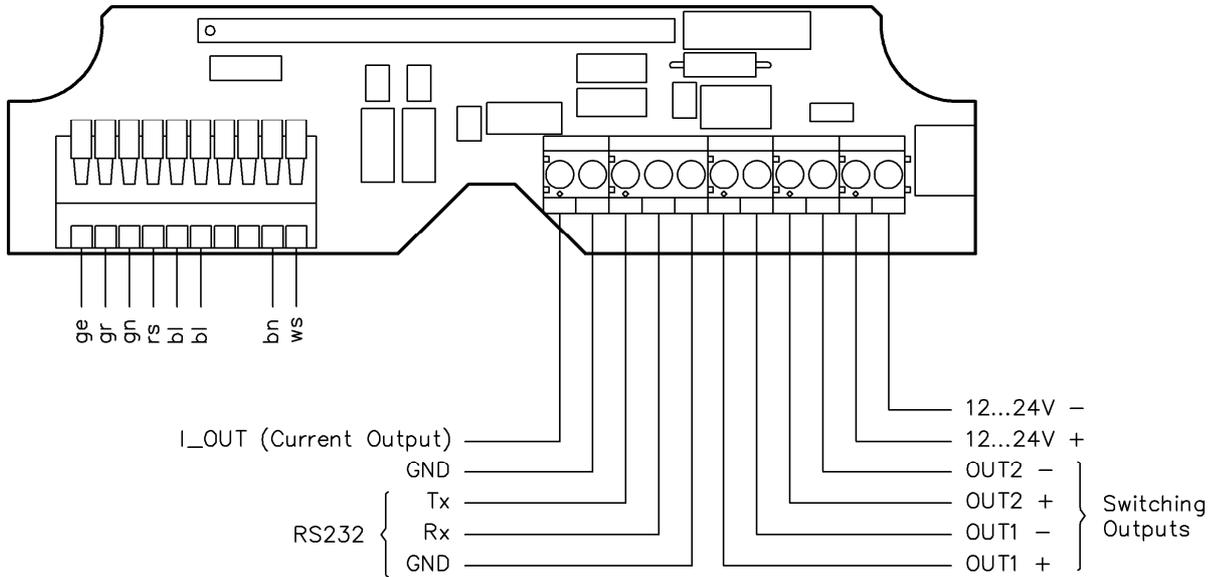
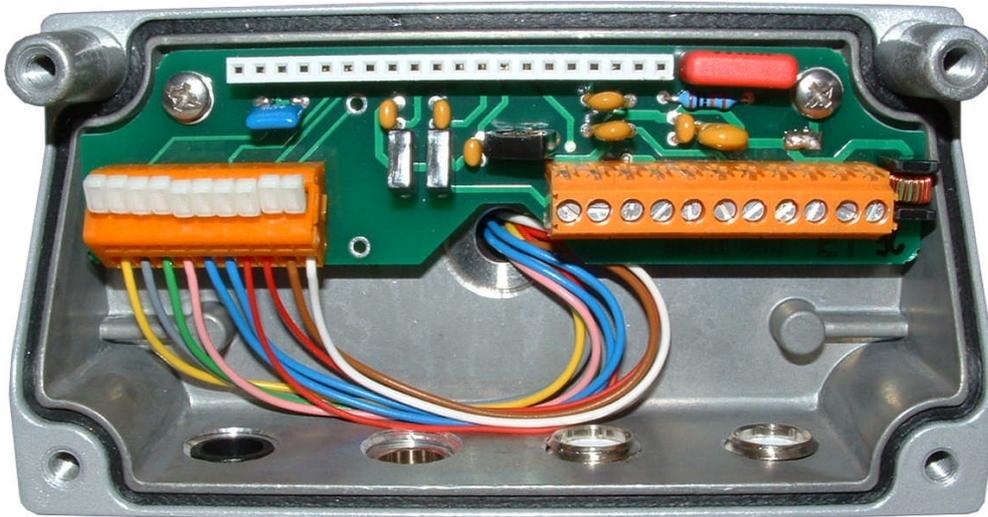
BARTEC GmbH and its agents shall be liable only for damage caused by gross negligence or intent. Said liability shall be limited to the value of the order in question issued to BARTEC GmbH.

In particular, BARTEC accepts no liability for damage resulting from non-observance of the safety information or from non-compliance with the operating instructions or operating conditions.

Liability for consequential damage is excluded.

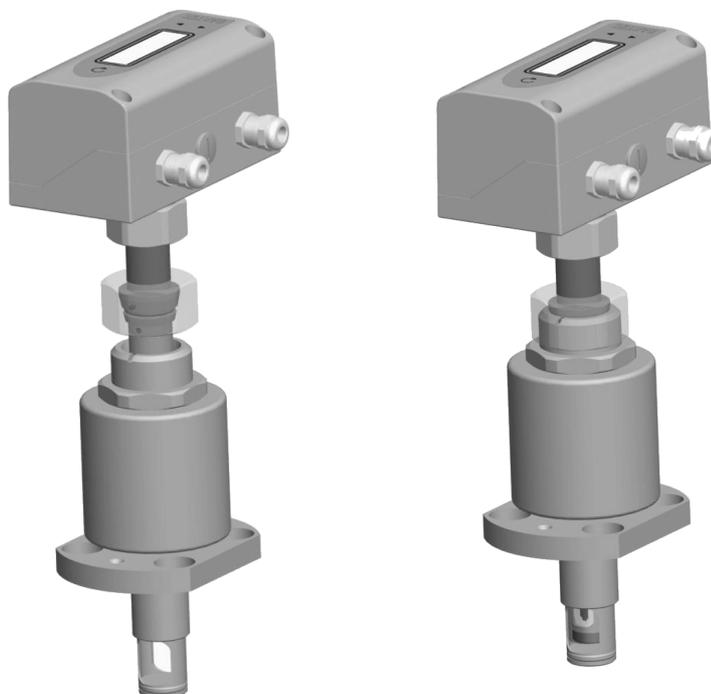
# 3 Installation

## 3.1 Connection



## 3.2 Installation of the Sensor

For the installation of the sensor a sensor change armature is used. With the help of the sensor change armature it is possible to take or exchange if necessary the sensor out of a line, which is at pressure, for maintenance or for inspection purposes.



For other references to the installation of the sensor you please contact the company BARTEC GmbH, Gotteszell.

## 4 Operation

### 4.1 Start Up

After initialisation of the operating voltage the equipment is ready for use. After a time from up to 1.5 minutes a measured value appears in the display.

**DT 0.3°C**

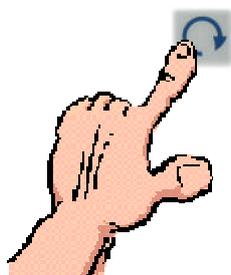
### 4.2 Measured Variable Indication

#### 4.2.1 Changing the Measured Variable Display

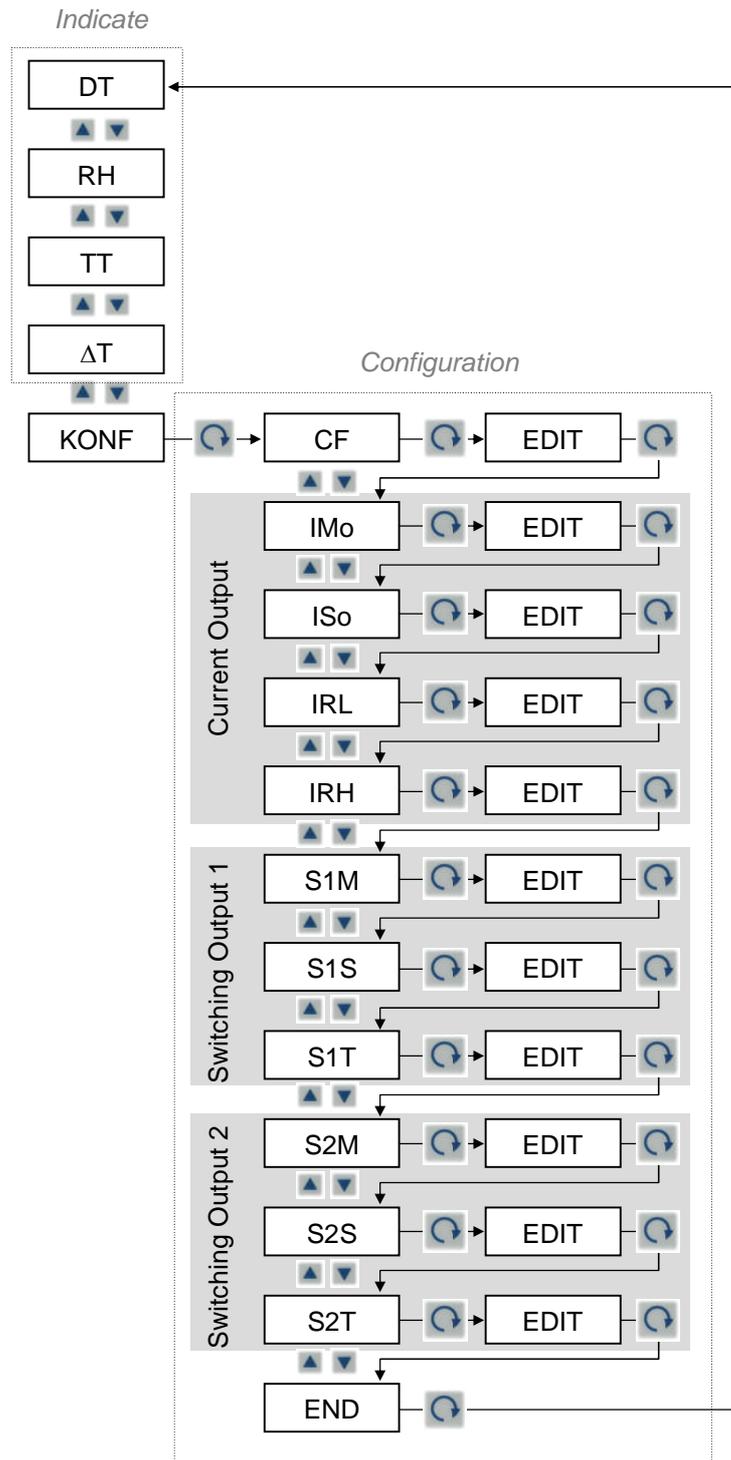
With the two arrow keys you can switch the indication to another measured variable.

DT	Dew point in °C	<b>DT 6.3°C</b>	▲ ▼	
RH	Relative Humidity in %	<b>RH 19.9P</b>	▲ ▼	
TT	Sample Temperature in °C	<b>TT 24.6°C</b>	▲ ▼	
ΔT	Dew point Difference in °C (Temperature difference between Dew point and Sample Temperature)	<b>ΔT 18.3°C</b>	▲ ▼	

#### 4.2.2 Operational Display



If you have selected a measured variable, you can make this the standard display by pressing the input key.



Overview of the Measured Value Display and Configuration Menu

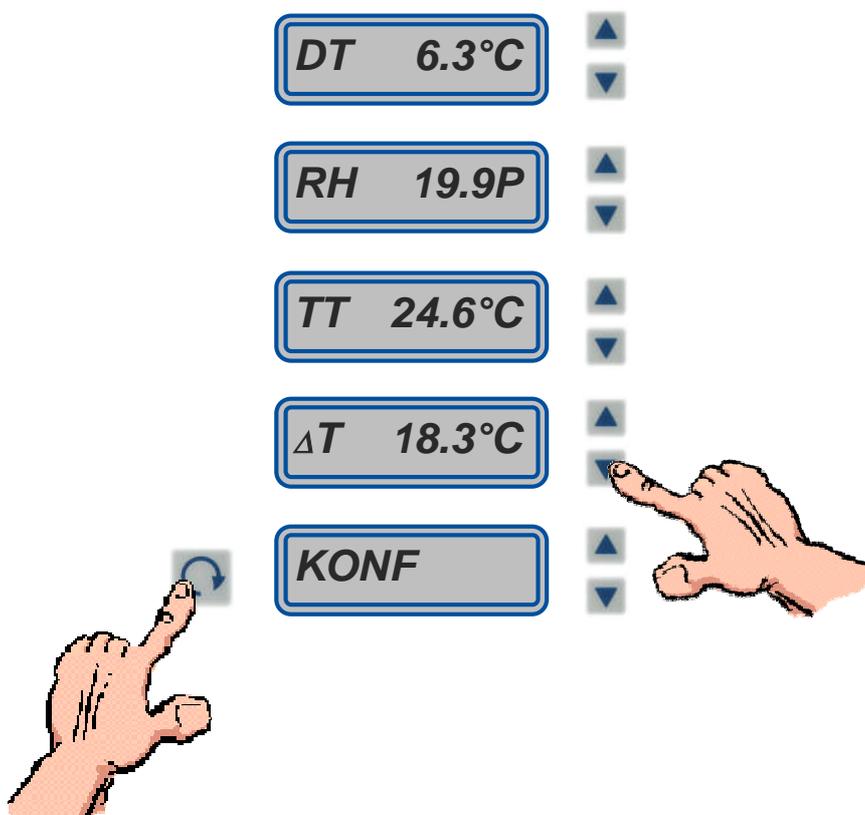
## 5 Configuration

For operation of the Humidity measuring system HYGROPHIL DT there are different operating parameters and programmable functions like:

- Allocation of a Measured variable to the Current Output,
- Output Current range,
- Allocation of the measured variable to the switching Outputs,
- Threshold values for the Switching Outputs.

### 5.1 Selecting Configuration

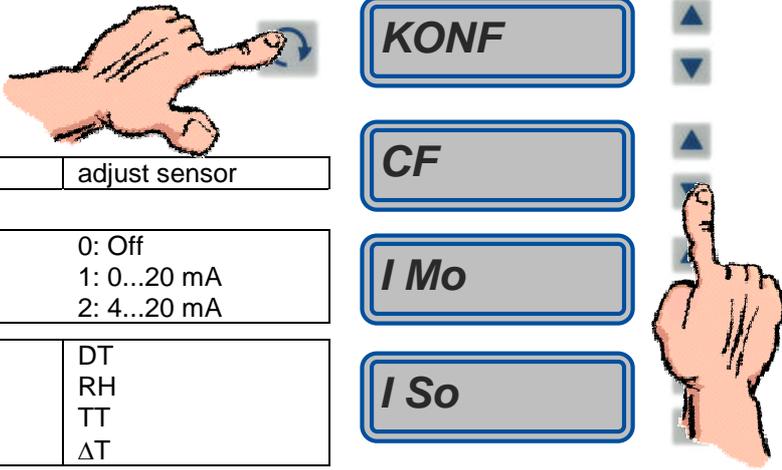
In the indicator mode Select the point KONF and press the input key.



## 5.2 Configuration menu

After this the first configuration menu (CF) is indicated. With the two arrow keys you can select a menu.

If you want to open a selected menu, press the input key. Thus you arrive into the editing mode for this menu. Make the necessary inputs and confirm these with the input key. Thereupon you leave the editing mode and the next menu is indicated.



Calibration Factor	adjust sensor	<b>KONF</b>	▲ ▼
Current Output Mode	0: Off 1: 0...20 mA 2: 4...20 mA	<b>CF</b>	▲ ▼
Current Output Source	DT RH TT ΔT	<b>I Mo</b>	▲ ▼
Current Output Range Low	Value for 0/4 mA	<b>I So</b>	▲ ▼
Current Output Range High	Value for 20 mA	<b>I RL</b>	▲ ▼
Switching Output 1 Mode	0: Falling below 1: Falling above	<b>I RH</b>	▲ ▼
Switching Output 1 Source	DT RH TT ΔT	<b>S1 M</b>	▲ ▼
Switching Output 1 Threshold	Value	<b>S1 S</b>	▲ ▼
Switching Output 2 Mode	0: Falling below 1: Falling above	<b>S1 T</b>	▲ ▼
Switching Output 2 Source	DT RH TT ΔT	<b>S2 M</b>	▲ ▼
Switching Output 2 Threshold	Value	<b>S2 S</b>	▲ ▼
		<b>S2 T</b>	▲ ▼
		<b>END</b>	▲ ▼

## 5.3 Editing Configuration Parameters

Depending on the respective parameter there are two editing methods:

1. Selection of possible variables from a list
2. Input of numeric values.

### 5.3.1 Selecting from the List

After opening a menu, in which you can select variables from a list, first the momentary variable is indicated. With the two arrow keys you can move within the possible variables.

If you want to select a variable, press the input key.

### 5.3.2 Input of Numeric values

After opening a menu, in which you must change a numeric value, at first the momentarily stopped value is indicated, where the first place digit flashes. You can change the flashing digit with the two arrow keys.

If you changed the first digit value, press the input key. Afterwards the second digit flashes, now you can change this.

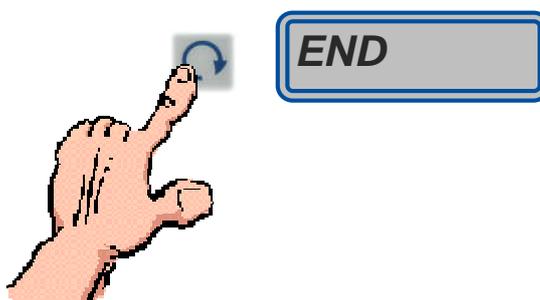
The **first place** is reserved for the **sign**. In order to enter a negative value, you press the decrement key with announcement of '0'. In the announcement a **minus sign** appears. In order to enter again positive values, you must pressure the increment key at the announcement of the minus sign. In place of the minus sign the zero appears again.

The input of numeric values is not only for configuring values of measured variables, but also for the establishment of the modes for the outputs. With these parameters the last digits in each case is crucially placed. Before these digits prominent zeros can stand.

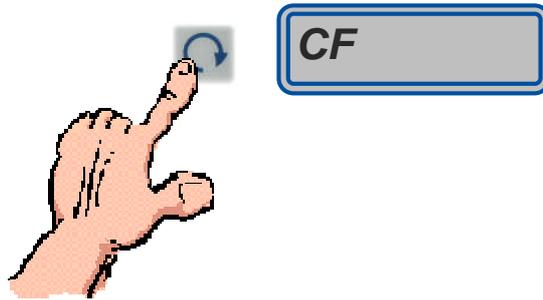
If you changed the last digit of a value, the menu following in each case is indicated after pressing input key.

## 5.4 Exiting the Configuration Menu

In order to return to the indicator mode after the configuration mode, you select the menu option "END" and press the input key.



## 5.5 Calibration Factor

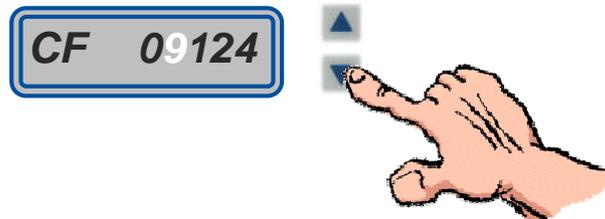


The calibration factor is the correction value for the respective sensor. It is determined during the factory-installed calibration. With a change of the sensor (only with devices with changeable sensor possible) you must register the calibration factor of the new sensor.

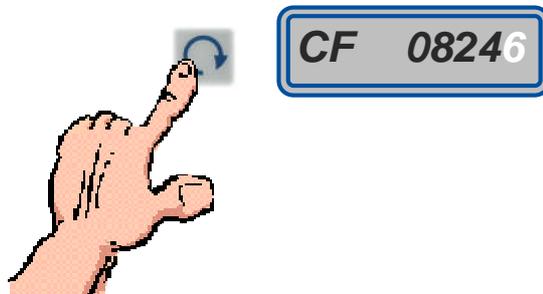
After selection of the menu the calibration factor is indicated. The first place flashes. With the two arrow keys you can change the sign here (s. section 5.3.2).



Press then the input key and adjust the second place (= first number of the calibration factor).

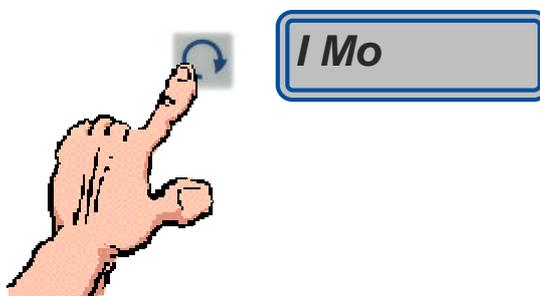


In the same way all places of the calibration factor can be changed.



## 5.6 Configuration of the Current Output

### 5.6.1 Mode



Here you can specify, which mode the current output is to work.

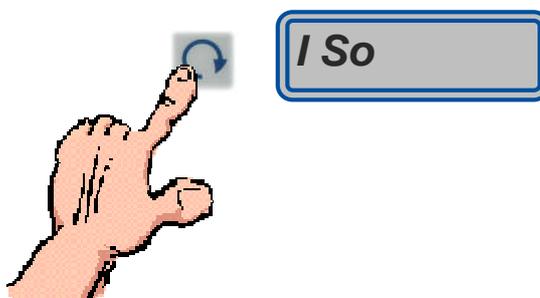
0: Off (no Current Output)

1: 0...20 mA

2: 4...20 mA



### 5.6.2 Source



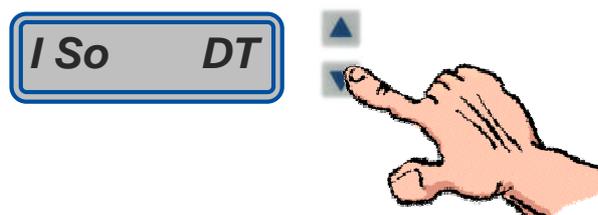
Here you can select, which measured variable is to be the source for the current output.

DT: Dew point Temperature

RH: Relative Humidity

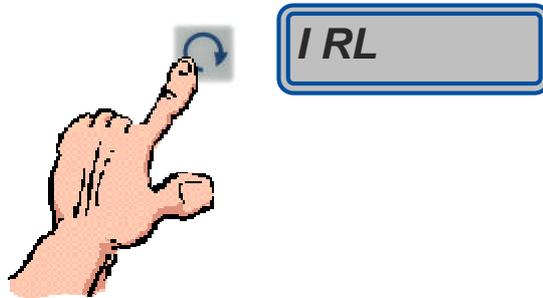
TT: Sample Temperature

$\Delta T$ : Dew point Difference

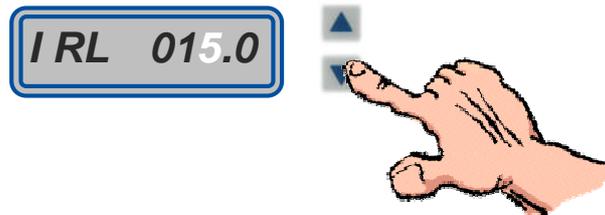


For each measured variable you can specify a measured value range, which is to be evaluated. This range must lie within the possible total measuring range for this measured variable. You can specify the measured value range with the two following parameters.

### 5.6.3 Measuring Range Beginning

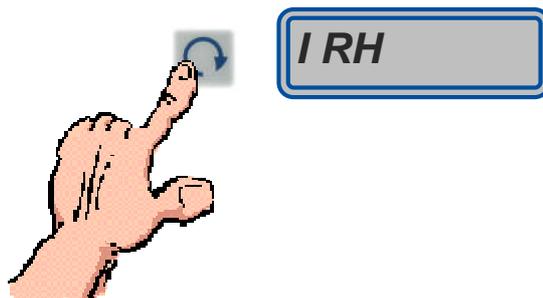


Here the entry of the lower value for the measured variable at the current output takes place. This value corresponds, dependent on the adjusted mode (s. section 5.6.1), to 0 or 4 mA.

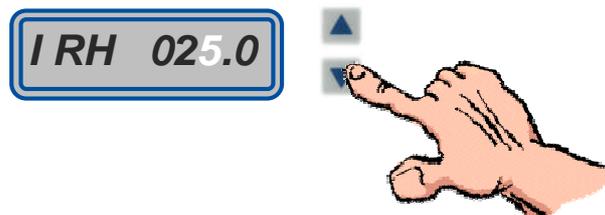


After you have confirmed the last place with the input key, the next menu is indicated.

### 5.6.4 Measuring Range End



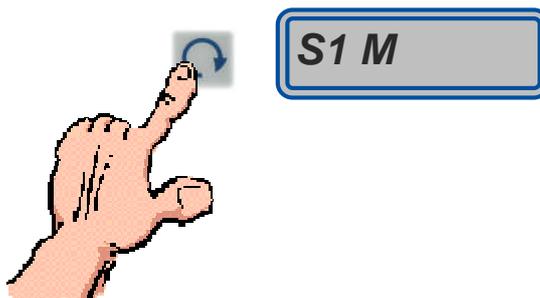
Here the entry of the upper value for the measured variable at the current output takes place. This value corresponds to 20 mA.



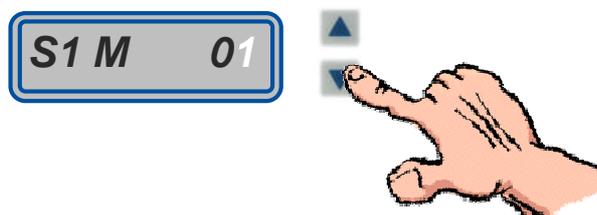
## 5.7 Configuration of the Switching Outputs

There are two electrically isolated switching outputs, protected from overload, available (OUT1, OUT2). These switch DC voltages up to 30V with a current of 200 mA maximum. Because of the galvanic separation, positive or negative switching is possible.

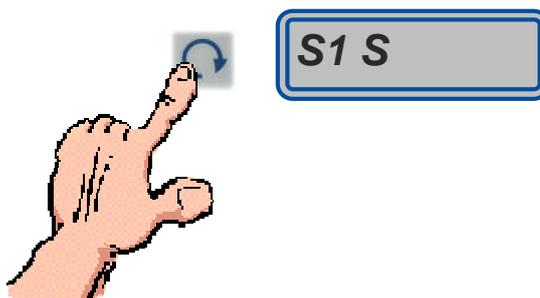
### 5.7.1 Mode



Here you can specify, in which mode the switching output is to work.  
 0: Switch on when falling below the threshold value (s. section **Fehler! Verweisquelle konnte nicht gefunden werden.**).  
 1: Switch on when in excess of the threshold value (s. section **Fehler! Verweisquelle konnte nicht gefunden werden.**).

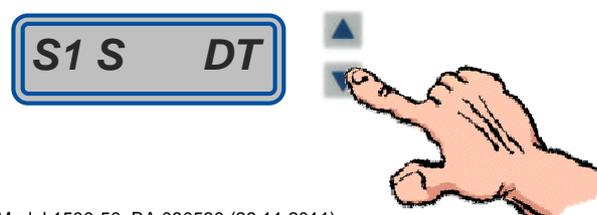


### 5.7.2 Source

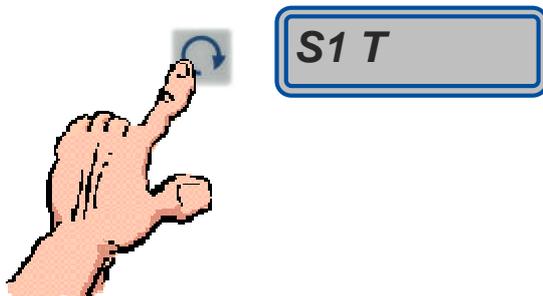


Here you can select, which measured variable is to be the source for the switching output 1.

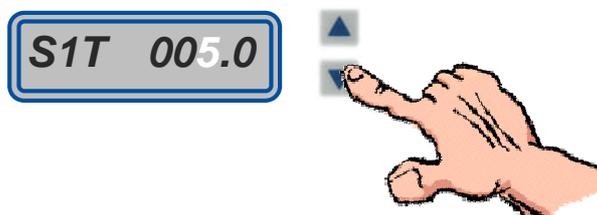
DT: Dew point Temperature  
 RH: Relative Humidity  
 TT: Sample Temperature  
 $\Delta T$ : Dew point Difference



## 5.7.3 Threshold Value



Here you enter the value of the measured variable configured as the source (s. section 5.7.2), when it's under or over (s. section 5.7.1) the switching output is operated.

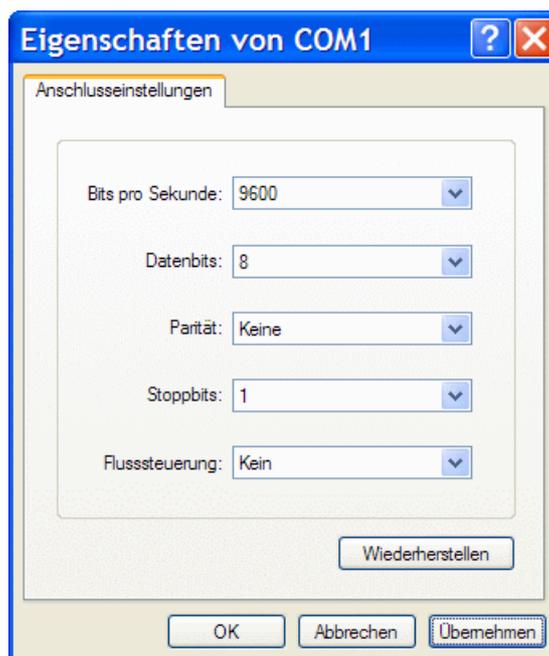


## 5.8 Serial Interface

The serial interface (RS232) is intended for observing different measuring and arithmetic procedures and for changing defaults. The Protocol is laid out in such a way that no special program is necessary. A standard terminal program (e.g. Windows HyperTerminal) on a laptop or a PC is sufficient.

Connect the serial interface of the HYGROPHIL DT with the serial port COM 1 on the PC or laptop.

Enter the following **Interface Parameters** on the PC and/or laptop:



With the interface, five freely selectable measured variables are displayed and cycle with two digit Ident No.s placed in front. All values planned for the access over the interface have such an Ident No. allocated, whereby the numbers 00-04 have a privileged position. They contain numbers of the measured variables over the interface to be constantly displayed. The list on the following page shows the available values.

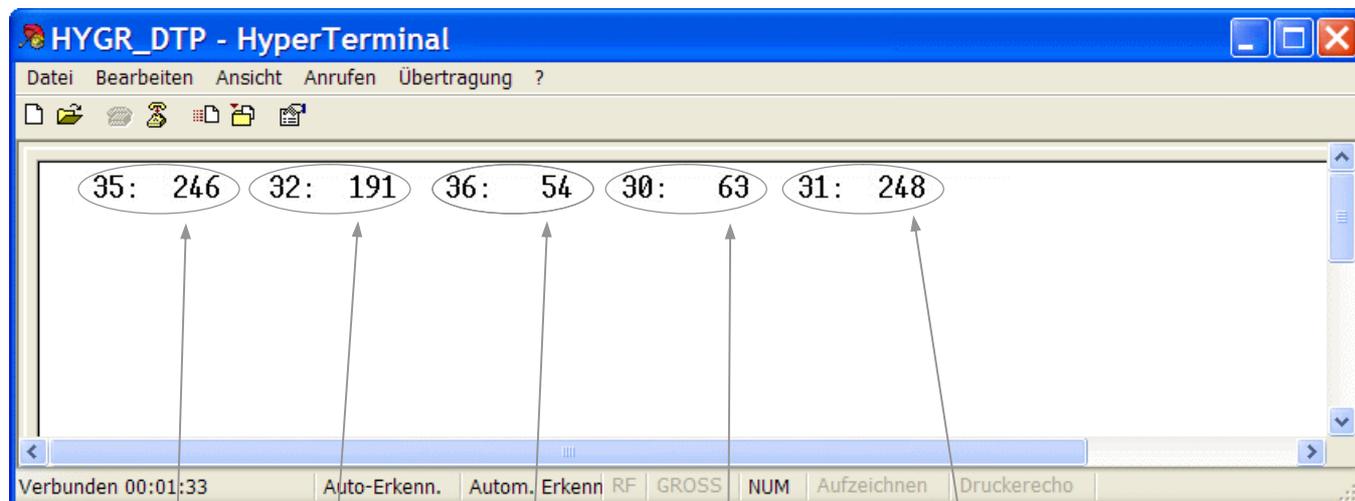
Changing the data to be displayed, as well as changing the configuration data is possible at any time. In the terminal program, input the appropriate instruction [Ident No.: Value CR]. The Ident No. must always be entered as 2-digits with a following colon. The input must contain no blanks and you must also press ENTER to lock it in. During the input the output is interrupted and each entered character is echoed. For inputs of characters that are not understood a "?" is displayed and the next line jumped. Inputs can be stopped at any time by pressing ESC.

In order to avoid inadvertent changes e.g. calibration data, write access into the EEPROM (wp) must first be released with identification-no 08 (see following table, Id-Nr. 08). Without this release during the writing, only the value in the main memory is changed. After a restart then the original value (EEPROM value) is again valid.

Ident-No.	Explanation	Access	Format
00	Id-No. of the first measured variable of the output	r/wp	00...38
01	Id-No. of of the second measured variable of the output	r/wp	00...38
02	Id-No. of of the third measured variable of the output	r/wp	00...38
03	Id-No. of of the fourth measured variable of the output	r/wp	00...38
04	Id-No. of of the fifth measured variable of the output	r/wp	00...38
05	Id-No. of the measured variable which is seen at the current output	r/wp	29...38
06	Maximum value of the measured variable at the current output (Value, which corresponds to 20 mA)	r/wp	-200...+1000
07	Minimum value of the measured variable at the current output (Value, which corresponds to 0 or 4 mA)	r/wp	-400...+800
08	EEPROM writing permitted 1= uniquely (for a value) 2= up to switching off	r/w	1/2
10	Current Output 0= OFF 1= 0...20 mA 2= 4...20 mA	r/wp	0/1/2
11	Function 1= Peltier Current Control ON 4= Dew point Control ON (add values for combinations)	r/wp	0...7
13	Peltier-Mode 0= OFF 33= Heat 34= Cool	r/w <sup>1</sup>	0/33/34
16	Id-No. of the measured variable for Switching Output 1	r/wp	29...38
17	Threshold value for Switching Output 1	r/wp	-400...+1000
18	Mode - Switching Output 1 0= ON if value falls below threshold 1= ON if value goes above threshold	r/wp	0/1
19	Id-No. of the measured variable for Switching Output 2	r/wp	29...38
20	Threshold value for Switching Output 2	r/wp	-400...+1000
21	Mode - Switching Output 2 0= ON if value falls below threshold 1= ON if value goes above threshold	r/wp	0/1
30	Glass temperature in 1/10 °C	r	-399...+799
31	Sample temperature in 1/10 °C	r	-399...+799
32	Peltier current in mA	r	0...1000
35	Lighting value photo sensor 1 (Ambient light compensated)	r	0...1023
36	Dew point in 1/10 °C	r	-400...+600
37	Relative Humidity in 1/10 %	r	20...1000
38	Dew point Difference in 1/10 °C	r	0...200
49	Correction value for sensor	r/wp	-9999...+9999
50	Correction Value for TT	r/wp	0
52	ERROR Message, Status Message 1 = ERROR Peltier (Current Interruption) 2= ERROR TT (ERROR external temperature sensor) 4 = ERROR DT-T (ERROR internal temperature sensor) 8 = ERROR DT (Dew point cannot be reached) 16 = ERROR LED (Photo diode gets no light signal)	r	1...32

Access: r = read  
w = write  
w<sup>1</sup> = write - only possible during switched off dew point regulation  
wp= permanent writing (stores in the EEPROM)

Example: Output of values with HyperTerminal:



Lighting value photo sensor 1

Peltier Current

Dewpoint

Glass temperature

Sample temperature

The **temperatures** are displayed in **one tenth degrees** (i.e divide value by ten).



## 6 Error Handling

In the case of an error the display shows an alternating measured value and an error message.

### Possible Error Messages:

*Err PELT*

Interruption to the Cooling Element

*Err LED*

Sensor error (Interruption / Defect in a Sensor component)

*Err DT-L*

Dew point is not reached (dew point too low, sensor too warm)

*Err DT-T*

Error mirror temperature sensor

*Err TT*

Error temperature sensor

After temporary disturbances the error display ends automatically.

If an error is indicated, except DT-L, the current output is set to 0 and the switching outputs are switched off.



# 7 Maintenance

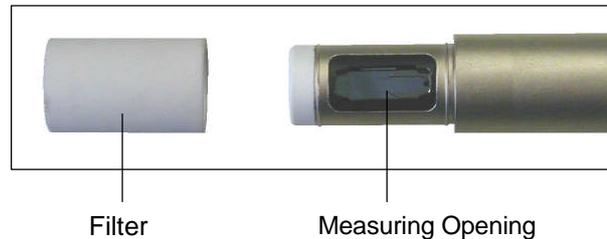
Once a year, depending on the degree of pollution of the measuring gas, or more frequently, HYGROPHIL DTP should be maintained.

This includes:

- Clean the glass area in the measuring opening
- Change the filter
- Visual Inspection of Operation
- Examine the accuracy of the temperature measurement (only by service staff)

## 7.1 Cleaning and Filter Change

- If the Sensor is hot when removed from the Process, let it cool off.
- Take the filter off from the end of the sensor.
- Clean glass area in the measuring opening with a soft rag or a Cottonbud, which you can moisten with Methylated Spirits.



- If necessary put a new filter on the sensor end.

## 7.2 Visual Inspection of Operation

You can examine the function of the sensor in a simple manner visually.

### Sensor function

- Take the sensor from the process, leave it switched on.
- Take the filter off of the sensor end.
- Observe the glass area in the measuring opening.  
After 1 to 1.5 minutes the glass area must fog up and dry briefly again thereafter.  
This procedure must repeat itself every of 10... 15 seconds constantly.

### Measured value-indication

In the above condition (demounted) the sensor measures the air dew point. You can examine the measured value display with a reference hygrometer.

- Toggle the measured value display to Relative Humidity RH.
- Compare the value with the value of the reference hygrometer, which measures the air dew point near the same position.

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