

Operating Manual

Precision Hygro-/Thermo-/Barometer

GFTB100



1	GENERAL	1
1.1	APPLICATION RANGE:	1
1.2	SAFETY INSTRUCTIONS:	2
1.3	DISPOSAL NOTICE.....	2
2	OPERATION.....	2
2.1	SWITCHING-ON AND -OFF.....	2
2.2	THE MEASUREMENT.....	2
2.2.1	Choice of measuring unit.....	3
2.2.2	Min-/max- value memory.....	3
2.2.3	Hold – function.....	3
2.3	DESCRIPTION OF THE MEASUREMENT VALUES	3
2.3.1	Absolute pressure	3
2.3.2	Temperature	4
2.3.3	Relative Humidity.....	4
2.3.4	Dew point temperature.....	4
2.3.5	Wet bulb temperature	4
2.3.6	Moisture content.....	4
2.3.7	Absolute humidity.....	4
2.4	ADDITIONAL FUNCTIONS AND INFORMATIONS	5
2.4.1	Hiding unwanted display values.....	5
2.4.2	Measuring rate	5
2.4.3	Calibration services.....	5
2.4.4	System Messages	5
3	CONFIGURATION OF THE INSTRUMENT.....	6
4	OFFSET AND SLOPE ADJUSTMENTS	7
5	TECHNICAL DATA:	8

1 General

1.1 Application range:

Quick-response measurement of air pressure, atmospheric humidity, temperature and further derived units in EDP rooms, museums, churches, administrative and residential buildings, storage rooms, green houses, pools, production rooms, for cooling technology and air conditioning as well as for building engineers and for the evaluation of damage to buildings etc.

Due to highly accurate sensors this device has a notably higher precision than comparable devices.

Via the additional displaying possibilities ('dew point temperature Td', 'wet bulb temperature Twb', 'absolute humidity [g/m³]' and 'moisture content of the air [g/kg]') the current state of the air is precisely and concretely shown. Due to the low power consumption, the device can be run permanently, for example as "weather station".



GREISINGER electronic GmbH

D - 93128 Regenstauf, Hans-Sachs-Str. 26

Phone: 0049 9402 / 9383-0, Fax: 0049 9402 / 9383-33, eMail: info@greisinger.de



1.2 Safety instructions:

This device has been designed and tested in accordance to the safety regulations for electronic devices. However, its trouble-free operation and reliability cannot be guaranteed unless the standard safety measures and special safety advises given in this manual will be adhered to when using it.

- Trouble-free operation and reliability of the device can only be guaranteed if it is not subjected to any other climatic conditions than those stated under 'Specification':
If the device is transported from a cold to a warm environment condensation may result in a failure of the function. In such a case make sure the device temperature has adjusted to the ambient temperature before trying a new start-up.
- If there is a risk whatsoever involved in running it, the device has to be switched off immediately and to be marked accordingly to avoid re-starting.
Operator safety may be a risk if:
 - there is visible damage to the device
 - the device is not working as specified
 - the device has been stored under unsuitable conditions
 In case of doubt, please return device to manufacturer for repair or maintenance.
- **Warning:** Do not use these product as safety or emergency stop devices, or in any other application where failure of the product could result in personal injury or material damage.
Failure to comply with these instructions could result in death or serious injury and material damage.

1.3 Disposal Notice

- Dispense exhausted batteries at destined gathering places.
- Send the device directly to us, if it should be disposed. We will dispose the device appropriate and non-polluting.

2 Operation

2.1 Switching-on and -off

The device is switched-on by shortly pushing the left button (**on/off**).

If the auto-off-function is activated (see chapter "configuration of the device"), the device will turn-off automatically after the preset time, if no button has been pushed. If this is deactivated, the device is in continuous operation mode.

The device can be turned-off by a long push of the left button (**on/off**).

2.2 The measurement

- a) Please pay attention that no dirt gets into the vents. If this has already taken place, please do not try to remove it. Improper treatment can damage the sensors. Additionally the device should be saved from mechanical agitation, because this can also damage the sensors (carrier material glass and ceramic)!

Attention: In the sensor area there is ESD-sensitive. Never touch or hold sensor head!

- b) For accurate measurements it is required that the device has the same temperature as the measured room.

If necessary you should wait therefore till the device can adept the ambient temperature.

If this is not possible, the measurement should be done as described below:

Hold device by the outstretched arm and sway back and forth (to fan) to accelerate the air exchange and the temperature matching. As soon as the measured value is quite stable, it can be read off. This applies to humidity as well as temperature measurements. It may make sense to press the hold key to "freeze" all values and therefore read them off easily.

- c) If the device is held in the hand during the measurement, both temperature and humidity are altered by the body heat. To minimise this influences the device should be held as far away from the sensor as possible and a direct contact with the exhaled air should be avoided. Most accurate measurements are achieved, if the device is set down and the measured value (as soon as it is stable) is read at adequate distance. Additionally you ought to consider that outdoor humidity measurements can not have a accuracy of 0.1% due to outside influences like e.g. airflow or thermal fluctuation.

2.2.1 Choice of measuring unit

The device can display following measuring units:

- absolute air pressure [hPa]
- temperature [°C] or [°F]
- relative humidity [%]
- dew point temperature Td [°C] or [°F]
- wet bulb temperature Twb [°C] oder [°F]
- moisture content [g/kg]
- absolute humidity [g/m³]

If the cyclic displaying function is deactivated (OFF, factory settings), the displayed measuring unit can be changed by a short push of the left button (**unit**). If the cyclic displaying mode is activated (2 or 4 seconds), all measuring units will be displayed successively.

How to configure the cyclic displaying mode is described in the chapter “configuration of the device”. The particular measuring units and their meaning will be described below.

Attention: The display of units can be suppressed by the configuration “HidE”, description in chapters “configuration of the device” and “Hiding unwanted display values”

2.2.2 Min-/max- value memory

For all measuring values the lowest and highest measured value since the turning-on of the device will be stored.

- | | | |
|------------------------|--------------------------------------|---|
| Watch MIN value (Lo): | press shortly key mode once | display changes between ‘Lo’ and MIN value |
| Watch MAX value (Hi): | press shortly mode once again | display changes between ‘Hi’ and MAX value |
| restore current value: | press shortly mode once again | current value of the chosen unit is displayed |
| delete MIN/MAX value: | press mode for 2 sec. | MIN and MAX values will be deleted, the display shows shortly ‘CLr’ (clear) |

After switching-off and turning-on again all min-/max- values will be deleted.

2.2.3 Hold – function

When the **hold** – key is pressed, the current measured values will be ‘frozen’ (display symbol: HLD) until the key is pressed again. Then the device will measure in its normal way again.

2.3 Description of the measurement values

2.3.1 Absolute pressure

The device measures absolute pressure P_{abs} . The unit is **hPa** (hectopascal). hPa and mbar are identical. The absolute pressure is mainly used for weather observation: the weather impacts the absolute pressure of the environment (e.g. low-pressure area: The current absolute pressure is lower than the normal one). It is also needed for the calculation of some other units.

Attention: The absolute pressure mustn’t muddled up with the “air pressure at sea level”, given by the meteorological services. For this value the decrease of air pressure because of the elevation is compensated. The device can do this air pressure elevation compensation. Therefore the configuration SEA.L (sea level adjustment) has to be activated (=“on”) and the current altitude above sea level (Alti = altitude) has to be entered to get a correct value. For the calculation a atmosphere of $T_0 = 15^{\circ}\text{C}$ is assumed.

Air pressure – tendency indicator

The tendency of the air pressure (falling or increasing, displayed by blinking arrows in the left part of the display) can be used as an important sign to forecast the weather.

For the calculation of the tendency the device uses the air pressure of the last 4 hours:

“arrow up”: air pressure has increased

“arrow down”: air pressure has decreased

As long as the air pressure is constant (e.g. changing <0.2 mbar/h) no tendency arrow is displayed.

Note: The tendency indicator is designated for a static use at one point.

The mobile use e.g. during a hike does not make sense, because it can not be distinguished between real variations of the air pressure and changes of the air pressure because of altitude differences. If the tendency indicator is used, the auto-off-function should be deactivated. (see “configuration of the device”).

2.3.2 Temperature

The device measures the ambient air temperature T . The selectable units are **°C or °F**.

The temperature sensor is arranged in the protecting probe tube. In order to measure the ambient air temperature as fast as possible the probe tube has big cut-outs. The temperature measurement can be accelerated by swaying the instrument.

2.3.3 Relative Humidity

The device measures the relative humidity F of the air. The unit is **% RH**

This unit shows, how much water the air contains relatively. 100% corresponds with that amount of water the air can maximally contain at the current temperature. More water than 100% is disposed as fog, dew or rime.

Warm air can contain a lot more water than cold air. So the relative humidity falls, if the air is warmed. The relative humidity in addition to the temperature of the room is often used for evaluating a healthful indoor climate.

A relative humidity between minimal 30 to maximal 55 % is normally seen as 'healthful'.

Dryer air increases the risk of acute respiratory disease (also advantages the generation of ozone), more humid air advantages the growth of noxious bacteria and fungi.

The relative humidity is also important if the energy input is concerned: You need a lot more energy to heat humid air than for dry air.

2.3.4 Dew point temperature

The device calculates the dew point temperature T_d . The selectable units are: **°C or °F**.

This temperature states at which temperature the measured air would dispose fog, dew or rime.

This cooling down under this temperature can also take place for example on cold surfaces.

Example: You take a cold bottle from the fridge – the ambient air steams up at the cold bottle surface, because its temperature is lower than the dew point temperature.

2.3.5 Wet bulb temperature

The device calculates the wet bulb temperature T_{wb} . The selectable units are: **°C or °F**.

The wet bulb temperature states, how cold a wet surface gets at the measured ambient air.

Because of evaporation wet surfaces are cooled down to the wet bulb temperature. The dryer the ambient air is, the more a wet surface is cooled down. If the relative humidity of the ambient air is 100%, the surface is not cooled down, the temperature just gets the same than that one of the ambient air. In former times the humidity of the air was measured with psychrometers by means of this effect.

Because of this cool-down effect snow can be formed even at temperatures above 0°C, for this reason the wet bulb temperature is a important value e.g. for snow cannons.

2.3.6 Moisture content

The device calculates the moisture content x of the air. The unit is **g/kg**.

The moisture content states, how many grams water are contained in one kilogram air. This unit is sometimes also called mixture ratio.

2.3.7 Absolute humidity

The device calculates the absolute humidity d of the air. The unit is: **g/m³**.

The absolute humidity states, how many grams water are contained in one cubic metre of the measured air.

By means of this value the influences on the indoor climate can be pointed out concretely.

Following factors adding water to the ambient (among e.g. structural conditions):

Bath	ca. 700g water per hour
Shower	ca. 2500g per hour
Indoor plant	ca. 100...500g per day
Breathing	ca. 100g per hour
Sleep period	ca. 1000g per person
Drying of clothes	ca. 1000...1500g per 4.5 kg clothes

For comparison: 1 cubic metre air at 20°C can maximally contain ca. 17 gram water.

This unit shows very clearly the importance of the right airing for a good living comfort.

If a room is not aired, the ambient air can get too humid very fast. The surplus water is disposed of on cool objects (windows, walls) or badly aired places (room corners). Thus a.o. noxious mildew can grow.

2.4 Additional Functions and Informations

2.4.1 Hiding unwanted display values

By means of the configuration of the “HidE” value a binary coded mask for hiding any of the display values may be entered.

Each value is represented by a corresponding number (e.g. Pressure =1, Temperature = 2, please refer to table below).

If the numbers of all values to be hidden are summed up and entered as “HidE” value, only the remaining displays will be visible. This enables customising of the instrument, the operation may be significantly simplified for special applications.

display	unit	code	example 1	example 2
absolute air pressure	[hPa]	1		1
temperature	[°C] or [°F]	2		
relative humidity	[%]	4		
dew point temperature Td	[°C] or [°F]	8	8	8
wet bulb temperature Twb	[°C] or [°F]	16	16	
moisture content	[g/kg]	32	32	32
absolute humidity	[g/m3]	64	64	64
HidE-code = sum:			120	105

Example 1: Only absolute air pressure, temperature and relative humidity are shown

Example 2: Only temperature, relative humidity and wet bulb temperature Twb are shown

At least on value is always visible.

Setting ex works: no (= code 0): all values are visible.

2.4.2 Measuring rate

The measuring rate is configurable (p.r.t. ‘Configuration of the instrument’). There is the choice of:

FAST: Standard measuring 1 per second. Application for quick response on site measurements

SLo Low Power measuring: 1 per minute. E.g. for permanent operation as weather station (auto power off deactivated: P_oF = oFF)

When using the slow rate the battery life is more than doubled. Assuming the standard zinc carbon batteries the device already runs more than a year. With better batteries (e.g. Lithium) the operation time can even be extended much more.

2.4.3 Calibration services

Calibration certificates can be issued by the factory. For this the device has to be sent to the manufacturer. Just the manufacturer can check the factory settings and correct them if necessary.

2.4.4 System Messages

Er. 1 = measuring range has been exceeded

Er. 2 = meas. value has fallen below permissible range

Er. 3 = display range has been exceeded (>19999)

Er. 4 = meas. value has fallen below displayable range (<-19999)

Er. 7 = System fault - the device has detected a system fault (defective or far outside allowable ambient temperature range)

Er.11 = Sensor error or value could not be calculated.

If the symbol **"LO BAT"** is displayed at the left side of display, the battery is weak, measuring can be continued for a short period.

If **"bAt"** is displayed in the main display the battery is used up and needs to be replaced. Measuring is no more possible.

3 Configuration of the instrument

To configure the instrument proceed as follows:

1. Switch off the instrument.
2. Press the "Mode" key while pressing the "on/off" key shortly.
Keep "Mode" key pressed (ca. 3 sec) until "P oF" appears in the display.

I.) Auto Power Off Time "P oF":

The auto power off time is entered in minutes. If no key is pressed during a measuring, the instrument switches itself off automatically after the entered period of time.

3. Press "up" (also "Mode") or "down" (also "Hold") key, the currently selected time will be displayed (off, 1..120min).
4. Enter the desired time by pressing "up" or "down" key.
Possible input: off: The auto power off function is deactivated (permanent operation).
1...120: auto power off time in minutes.
5. Confirm the value by pressing "On/Off" key: The display shows now "Unit".

II.) Display Unit "Unit":

6. Press "up" or "down" key, the currently selected unit for all temperature values will be displayed:
Temperature unit °C or °F
7. Enter the desired unit by pressing "up" or "down" key.
8. Confirm the unit by pressing "On/Off" key: The display shows now "SEA.L".

III.) Sea Level Adjustment of the barometer display "SEA.L":

The sea level adjustment calculates the air pressure at sea level from the measured air pressure.

9. Press "up" or "down" key, the currently selected state of the sea level adjustment will be displayed.
10. Enter the desired state by pressing "up" or "down" key.
Selectable states are: on/off: sea level adjustment is activated/deactivated.
11. Confirm by pressing "On/Off": The display shows now "CYCL" (SEA.L = off) or "ALti" (SEA.L = on).

IV.) Altitude Input for sea level adjustment "ALti" (only for SEA.L = on):

The current altitude above sea level is entered here.

12. Press "up" or "down" key, the currently selected altitude for sea level adjustment will be displayed.
13. Enter the current altitude by pressing "up" or "down" key:
Selectable values are: -500...9000m.
14. Confirm by pressing "On/Off" key: The display shows now "CYCL".

V.) Cyclic Alternating of the displayed unit "CYCL":

15. Press "up" or "down" key, the currently selected state of the cyclic display will be displayed.
16. Enter the desired state by pressing "up" or "down" key.
Selectable values: off: cyclic display is deactivated, the displayed unit is changed by "unit" key.
2,4: display cycle 2 or 4 seconds.
17. Confirm by pressing "On/Off" key: The display shows now "HidE".

VI.) Hiding unwanted display values "HidE":

17. Press "up" or "down" key, the currently selected HidE code will be displayed.
18. Enter the desired state by pressing "up" or "down" key.
Selectable values are: no: no display value hidden, all values visible
1..126: binary coded value to hide any values
17. Confirm by pressing "On/Off" key: The display shows now "rAtE".

VII.) Measuring Rate "rAtE":

18. Press "up" or "down" key, the currently selected measuring rate will be displayed.
19. Enter the desired state by pressing "up" or "down" key.
Selectable values are: FAST: standard measurement, 1 measurement per second.
Slo: energy-saving measurement, 1 measurement per minute.
20. Confirm pressing "On/Off" key.
21. The vales will be stored, the instrument will restart afterwards.

Please note: If during the configuration no key is pressed within 60 seconds, the configuration will be aborted. Eventually made changes won't be stored!

4 Offset and Slope Adjustments

The values of pressure, humidity and temperature measurement can be readjusted by the adjustment as follows. But please consider: The integrated sensors are highly precise, a readjustment is only needed in very few exceptional cases. On the other hand there can be caused a lot bigger faults by incorrect parameter settings.

If you don't have adequate measuring references, you may consider the details of our calibration service in the chapter before.

The offset and scale adjustment is intended to be used to compensate errors of the internal pressure, humidity and temperature sensors. The display value is given by following formulas:

$$\text{Unit} = \text{°C, hPa, \%}: \text{Display} = (\text{measured value} - \text{offset}) * (1 + \text{scale adjustment}/100)$$

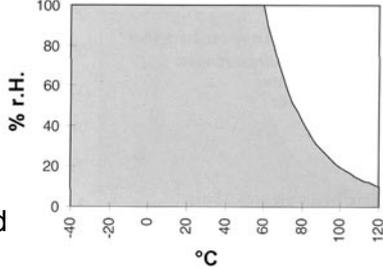
$$\text{Unit} = \text{°F}: \text{Display} = (\text{measured value} - 32\text{°F} - \text{offset}) * (1 + \text{scale adjustment}/100) + 32\text{°F}$$

To adjust a measuring offset and slope proceed as follows:

1. Switch off the instrument.
2. Press the "Hold" key while pressing the "on/off" key shortly.
Keep "Mode" key pressed (ca. 3 sec) until "OFS.P" appears in the display
3. Press "up" or "down" key, the currently selected offset value for pressure measurement (P) will be displayed.
4. Enter the desired offset by pressing "up" or "down" key (max. selectable value: ±5mbar).
5. Confirm the value by pressing "On/Off" key: The display shows now "SCL.P" (slope adjustment P).
6. Press "up" or "down" key, the currently selected slope value for pressure measurement (P) will be displayed.
7. Enter the desired slope by pressing "up" or "down" key (max. selectable value: ±5.00%). The input is displayed in %.
*example: scale adjustment is 1.00 => scale is increased by 1.00% => Scale = 101%.
At a measured value of 1000.0 (without correction) the instrument would show 1010.0.*
8. Confirm the value by pressing "On/Off" key: The display shows now "OFS.t".
9. Press "up" or "down" key, the currently selected offset value for temperature measurement (T) will be displayed.
10. Enter the desired offset by pressing "up" or "down" key (max. selectable values: ±5.0°C or ±9.0°F).
11. Confirm the value by pressing "On/Off" key: The display shows now "SCL.t" (slope adjustment T).
12. Press "up" or "down" key, the currently selected slope value for temperature measurement (T) will be displayed.
13. Enter the desired slope by pressing "up" or "down" key (max. selectable value: ±5.00%). The input is displayed in %.
14. Confirm the value by pressing "On/Off" key: The display shows now "OFS.F".
15. Press "up" or "down" key, the currently selected offset value for humidity measurement (F) will be displayed.
16. Enter the desired offset by pressing "up" or "down" key (max. selectable values: ±5.0%RH).
17. Confirm the value by pressing "On/Off" key: The display shows now "SCL.F" (slope adjustment F).
18. Press "up" or "down" key, the currently selected slope value for humidity measurement (F) will be displayed.
19. Enter the desired slope by pressing "up" or "down" key (max. selectable value: ±5.00%). The input is displayed in %.
20. Confirm the value by pressing "On/Off" key. The values will be stored, the instrument will restart.

Please note: If during the changing of the offset and slope adjust no key is pressed within 60 seconds, the input will be aborted. Eventually made changes won't be stored!

5 Technical Data:

Measuring ranges:	Temperature: -25.0°C ... +70.0 °C or -13.0 ... +158.0 °F Humidity: 0.0 ... 100.0 %RH (recommended range: 11 .. 90 %RH) Air pressure 10.0 ... 1100.0 mbar	
Derived units:	Dew point temperature Td: -40.0 ... 70.0 °C or -40.0 ... +158.0 °F Wet bulb temperature Twb: -27.0 ... 70.0 °C or -16.6 ... +158.0 °F Moisture content x: 0.0 ... 280.0 g/kg Absolute humidity d: 0.0 ... 200.0 g/m ³	
Resolution:	Temperature: 0.1°C or 0,1°F (selectable) Humidity: 0.1% RH Air pressure: 0.1mbar	Working area of humidity sensor: 
Measuring probe:	Temperature: Pt1000 (accuracy 3* better DIN B) Humidity: capacitive polymer humidity sensor Air pressure: piezoresistive pressure sensor hybrid	
Response time:	T90 = 10 sec.	
Accuracy: (±1 Digit) (at nominal temperature = 25°C)	Temperature: ± 0.5% of m.v. ± 0.1°C (Pt1000 1/3 DIN B) Humidity: ± 1.5% linearity, ± 1.5% hysteresis (at range: 11 ... 90 %RH) Air pressure: ± 1.5mbar (750...1100mbar) with calibration certificate WPD: ± 0.5mbar (750...1100mbar)	
Display:	ca. 11 mm high, 4½-digit LCD-display with additional segments for displaying units etc.	
Operation elements:	3 keys for ON/OFF, min-/max-value display, hold	
Operating conditions:	electronics: -25 to 70°C; 0 to 80% RH (non-condensing) sensors: -25 to 70°C; 0 to 100% RH; max. 4000 mbar abs.	
Power supply:	9V-battery type IEC 6F22 (in scope of supply)	
Power consumption: (depend. on mode, selectable)	ca. 75µA at 1 measuring / s (mode FAST) ca. 30µA at 1 meas. / 60s: (mode Slo) standard battery life > 1 year	
Low battery warning:	"BAT" automatically displayed if battery is low	
Auto off function:	when Auto Off is activated, the device switches automatically off, if keypad is not attended for a longer time (selectable 1..120min).	
Min-/Max-value memory:	Min and max measured values are stored for all measuring ranges.	
Hold key:	the current measuring will be "frozen" (all ranges).	
Configurable display:	The device can be configured by the user: display all measuring values alternating (2 or 4 sec. Cycle) or permanent with manual choice. Not required values can be suppressed.	
Sea level adjustment:	The displayed value of the barometer can be converted to air pressure at sea level (therefore the altitude above sea level has to be entered)	
Tendency indicator:	for barometer: air pressure falling/increasing	
Offset- and scale:	digital offset- and scale adjustment of measurements	
Housing:	impact resistant ABS-housing: approx. 106 x 67 x 30 mm (HxWxD), in addition, sensor head protruding vertically, length 35 mm, diameter 14 mm, overall length 141 mm.	
Weight:	approx. 130g incl. battery	
EMC:	The device corresponds to the essential protection ratings established in the Regulations of the Council for the Approximation of Legislation for the member countries regarding electromagnetic compatibility (2004/108/EG). Additional fault: <1%	