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EN

GREISINGER electronic GmbH

Operating Manual Precision Thermometer
Pt100 4-Wire GMH 3750

as of Version 1.8

CE

Made in Germany

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Contents

1 Intended Use

The GMH 3750 is a precision thermometer for the measurement of the temperature with exchangeable 4-wire Pt100 temperature sensors. With high resolution and precision temperature values can be measured from -200 to 850 °C.
The device is to be protected against wetness and soiling and has to be stored and operated only within the permissible environmental conditions and connection data (see “Specification”).

2 General Advice

Read through this document attentively and make yourself familiar to the operation of the device before you use it. Keep this document in a ready-to-hand way in order to be able to look up in the case of doubt.

3 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.

1. 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”.
   Transporting the device 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.
2. The circuitry has to be designed most carefully, especially if the device should be connected to other devices. Internal connection in third party devices (e.g. connection GND and earth) may result in not-permissible voltages impairing or destroying the device or another device connected.
3. **Warning:** Operating the device with a defective mains power supply (e.g. short circuit from mains voltage to output voltage) may result in hazardous voltages at the device (e.g. at sensor socket)
4. Whenever there may be 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 for a longer time
     In case of doubt, please return device to manufacturer for repair or maintenance.
5. **Warning:** Do not use these product as safety or emergency stop device, 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.

4 Operating and Maintenance

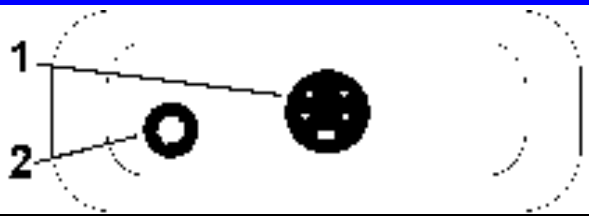
- **Battery Operation**
  The battery has been used up and needs to be replaced, if „bAt“ are shown in lower display.
  The device will, however, continue operating correctly for a certain time.
  The battery has been completely used up, if ´bAt´ is shown in the upper display.
  The battery has to be taken out, when storing device above 50°C.

Hint: We recommend to remove the battery if device is not used for a longer period of time!

- **Mains Operation**
  Attention: When using a power supply unit please note that operating voltage has to be 10.5 to 12 V DC. Do not apply overvoltage!! Simple 12V-power supplies often have excessive no-load voltage. We, therefore, recommend using regulated voltage power supplies. Trouble-free operation is guaranteed by our power supply GNG10/3000.
  Prior to connecting the plug power supply with the mains supply make sure that the operating voltage stated at the power supply is identical to the mains voltage.
- Treat device and probes carefully. Use only in accordance with above specification. (do not throw, hit against etc.). Protect plugs and sockets from soiling.
- To disconnect sensor plug do not pull at the cable but at the plug.
- When connecting the probe the plug will slide in smoothly if plug is entered correctly.

Selection of Output-Mode: The output can be used as serial interface or as analogue output. This choice has to be done in the configuration menu.

5 Connections



1 Probe connection: 4 pole Mini-DIN-Socket, for Pt100 4-wire probes (see also chapter 10)

2 Output: 3-pole stereo phone socket Ø3mm
Operation as interface: Connection to optically isolated interface adapter (accessory: USB 3100, GRS 3100, ..)
Operation as analogue output: Connection via suitable 2pole cable.
Attention: The output mode has to be configured (see chapters 8, 9.6) and influences battery life!

The **mains socket** is located at the left side of the instrument

6 Display- and Button Elements

a) Display Elements

1 Main Display: Currently measured temperature

2 Auxiliary Display: Display of min, max or hold values

Special display elements:

3 Min/Max/Hold: shows if a min., max. or hold value is displayed in the auxiliary display

4 „Offset“ arrow: indicates that zero point offset is activated

5 „Corr“ arrow: indicates that a scale correction is activated

6 „Logg“ arrow: Shown if logger function is selected, flashes if cyclic logger is running

7 „Alarm“ arrow: Flashes if alarm is present

b) Pushbuttons and Operation

Key 1:
On/Off

Key 2:
press shortly: maximum measured value will be displayed
press for 2 sec.: the max. value will be deleted

Key 3:
Function only during configuration: Selection of menu-parameter

Key 4:
press (Menu) for 2 sec.: configuration will be activated

Key 5:
press shortly: minimum measured value will be displayed
press for 2 sec.: the min. value will be deleted

Key 6:
Measurement: Hold current measuring value ('HLD' in display) or operation of logger functions (p.r.t. Chapter 12)

7 Start of Operation

Connecting Temperature probe to the instrument.
Switch instrument on with key 1 „ON OFF”
The device is ready to measure.

8 Device Configuration

Note: Some menu items will be shown depending on the actual device configuration (e.g. some items are disabled when the logger contains data). Please note the hints by the menu items.

Enter Configuration:	Set Menu	Press for 2 seconds. The main menu will be shown SEt ConF or rEAd LoGG
Navigation:	Set Menu	choose menu branch (*1)
	Tara ►	choose the parameter (*2)
	▲ max / min ▼	edit the parameter values (*2)
	Set Menu	Stores the settings, jumps back to the main menu
	Store Quit	Stores the settings, leaves configuration

Menu(*1)	Parameters/Values (*2)		Meaning	p.r.t.	
Set Menu	Tara ►	▲ max / min ▼			
rEAd LoGG	**Read Logg: single value-logger read out (only when data existing! Please refer to chapter 12)**			**12**	
SEt ConF	**Set Configuration: Generic Settings**				
	Unit	**°C:**	All temperature values are in degrees Celsius	*	
		°F:	All temperature values are in degrees Fahrenheit		
	rES	**0.1° / 0.01°:**	Resolution 0.1° / 0.01°	*	**9.1**
		Auto:	Resolution is selected automatically		
	LIn	**E.751**	characteristic curve according to EN60751	*	**9.2**
		USEr	User sensor curve (Predefined to EN60751 values, changeable by software GMHKonfig)		
	OFFS	**-2.50...2.50°C / -4.50...4.50°F**	Zero correction	*	**9.3**
		oFF:	Zero displacement inactive (=0.0°)		
	SCAL	**-2.000...2.000:**	Scale correction [in %]	*	**9.4**
		oFF:	Scale correction factor inactive (=0.000)		
	t.AVG	**1...30:**	Average filter (period in seconds)	*	**9.5**
		oFF:	Average filter inactive		
	P.oFF	**1...120**	Power-off delay in minutes. Device will be automatically switched off as soon as this time has elapsed if no key is pressed or no interface communication takes place		
		oFF	Power-off function inactive (continuous operation)		
	Out	**oFF:**	No output function		**9.6**
		SEr:	Output is serial interface		
		dAC:	Output is analogue output		

	Adr.	**01,11..91**	Base address of device for interface communication		**9.6**
	dAC.0	**-200..850°C / -328...1562°F**	Zero point of analogue output: Temperature at which the analogue output potential should be 0V		**9.6**
	dAC.1	**-200..850°C / -328...1562°F**	Scale of analogue output : Temperature value at which the analogue output potential should be 1V		**9.6**
	**Set Alarm: Setting of Alarm Function**				
	AL.	**On / No.So**	Alarm on with horn-sound / Alarm on without horn-sound		**9.7**
		OFF	no alarm function		
	AL.Lo	**-200°C ... AL.Hi**	Min alarm rail (not when AL. oFF)		
	AL.Hi	**AL.Lo ... 850°C**	Max alarm rail (not when AL. oFF)		
	**Set Logger: Setting of Logger Function**				
	Func	**CYCL**	**Cyclic**: logger function cyclic logger	*	**12**
		Stor	**Store**: logger function individual value logger		
		OFF	No logger function		
	CYCL	**0:01... 60:00**	Cycle time of cyclic logger [minutes:seconds]	*	**12**
	**Set Clock: Setting of Real Time Clock**				
	CLOC	**HH:MM**	**Clock**: Setting of time hours:minutes		**9.8**
	YEAr	**YYYY**	**Year**		
	dAtE	**TT.MM**	**Date**: day.month		

(*) If the logger memory contains data already, the menus/parameters marked with (*) can not be invoked! If these should be altered the logger has to be stopped and the memory has to be cleared before!

Hint: Restoring of ex-works settings
The settings will be set to the settings ex works, if keys ‘Set‘ and ‘Store‘ are pressed simultaneously for more than 2 seconds.

9 Special Functions

9.1 Display Resolution

Standard setting: 'Auto', i.e. the device automatically switches over to the optimum resolution between .01° and 0.01°.
If temperatures to be measured are near the switching threshold, a fixed resolution may be better, e.g. for easy manual recording. In such a case please set the optimum resolution to the desired value.

9.2 User Sensor Curve ('Lin USEr')

By means of this function besides the standard conversion of resistance to temperature following EN60751(Lin E.751) also other curves can be used. The user sensor curve can be read and edited by the configuration software GMHKonfig. The standard setting ex works is also set to the EN60751 data. The curve is defined by a table with two columns (input resistance[Ohm]/output temperature [°C]) with 50 rows.
Info: the sensor curve following EN60751 uses the international temperature scale ITS90 and following formulas:.

Temperatures < 0°C:

$$R_{neg}(T) := 100 \cdot [1 + 3.9083 \cdot 10^{-3} \cdot T - 5.775 \cdot 10^{-7} \cdot T^2 - 4.183 \cdot 10^{-12} \cdot (T - 100) \cdot T^3]$$

Temperatures >= 0°C:

$$R_{pos}(T) := 100 \cdot (1 + 3.9083 \cdot 10^{-3} \cdot T - 5.775 \cdot 10^{-7} \cdot T^2)$$

Please notice: ***Temperature measurements with the user sensor curve are allowed only within the temperature range which has been used to generate the user sensor curve. Measuring with activated user sensor curve beyond the checked temperature range may lead to larger errors. Therefore the sensor curve acc. to EN 60751 (Lin E.751) has to be used for temperature measurements beyond the checked temperature range.***

9.3 Zero Displacement ('Offset')

The zero displacement is used to adjust the measuring display for probe deviations.

temperature displayed = temperature measured - offset

Standard setting: 'off' = 0.0°, i.e. no zero displacement will be carried out. Together with the scale correction (see below) this factor is mainly used to compensate for sensor deviations.
Unless the factor is set to 'off', the offset arrow in the display shows an active zero displacement.*)

9.4 Scale Correction ('Scale')

The scale correction is used to adjust the measuring display for probe deviations. (factor is in %):

displayed temperature[°C] = measured temperature[°C] * (1+Scal/100)

or: displayed temperature[°F] = (measured temperature [°F]-32°F) * (1+Scal/100) + 32°F

Standard setting: 'off' =0.000, i.e. temperature is not corrected.
Unless the factor is set to 'off', the Corr arrow in the display shows an active scale correction.*)*

) The standard curve (Lin E.751) and the user sensor curve (Lin USEr) posses separate correction settings.

9.5 Average filter („t.AuG“)

The filter forms the arithmetic floating average over the entered time. The displayed value will be correspondingly slower in this case.

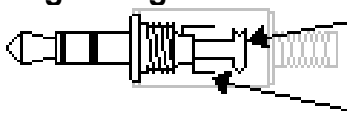
9.6 Output („Out“)

The output can be either used as serial interface (for USB 3100, GRS 3100 or GR S3105 interface converters) or as analogue output (0-1V). If none of both is needed, we suggest to switch the output off, because battery life then is extended

a) Operation as analogue Output („Out dAC“)

With the DAC.0 and DAC.1 values the output can be rapidly scaled to Your efforts.
Example: -50°C ... 250°C should correspond to 0 ... 1V at the output
Set “DAC.0” to –50.00°C and “DAC.1” to 250.0°C -> finished.
Keep in mind not to connect low-resistive loads to the output, otherwise the output value will be wrong and battery life is decreased. Loads above ca 10kOhm are uncritical.
If the display exceeds the value set by DAC.1, then the device will apply 1V to the output
If the display falls below the value set by DAC.0, then the device will apply 0V to the output
In case of an error (Err.1, Err.2, no sensor, etc.) the device will apply slightly above 1V to the output.

Plug wiring:



Attention!
The 3rd contact has be left floating
Only stereo plugs are allowed!

b) Operation as interface („Out SEr“)

By using an electrically isolated interface converter USB 3100, GRS 3100 or GRS 3105 (accessory) the device can be connected to a PC.
Configure Base address ('Adr.'): With the GRS 3105 it is possible to connect up to 5 instruments to a single interface. In this case the devices have to have different addresses, eg. Device 1: address 01, device 2: address 11, device 3: address 21 ...
In order to avoid transmission errors, there are several security checks implemented (e.g. CRC).
The following standard software packages are available for data transfer:

- **EBS9M**: 9-channel software to record and display the measuring values
- **GSOFT3050**: operation and read out software for devices of GMH3000 series with logger
- **GMHKonfig**: free set-up software

In case you want to develop own software we offer a **GMH3000-development package** including

- An universally applicable Windows function library ('GMH3000.DLL') with documentation that can be used by all serious programming languages. Applicable for Windows 95 / 98™, Windows NT™, Windows2000™, Windows XP™ and VISTA
- Programming examples for Visual Basic 6.0™, Delphi 1.0™, Testpoint™, Labview™ and others

Supported interface functions with 'GMH3000.DLL' :

code	name / function	code	name / function
0	Read nominal values	201	Read max. display range
3	Read system status	202	Read unit of display
6	Read min. values	204	Read decimal point of display
7	Read max values	208	Read channel count
12	Read ID-no	214	Read scale correction
22	Read min. alarm rail	215	Set scale correction
23	Read max. alarm rail	216	Read zero displacement
32	Read configuration flag	217	Set zero displacement
	Alarm function: 1, Alarm horn: 3	222	Read power – off time
	BitLoggerOn: 50, BitCyclicLogger: 51	223	Set power – off time
102	Set min. alarm rail	224	Logger: read data cyclic logger
103	Set max. alarm rail	225	Logger: read cycle time (LoGG - CYCL)
160	Set configuration flag (see 32)	226	Logger: set cycle time (LoGG - CYCL)
174	Delete min. value	227	Logger: start recording
175	Delete max. value	228	Logger: read # of data
176	Read min. measuring range	229	Logger: read status
177	Read max. measuring range	231	Logger: read stop time
178	Read measuring range unit	233	Read real time clock (CLOC)
179	Read measuring range decimal point	234	Set real time clock (CLOC)
180	Read measuring type	236	Read logger memory size
194	Set display unit	240	Reset
199	Read measuring type in display	254	Read program identification
200	Read min. display range	260	Logger: read data manual logger

Note: The measuring and display range values read via interface are always in the selected display unit (°C/°F)!

9.7 Alarm („AL.“)

There are three possible settings:
Alarm off (AL. oFF), on with horn sound (AL. on), on without horn sound (AL. no.So).
Following conditions will display an alarm, when the function is activated (on or no.So):

- Value is below lower (AL. Lo) or above upper alarm rail (AL.Hi).
- Sensor error
- Low battery (bAt)
- Err.7: System error (always with sound)

In case of an alarm and when polling the interface the “prio”-flag is set in the returned message.

9.8 Real Time Clock („CLOC“)

The real time clock is used for the logger function: Recorded values are also containing the point of time, when they were measured. Please check the settings when necessary.
If the battery was replaced the referring menu ‚CLOC‘ will automatically be started

10 Probe Connection

The device is constructed and optimised for the connection of a **Pt100 4-wire probe** via 4 pole Mini-Din connectors.

4-wire connection

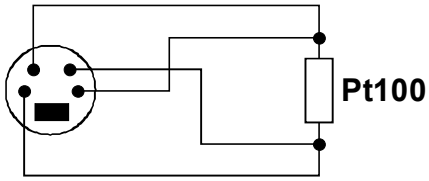
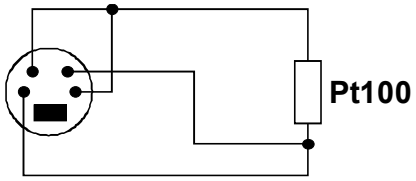


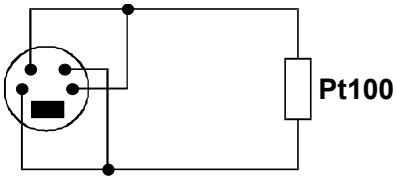
Figure shows upon probe jack pins

It is also possible to connect an **3- or 2-wire probe** to the device. Please observe that in consequence of the cable and contact resistance an increased measuring fault will occur.
The connection of this probes should be carried out as follows:

3-wire connection



2-wire connection



11 Calibration Services

Factory calibration certificate - DKD certificate - official certifications
If the measuring instrument is supposed to receive a factory calibration certificate, it has to be sent to the manufacturer. (declare test levels, e.g. –20°C, 0°C; 70°C).
If the factory calibration certificate is issued for the instrument including a probe, extremely high precision can be achieved.
Just the manufacturer can check the factory settings and correct them if necessary.

12 Operation Of Logger

The device supports two different logger functions:

„Func-Stor“: manual recording via keypress “Store” (key 6).

„Func-CYCL“: automatic recording with the selected recording interval/cycle

The logger records 1 measurement result each time

The data set consists of: - measuring value at time of recording
- time and date of recording

For the read out and evaluation of the data the software GSOFT3050 (V1.7 or higher) has to be used. The software also allows easy configuration and starting of the logger.

When the logger is activated (Func Stor or Func CYCL) the hold function is no longer available, key 6 is solely used for the operation of the logger functions.

12.1 Storing Single Measurements („Func-Stor“)

a) Record Measuring:

If the logger function “Func Stor” was activated (see chapter 8 “Device Configuration”), up to 99 measuring data sets can be recorded manually.

Store Quit **Press shortly:** Data set will be recorded (“St. XX” will be shown shortly. XX is the number of the data set)

If the logger memory is full, the display will show: 

b) Viewing Recorded Measurings:

Stored data sets can be either read out via PC Software GSOFT3050, or be viewed in the display directly.

Set Menu **Press for 2 seconds:** The display will show: 

Please note: ”rEAd Logg” only appears, if there are already data stored! If memory is empty, the configuration menu  will show.

Tara ►	Press shortly: Changing between measuring value and date+time of data set
▲ max or min ▼	Changing between the data sets
Store Quit	Exit logger data display

c) Clear recorded measurings:

If there are already data sets stored, these can be deleted via the store key:

Store Quit **Press for 2 seconds:** Calling of clear-Menu

Change selection by: ▲ max or min ▼:

	Clear nothing (cancel menu)
	Clear all recordings
	Clear the last recording

Store Quit Stores the settings

12.2 Automatic Recording With Selectable Cycle Time „Func CYCL“

If the logger function “Func CYCL” was activated (see chapter 8 “Device Configuration”), and the logger was started, it automatically records data sets at intervals of the selected logger cycle time The logger cycle time is selectable from 1s to 60min (see chapter 8 “Device Configuration”).

Max. number of measurings: 16384

a) Starting a recording:

Store Quit **press for 2 seconds:** the recording will be started.

Each recodring is signales with a short diplay of ‘St.XXXXX’. XX is the number of the data set.
If the logger memory is full, the display will show 

b) Stop the recording:

Store Quit **Press for 2 seconds:** If a recording is running, the Stop menu will be shown

Change selection by: max or min:

 Do not stop the recording

 Stop the recording

Store Quit Stores the settings

Note: ***If you try to switch off the instrument in the cyclic recording operation, You will be asked automatically if the recording should be stopped.***
The device can only be switched off after the recording has been stopped!
The Auto-Power-Off-function is deactivated during recording!

c) Clear recorded measurings:

Store Quit **Press for 2 seconds:** If logger data are present and the recording was stopped, the clear menu will be shown

Change selection by: max or  :

 Clear nothing
(cancel menu)

 Clear all recordings

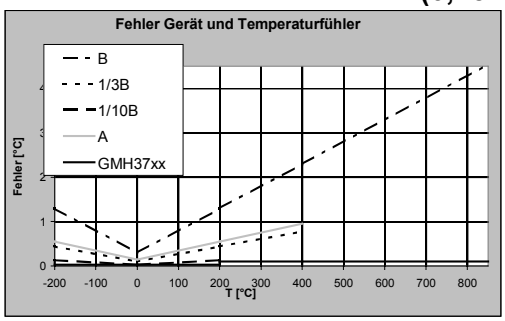
Store Quit Stores the settings

13 Some Basics Of Precision Temperature Measuring

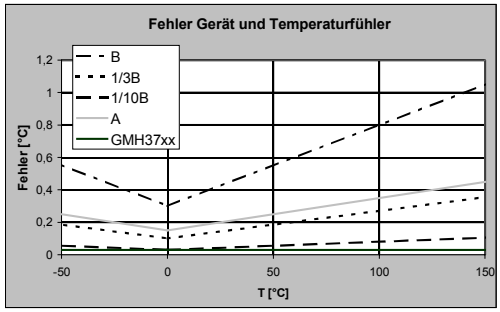
Probe Precision/Device Precision

The device is very precise (please refer to technical data). To be able to use this high precision, the connected temperature probe has to be as precise as possible, too. The following precision classes are available as a standard at reasonable prices (Platinum resistor thermometers according to EN60751):

Class	Error ranges
B	**± (0,3 + 0,005 • | Temperature |)**
1/3 B (=1/3 DIN)	**± (0,1 + 0,0017 • | Temperature |)**
1/10 B (=1/10 DIN)	**± (0,03 + 0,0005 • | Temperature |)**
A	**± (0,15 + 0,002 • | Temperature |)**



Error over measuring range



Error over range –50...150°C

For applications demanding higher precision than given by this classes we suggest to adjust the device to the used probe or to get a calibration certificate for the device combined with the probe.

Attention: if an adjusted or calibrated probe is replaced, also the adjustment or calibration certificate has to be renewed to maintain the referring overall precision! Be careful when buying third party temperature probes: Besides the standard EN60751 there are some other obsolete or unusual standards on the market. If such a probe has to be connected, the user sensor curve (have a look to the referring chapter) can be used to adjust the instrument!

4-Wire-Measuring

When using resistance thermometers as the Pt100 a quite large measuring error can be caused by inadequate cables and connections. Using 4wire measuring avoids this kinds of errors mainly caused by unwanted resistances. It is suggested to use suitable probes and extensions only. (For pin assignment please refer to chapter 7)

Heat loss caused by probe construction:

Especially when measuring temperatures which deviate very much from the ambient temperature, measuring errors often occur if the heat loss caused by the probe is not considered. When measuring fluids therefore the probe should be emerged sufficiently deep and be stirred continuously. When measuring gases the probe should also emerge as deep as possible in the gas to be measured (e.g. when measuring in channel/pipes) and the gas should flow around the probe at sufficient flow.

Measuring Surface Temperature

If temperature of the surface of an object has to be measured, one should pay attention especially when measuring hot (or very cold) surfaces, that the ambient air cools (or heats) the surface. Additionally the object will be cooled (or heated) by the probe or the probe can have a better heat flow to the ambient temperature as to the objects surface. Therefore specially designed surface probes should be used. The measuring precision depends mainly on he construction of the probe and of the physics of the surface itself. If selecting a probe try to choose one with low mass and heat flow from sensor to handle. Thermally conductive paste can increase the precision in some cases.

Allowable temperature Range Of Probes

Pt100 Sensors are defined over a wide temperature range. Depending on probe materials and sort of sensor (e.g. hybrid sensors, wire wound resistors...) the allowable temperature ranges have to be considered. Exceeding the ranges at least causes a wrong measuring, it may even damage the probe permanently!

Often it also has to be considered, that the temperature range is just valid for the probe tube, (plastic-) handles can't stand the same high temperatures. Therefore the tube length should be selected long enough, that temperature keeps low at the handle.

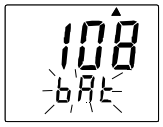
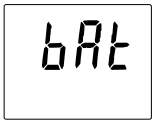
Self Heating

The measuring current of the instrument is just 0.3mA. Because of this comparably low current practically now self heating effect has to be considered, even at air with low movement the self heating is <= 0.01°C.

Cooling by Evaporation

When measuring air temperature the probe has to be dry. Otherwise the cooling due to the evaporation causes too low measuring.

14 Fault and System Messages

Display	Meaning	Remedy
	Low battery voltage, device will continue to work for a short time	Replace battery
	If mains operation: wrong voltage	Check/replace power supply, if fault continues to exist: device damaged
	Low battery voltage	Replace battery
	If mains operation: wrong voltage	Check/replace power supply, if fault continues to exist device damaged
No display Or Weird display Device does not react on keypress	Low battery voltage	Replace battery
	If mains operation: wrong voltage	Check/replace power supply, if fault continues to exist device damaged
	System error	Disconnect battery or power supply, wait some time, re-connect
	Device defective	Return to manufacturer for repair
----	Sensor error, no sensor connected	Connect sensor to socket
	Sensor/cable or device defective	Return to manufacturer for repair
Err.1	Value exceeding measuring range	Check: Is the value exceeding the measuring range? Temperature too high!
	Wrong probe connected	Check probe
	Sensor/cable defective	Replace
Err.2	Value below display range	Check: Is the value below the measuring range? Temperature too low!
	Wrong probe connected	Check probe
	Sensor/cable defective	Replace
Err.3	Value exceeding display range	Set resolution to 0.1° or Auto
Err.4	Value below display range	Set resolution to 0.1° or Auto
Err.7	System error	Return to manufacturer for repair

15 Disposal notes

Dispense exhausted batteries at destined gathering places.
This device must not be disposed as ‘residual waste’.
To dispose this device, please send it directly to us (adequately stamped).
We will dispose it appropriately and environmentally friendly.

16 Specification

Supported probes	Pt100 4-wire (2 or 3-wire possible)			
Sensor Curve	According to EN60751 or with user-sensor curve (table of 50 rows)			
Probe connection	4pole Mini-DIN socket			
Measuring Ranges	**0,01°C:**	**0,1°C:**	**0,01°F:**	**0,1°F:**
	-199,99...199,99	-200,0...850,0	-199,99...199,99	-328,0...1562,0
Precision without probe	±1Digit (at nominal temperature) **Range 0,01°C/F:** ±0,03°C / 0,06°F **Range 0,1°C/F:** ±0,1°C / ±0,2°F			
Measuring	4-wire measuring with thermovoltage compensation, measuring current 0.3mA			
Temperature drift	<=0.002K pro 1K			
Nominal temperature	25°C			
Ambient	Temperature -25 ... +50°C (-13 .. 122°F) Relative humidity 0 bis 95%r.F. (not condensing)			
Storage temperature	-25 ... +70°C (-13 .. 158°F)			
Housing	impact-resistant ABS plastic housing, membrane keyboard, transparent panel. Front side IP65,integrated pop-up clip for table top or suspended use.			
Dimensions	142 x 71 x 26 mm (L x B x D)			
Weight	Approx. 155 g			
Output	3.5mm audio plug, stereo			
either serial interface:	via optically isolated interface adapter USB 3100, GRS 3100 or GRS 3105 (accessory) connectable to PCs with USB- or RS232-interfaces.			
or analogue output:	0..1V, freely scaleable (resolution 13bit, accuracy 0.05% at nominal temperature, cap. load <1nF)			
Min/Max-Alarm	The measuring value is constantly monitored for the min and max rails. Alarming is done by integrated horn, display and interface			
Real time clock	Integrated clock with date and year			
Logger:	2 Functions: individual value logger („Stor“) and cyclic logger („CYCL“)			
Memory	Stor: 99; CYCL: 16384			
Cycle time CYCL	0:01...60:00 (minutes:seconds, min 1s, max 1h)			
Power Supply	9V-Battery, type 6F22 (included) as well as additional d.c. connector (diameter of internal pin 1.9 mm) for external 10.5-12V direct voltage supply. (suitable power supply: GNG10/3000)			
Power Consumption	Output off	ca. 0,90mA		
	Output serial interface	ca. 1,15mA		
	Analogue output	ca. 1,25mA		
Display	Two 4 ½ digits LCD’s (12.4mm and 7 mm high), additional segments			
Pushbuttons	6 membrane keys			
Min-/Max Value Memory	Both the max. and the min. value will be memorised			
Hold function	Press button to store current value.			
Automatic-Off-Function	Device will be automatically switched off if not operated for longer time (adjustable from1..120min)			

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) EN61326 +A1 +A2 (Appendix B, class B), additional error: < 1% FS