**SIKA®**

# Operating Manual

# Precision Thermometer
# MH 3750
**from Version 1.0**

## For Pt100 4-Wire Temperature Probes



CE

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# 1 In General

## 1.1 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".
2. 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.
3. If device is to be connected to other devices the circuitry has to be designed most carefully. 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.
4. **Warning:** If device is operated with a defective mains power supply (e.g. short circuit from mains voltage to output voltage) this may result in hazardous voltages at the device (e.g. at sensor socket)
5. 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 for a longer time
   
   In case of doubt, please return device to manufacturer for repair or maintenance.
6. **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.

## 1.2  How to Operate And Maintain Device

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

  *Hint: We recommend to take out 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.

## 1.3  Connections
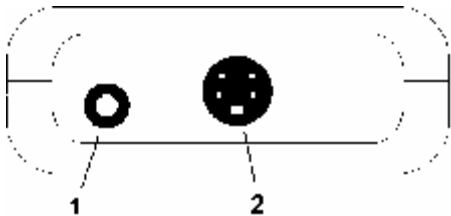


1. **Output:** Operation as interface: Connect to optically isolated interface adapter (accessory: GRS 3100 or GRS3105)
   Operation as analogue output: Connection via suitable cable.
   Attention: The output mode has to be configured (p.r.t. 2.7) and influences battery life!

2. **Probe connection** Pt100 4-wire
3. The **mains socket** is located at the left side of the instrument

## 1.4  Display Elements



| | | |
|---|---|---|
| 1 = | **Main Display:** | Currently measured temperature |
| 2 = | **Auxiliary Display:** | Display of min, max or hold values |

**Special display elements:**

| | | |
|---|---|---|
| 3 = | **Warning triangle:** | indicates a low battery |
| 4 = | **Corr-arrow**: | indicates that correction factor is activated |
| 5 = | **Offset-arrow**: | indicates that zero point offset (offset) is activated |
| 6 = | **Min/Max/Hold**: | shows if a min., max. or hold value is displayed in the secondary display |
| 7 = | **Alarm-arrow**: | Flashes if alarm is present |
| 8 = | **Logg-arrow**: | Shown if logger function is selected, flashes if cyclic logger is running |

## 1.5  Pushbuttons



| | |
|---|---|
| **key 1:** | **On/Off key** |
| **key 4:** | **Set/Menu** |
| | press (Menu) for 2 sec.: configuration will activated |
| **keys 2, 5:** | **min/max when taking measurements:** |
| | press shortly: min. or max. measuring value will be displayed |
| | press for 1 sec.: the min. or max. value will be deleted |
| | **up/down for configuration:** |
| | to enter values or change settings |
| **key 6:** | **Store/Quit** |
| | - Measurement: Hold current measuring value ('HLD' in display) or operation of logger functions (p.r.t. Chapter 5) |
| | - Menu: Acknowledge setting, return to measuring |
| **key 3:** | **When taking measurements**: no function |
| | **During configuration**: Selection of menu-parameter |

# 2 Device Configuration

For configuration of the device press "**Menu**"-key (key 4) for 2 seconds, the main menu will be shown (main display: "SEt"). Choose the desired menu branch by pressing the "**Menu**"-key (key 4). By pressing "4" (key 3) the referring parameters can be chosen. The referring values are changed by pressing the keys "5" (key 2) or "6" (key 5) (Choice of parameter: "4").

Pressing **"Menu"** (key 4) again will jump back to the main menu selection and stores the settings.

Use key "**Quit**" (key 6) to leave configuration.

| Menu | Parameter | Values | Meaning | | |
|---|---|---|---|---|---|
| key **Menu** | key 4 | key 5 or 6 | | | p.r.t. |
| **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°: | Resolution 0.1°C | * | 4.1 |
| | | 0.01°: | Resolution 0.01°C | | |
| | | Auto: | Resolution is selected automatically | | |
| | Lin | E.751 | Measuring / sensor curve according to EN60751 | * | 4.2 |
| | | USEr | User sensor curve (Predefined to EN60751 values, changeable by software MHKonfig) | | |
| | OFFS | -2.50°C..2.50°C  resp. -4.50°F...4.50°F | The zero point of the measurement will be displaced by this value to compensate for deviations in the probe or in the measuring device. | * | 4.3 |
| | | oFF: | Zero displacement inactive (=0.0°) | | |
| | SCAL | -2.000...2.000: | The scale of the measuring will be changed by this factor (in %) to compensate deviations of temperature probe or measuring device | * | 4.4 |
| | | oFF: | Scale correction factor inactive (=0.000) | | |
| | 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/no interface communication takes place | | |
| | | oFF | Power-off function inactive (continuous operation, e.g. mains operation) | | |
| | Out | oFF: | Function of the output: No output function, lowest power consumption | | 4.5 |
| | | SEr: | Output is serial interface | | |
| | | dAC: | Output is analogue output 0...1V | | |
| | Adr. | 01,11..91 | Base Address when Output = Serial Interface : Base address of device for interface communication. | | 4.5.1 |
| | dAC.0 | -200.0...850.0°C resp. -328.0...1562.0°F | Output offset when output = analogue output: (depending on selected unit) Input of the temperature at which 0V should be output | | 4.5.2 |
| | dAC.1 | -200.0...850.0°C resp. -328.0...1562.0°F | Output scale when output = analogue output: (depending on selected unit) Input of the temperature at which 1V should be output | | 4.5.2 |
| **SEt AL.** | **Set Alarm: Settings Of Alarm Function** | | | | |
| | AL. | on | **Alarm** on, with horn-sound | | 4.6 |
| | | no.So | Alarm on, without horn-sound | | |
| | | oFF | no alarm function | | |
| | AL.Lo | min range ...AL.Hi | Min alarm rail (not when AL. oFF) | | |
| | AL.Hi | AL.Lo ...max range | Max alarm rail (not when AL. oFF) | | |
| **SEt LoGG** | **Set Logger: Configuration Of Logger Function** | | | * | |
| | Func | CYCL | **Cyclic**: logger function ‚cyclic logger‘ | * | 5 |
| | | Stor | **Store**: logger function ‚individual value logger‘ | | |
| | | oFF | no logger function | | |
| | CYCL | 0:01..60:00 | Cycle time of cyclic logger [minutes:seconds] | * | 5.2 |
| **SEt ClOC** | **Set Clock: Setting Of Real Time Clock** | | | | |
| | ClOC | HH:MM | **Clock**: Setting of time  hours:minutes | | 4.7 |
| | YEAr | YYYY | **Year** | | |
| | dATE | TT.MM | **Date**:                    day.month | | |

*Hint:* *If keys 'Set' and 'Store' are pressed simultaneously for more than 2 seconds, the settings are reset to the settings ex works*

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

# 3  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\|) |
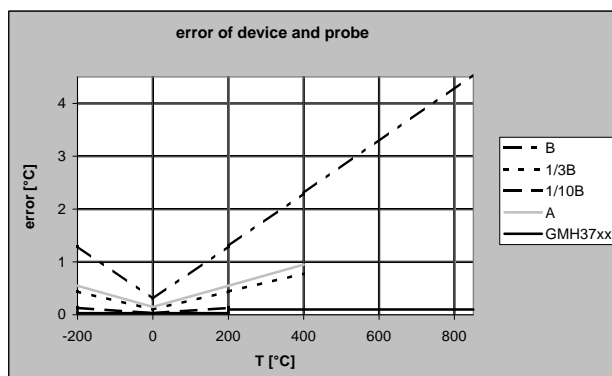


*Error over measuring range Pt100*
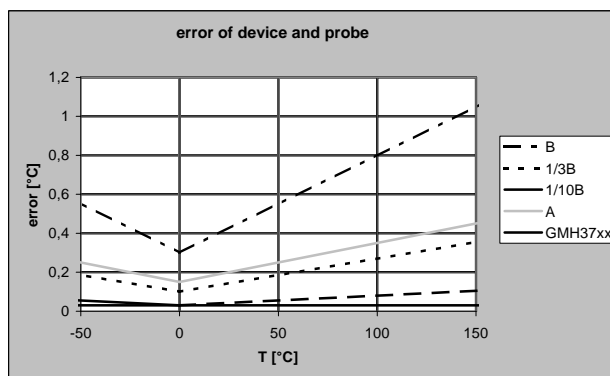


*Error over range –50...150°C Pt100*

  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.

- **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 cold due to the evaporation causes too low measurings.

# 4 Special Functions

## 4.1 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 recording. In such a case please select the optimum resolution manually.

## 4.2 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 MHKONFIG. 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: $\quad R_{neg}(T) := 100\left[1 + 3.9083\,10^{-3}{\cdot}T - 5.775\,10^{-7}{\cdot}T^2 - 4.183\,10^{-12}{\cdot}(T - 100){\cdot}T^3\right]$

Temperatures >=0°C: $\quad R_{pos}(T) := 100\left(1 + 3.9083\,10^{-3}{\cdot}T - 5.775\,10^{-7}{\cdot}T^2\right)$

## 4.3 Zero Displacement ('Offset')

A zero displacement can be carried out for the measured temperature:

**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.

## 4.4 Scale Correction ('Scale')

The scale of the measuring can be influenced by this setting (factor is in %):

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

Standard setting: 'off' =0.000, i.e. temperature is nor corrected. Together with the zero displacement (see above) this factor is mainly used to compensate for sensor deviations.
Unless the factor is set to 'off', the Corr arrow in the display shows an active scale correction.

## 4.5 Output

The output can be used as serial interface (for GRS3100 or GRS3105 interface adapters) 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.

### 4.5.1 Interface - Base Address ('Adr.')

By using an electrically isolated interface converter GRS3100 or GRS3105 (accessory) the device can be connected to a PC. With the GRS3105 it is possible to connect up to 5 instruments to a single interface (please also refer to GRS3105-manual). As a precondition the base addresses of all devices must not be identical. In case several devices will be connected via one interface make sure to configure the base addresses accordingly. 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
§ **EASYControl**: Universal multi-channel software (EASYBUS-, RS485-, and/or MH3000- operation possible) for real-time recording and presentation of measuring data in the ACCESS®-data base format.
In case you want to develop your own software we offer a **MH3000-development package** including
- an universally applicable 32bit Windows functions library ('MH3000.DLL') with documentation that can be used by all 'serious' programming languages.
- Programming examples for Visual Basic 6.0™, Delphi 1.0™, Testpoint™, Labview™

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

Supported interface functions:

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

## 4.5.2  Analogue Output – Scaling with DAC.0 and DAC.1

With the DAC.0 and DAC.1 values the output can be rapidly scaled to Your efforts.
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::**  GND

+Uout
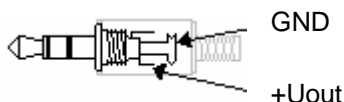
**Attention!**
The 3$^{rd}$ contact  has to be left floating!
Only stereo plugs are allowed!

## 4.6  Alarm

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 interface message.

## 4.7  Real Time Clock

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.

# 5 Operation Of Logger

The device supports two different logger functions:

**„Func-Stor":** each time when „store" (key 6) is pressed a measurement will be recorded.

**„Func-CYCL":** measurements will automatically be recorded at each interval, which was set in the logger menu ‚CYCL' until the logger will be stopped or the logger memory is full. The recording is started by pressing „Store" 2 seconds.

The logger records 1 measurement result each time

For the 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.

## 5.1 „Func-Stor": Storing Single Measurements

Each time when „store" (key 6) is pressed a measurement and its time stamp will be recorded.

The recorded data can be viewed either in the display (when calling the configuration an additional menu „REAd LoGG" is displayed, see below) or by means of the interface and a PC with GSOFT3050-software.

Max. number of measurings:     99

A measuring contains:          - current measuring value at the time of recording
                               - time and date of the recording

After each recording „St. XX" will be displayed for a short time. XX represents the number of the recording.

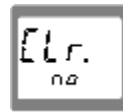**When logger memory contains recordings already:**

When „Store" is pressed for 2 seconds, the choice for clearing the logger memory will be displayed:

| | | |
|---|---|---|
| CLr AtL   Clear all recordings | CLr LASt   Clear the last recording | CLr no   Clear nothing (cancel menu) |

The selection can be made by 5 (key 2) and 6 (key 5). "Quit" (key 6) enters the choice.

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

### *Viewing Recorded Measurings*

Within the „LoGG Stor" function the measurings can be viewed directly in the display not only by means of a computer (like at „Func CYCL"): press 2 seconds „Set" (key 4): The first menu displayed now is „rEAd LoGG" (read logger data).

After pressing 4 (key 3) the measurement recorded last will be displayed, changing between the different data referring to the measurement also is done by pressing 4.

Changing the measurement is done by pressing the keys 5 or 6.

## 5.2 „Func-CYCL": Automatic Recording With Selectable Logger-Cycle-Time

The Logger-Cycle-Time is selectable (p.r.t. Configuration). For example „CYCL" = 1:00: A measuring is recorded after each 60 seconds.

Max. number of measurings: 16384

Cycle time: 0:01...60:00 (minutes:seconds, min 1s, max 1h), selectable in the configuration

A measuring contains: - current measuring value at the time of recording

**Starting a recording:**
By pressing "Store" (key 6) for 2 seconds the recording will be initiated. After that the display shows 'St.XXXXX' for a short time whenever a measuring is recorded. XXXXX is the number of the measuring 1..16384.

If the logger memory is full, the display will show: ┌─────┐ The recording automatically will be stopped.

**Stopping the recording manually:**
By pressing "Store" (key 6) the recording can be stopped manually. Then the following choice appears:

StoP YES — Stop the recording

StoP no — Do not stop the recording

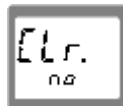The selection can be made by 5 (key 2) and 6 (key 5). "Quit" (key 6) enters the choice.

*Note:* *If you try to switch off the instrument in the cyclic recording operation You will be asked once again 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!*

**Clear Recordings:**
When „Store" is pressed for 2 seconds, the choice for clearing the logger memory will be displayed:

CLr. ALL — Clear all recordings

CLr. no — Clear nothing (cancel menu)

The selection can be made by 5 (key 2) and 6 (key 5). "Quit" (key 6) enters the choice.

# 6 Fault and System Messages

| Display | Meaning | Remedy |
|---|---|---|
| *108 -bAt* | low battery voltage, device will continue to work for a short time | replace battery |
| | If mains operation: wrong voltage | replace power supply, if fault continues to exist: device damaged |
| *bAt* | 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<br><br>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 specified? ->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 specified? -> 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 |

# 7 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.

# 8  Technical Data

**Supported probes** Pt100 4-wire (2-wire possible)
**Sensor Curve** according to EN60751
or with user-sensor curve (table of 50 rows and 2 columns: Ohm/°C]

**Probe connection** 4pole Mini-DIN socket

**Resolution** 0.01°C respectively 0.1°C, 0.01°F respectively 0.1°F

**Measuring Ranges**

| **0.01°C** | **0.1°C** | **0.01°F** | **0.1°F** |
|---|---|---|---|
| −199.99... +199.99°C | -200.0... +850.0°C | -199.99... +199.99°F | -328.0... +1562.0°F |

**Precision** Device without probe ±1Digit (at nominal temperature)

| **Range 0.01°C/F** | **Range 0.1°C/F** |
|---|---|
| ±0.03°C / 0.06°F | ±0.1°C / ±0.2°F |

**Measuring** 4-wire measuring with automatic compensation of thermovoltage errors,
measuring current ca. 0.3mA

**Temperature drift** <=0,002K per 1K for Pt100 4-wire

**Nominal temperature** 25°C

**Ambient** Temperature **-**25 ... +50°C (-13 .. 122°F)
rel. humidity 0 ... 95%r.F. (not condensing)

**Storage temperature -**25 ... +70°C (-13 ... 158°F)

**Housing** Dimensions: 142 x 71 x 26 mm (L x W x D)
impact-resistant ABS plastic housing, membrane keyboard, transparent panel. Front side IP65,integrated
pop-up clip for table top or suspended use.
**Weight** approx. 155 g

**Output:** 3.5mm audio plug, stereo
  **Selectable as serial interface:** via optically isolated interface adapter GRS3100 or GRS3105 (p.r.t. accessories) directly
connectable to RS232-interfaces.
  **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 set. Alarming is done by integrated
horn, display and interface

**Real time clock:** Integrated clock with date and year

**Logger:** 2 Functions: individual value logger („Func–Stor") and cyclic logger („Func–CYCL")
 Memory: Stor: 99 data sets; CYCL: 16384 data sets
 Cycle time CYCL: 0:01...60:00 (minutes:seconds, min 1s, max 1h)

**Power Supply** 9V-Battery, type IEC 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 high and 7 mm high) for temperature,  min./ max values, hold function, etc.
as well as additional pointing arrows.

**Pushbuttons** 6 membrane keys for on/off switch, menu operation, min. and max. value memory, hold-function etc.

**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 no key is pressed/no interface communication takes place for
the time of the power-off delay. The power-off delay can be set to values between 1 and 120 min.; it can be
completely deactivated.

**EMC:** The MH3750 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
(89/336/EWG)
EN61326 +A1 +A2 (Appendix B, class B), additional error: < 1% FS.