

Operating Manual

Quick-Response Double / Difference Thermometer

GMH 3250

with Alarm and Logger Function
for Thermoelement Sensor Type J, K, N, S or T

as of version 2.6



How to Operate And Maintain Device:

a.) When to replace battery:

If Δ and 'bAt' are shown in the lower display the battery has been used up and needs to be replaced. The device will, however, operate correctly for a certain time.

If 'bAt' is shown in the upper display the voltage is too low to operate the device; the battery has been completely used up.

Please note: The battery has to be taken out, when storing device above 50°C.

We recommend to take out battery if device is not used for a longer period of time.

b) Treat device and sensor carefully. Use only in accordance with above specification. (do not throw, hit against etc.).

Protect plug and socket from soiling.

c) To disconnect sensor thermoelement plug do not pull at the cable but at the plug.

d) Selection of types of thermoelements:

Prior to carrying out a measurement make sure to check if device is set to the thermoelement type used (type is shown on the display shortly after device has been switched on). Unless the correct thermoelement is set, temperature measurements will be incorrect.

e) Mains operation:

When using a power supply device please note that operating voltage has to be 10.5 to 12 V DC.

Do not apply overvoltage!! Cheap 12V-power supply devices often have excessive no-load voltage. We, therefore, recommend using regulated voltage power supply devices. Trouble-free operation is guaranteed by our power supply GNG10/3000.

Prior to connecting the plug power supply device with the mains supply make sure that the operating voltage stated at the plug power supply device is identical to the mains voltage.



Safety Requirements:

This device has been designed and tested in accordance with 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 the device.

1. Trouble-free operation and reliability of the device can only be guaranteed if the device 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 cause 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 (e.g. via serial interface) 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.

Warning: If device is operated with a defective mains power supply (short circuit from mains voltage to output voltage) this may result in hazardous voltages at the device (e.g. sensor socket at interface).

4. 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:

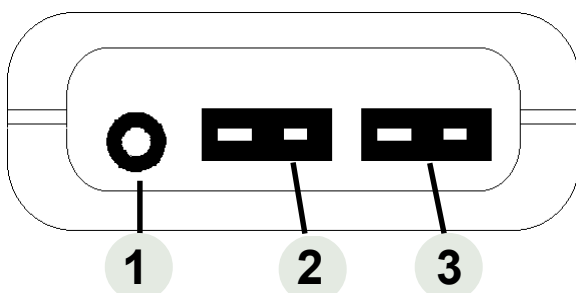
- there is visible damage to the device
- the device is not working as specified
- the device has been stored under unsuitable conditions for a longer time.

In case of doubt, please return device to manufacturer for repair or maintenance.

5. **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.

Connections



1 Interface: Connection for electr. isolated interface adapter (accessories: GRS 3100)

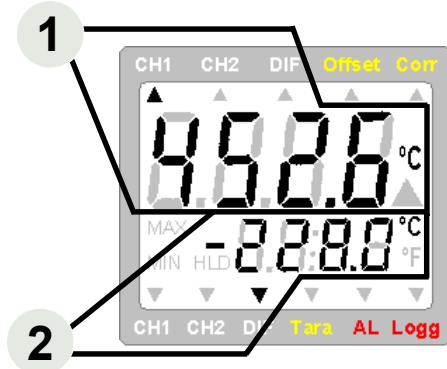
2 Sensor connection CH2: channel2

3 Sensor connection CH1: channel1

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

Displays

Display With Two Sensors Connected:

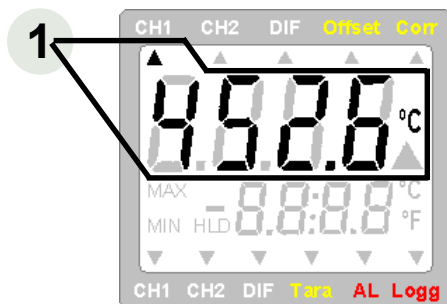


1 Main display:
CH1: sensor 1, CH2: sensor 2, DIF: sensor1-sensor2

2 Secondary display:
CH1: sensor 1, CH2: sensor 2, DIF: sensor1-sensor2

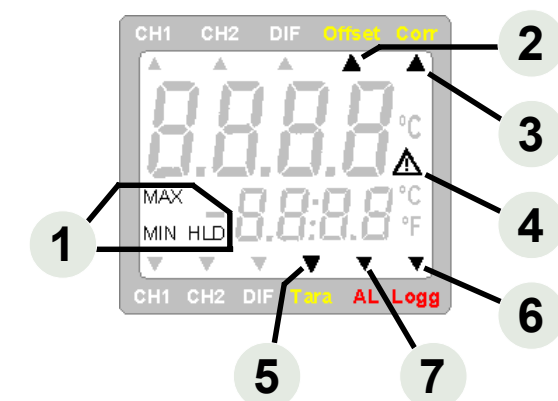
The display desired can be selected by pressing the  key.

Display With One Sensor Connected:



1 Main display:
CH1: sensor 1, CH2: sensor 2, device automatically detects to which socket sensor is connected.

Special Displayelements:



1 Min/Max/Hold: shows if a min., max. or hold value is displayed in either the main or the secondary display.

2 Offset arrow: indicates that zero point offset (offset) is activated

3 Corr arrow: indicates that correction factor is activated

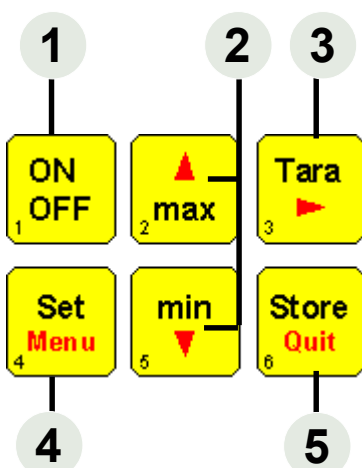
4 Warning triangle: indicates a low battery

5 Tare arrow: indicates that tare function is activated (for 'DIF'-display when working with two sensors only)

6 Logger arrow: indicates that the logger function is activated.

7 Alarm arrow: indicates an alarm

Pushbuttons



1 On/off key

2 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 or selection for logger operation:
to enter values, or change settings

3 Tare: (for 'DIF'-display when working with two sensors only)

press shortly: the difference between CH1-CH2 will be set to zero.

press for 1 sec.: tare function will be deactivated

4 Set/Menu:

press (Set) shortly in case of 2 sensors: the values displayed (CH1, CH2, DIF) can be selected

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

5 Store/Quit:

Measurement: Hold current measuring value ('HLD' in display)

Set/Menu: Acknowledge setting, return to measuring.

Instrument Configuration

For configuration of the device press key "Menü" (key 4) for 2 sekunds; the main menu (display 'SEt') of the configuration will be called up. Use key "Menü" (key 4) to select a sub-menu; use the key "▶" (key 3) to actually go into the sub-menu selected and to change parameters.

Use key "▲" (key 2) or key "▼" (key 5). to set the individual values. Press the key "Menü" (key 4) again to memorize the changes made and to change over to the main menu. Use key "Quit" (key 6) to leave the configuration.



'Read Logger': Read Out Logger Data (will be displayed only if data are memorized in the individual value logger mode)



For more information please refer to the chapter 'data logger - how to display individual values'.

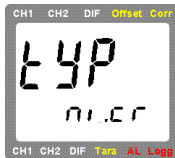


'Set Configuration': General Device Configurations



Setting general configuration:

Please note: the points marked by *1 will only be displayed if no data is stored in the logger.



'Typ': Selection of Thermoelement Type *1



ni.cr: Typ K, NiCr-Ni

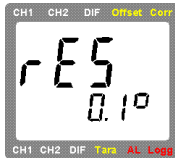


n: Typ N, NiCrSi-NiSi

t: Typ T, Cu-CuNi

S: Typ S, Pt10Rh-Pt

J: Typ J, Fe-CuNi



'Resolution': Selection of Display Resolution

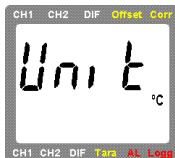


1°: Resolution 1°C



0.1°: Resolution 0.1°C

Auto: Resolution is selected automatically



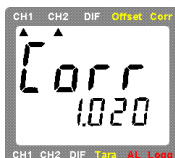
'Unit': Selection of Temperature Unit °C /°F *1



°C: All temperature values in degrees Celsius



°F: All temperature values in degrees Fahrenheit



'Corr': Selection of Display Correction Factor *1



0.950 ... 1.200: The temperature value (referring to 0°C or 32°F) will be multiplied by this factor. This factor will be applied to both sensor values.



off: Factor is deactivated (=1.000)



'Offset': Zero Displacement Channel 1 *1



-10.0°C...10.0°C or -18.0°F...18.0°F: The zero point of the measurement of channel 1 will be displaced by this value.



off: Zero point displacement is deactivated (=0.0°)



'Offset': Zero Displacement Channel 2 *1



-10.0°C...10.0°C or -18.0°F...18.0°F: The zero point of the measurement of channel 1 will be displaced by this value.



off: Zero point displacement is deactivated (=0.0°)



'Power.off': Selection of Power-Off Delay



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: automatic power-off function deactivated (continuous operation, e.g. in case of mains operation)



'Address': Selection of Base Address'



01, 11, 21, ..., 91: Base address for interface communication.





'Set Alarm': Alarm Settings

Settings for the alarm function:

Please note: the points marked by *2 will only be displayed if the alarm functions 'on' or 'no'.So' have been selected.



'Alarm': Selection of Alarm Function



off: Alarm off



no.So: Alarm on, the "AL" arrow will be displayed in case of alarm

on: Alarm on, in case of alarm the "AL" arrow will be displayed; in addition an audible alarm signal will be given.



'Alarm Input': Selection of Alarm Input *2



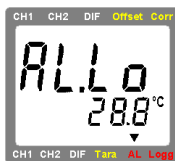
CH 1: Channel 1 alarm monitoring

CH 2: Channel 2 alarm monitoring



CH 1.2: Channels 1 and 2 alarm monitoring

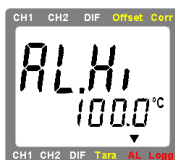
dif: Difference channel alarm monitoring



'Alarm Low': Setting of Min. Alarm *2



Setting of the display limit value triggering a min. alarm.



'Alarm High': Setting of Max. Alarm *2



Setting of the display limit value triggering a max. alarm



'Set Logger': Logger Settings (not possible if there are data in the logger memory)

Setting for the logger function:



'Function': Selection of Logger Function

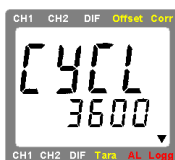


off: Logger function off (Use key 6 for Hold-function)



Stor: Individual value logger (Press key 6 to store an individual value set)

CYCL: Cyclic logger (Start by pressing key 6)



'Cycle Time': Setting of Cycle Time (only with Func = CYCL)



1 ... 3600: Cycle time in seconds giving the intervals between the logger data recordings



'Set Clock': Setting of the Real-Time Clock

Setting of the internal real-time clock:



'Clock': Set the Time



Setting of the time (hours : minutes)



'Year': Set the Year



Setting of the year.



Time span that can be set: 1997 ... 2100



'Date': Set the Date



Setting of the date (day.month)



Measuring Temperature With Thermoelements

- Make sure that the correct type of thermoelement is set (p.r.t. "Configuration of The Instrument")! Otherwise a wrong temperature will be displayed. The measuring device has been optimised for measurements with a type K probe.
- If other thermoelements but type K (NiCr-Ni) are used already the smallest temperature difference between plug and instrument will result in measuring errors. Therefore wait for the temperatures to adjust after plug-in or touching a sensor plug (depending on temperature ~15min.)
- Thermoelements are suitable to measure within a large temperature range. But keep in mind the allowed temperature range of your specific temperature probe!

Special Functions - Please Note

Display Resolution ('Resolution')

Standard setting: 'Auto', i.e. the device automatically switches over to the optimum resolution between 1° and 0.1°. 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.

Zero Displacement ('Offset')

A zero displacement can be carried out for each of the two channels CH1 or CH2.

$$\text{temperature displayed} = \text{temperature measured} - \text{offset}$$

Standard setting: 'off' = 0.0°, i.e. no zero displacement will be carried out. The zero displacement is mainly used to compensate for sensor deviations. Unless 'off' is set, this value will be displayed shortly after the device is switched on; during operation it will be identified by means of the offset arrow in the display.

Display Correction Factor ('Corr')

This factor is applied to both sensor channels.

$$\begin{aligned} \text{temperature displayed [}^\circ\text{C]} &= \text{temperature measured [}^\circ\text{C]} * \text{Corr} \\ \text{or temperature displayed [}^\circ\text{F]} &= (\text{temperature measured [}^\circ\text{F]} - 32^\circ\text{F}) * \text{Corr} + 32^\circ\text{F} \end{aligned}$$

Standard setting: 'off' = 1.000

This factor is used to compensate for losses of transfer in case of surface measurements, occurring if the object to be measured is extremely hot but will be cooled by lower ambient temperatures. The same can be true for sensors with a large mass. Unless 'off' is set, this value will be displayed shortly after the device is switched on; during operation it will be identified by means of the Corr-arrow in the display.

Tare Function

The tare function is used to set the DIF-display to zero, which is especially important when monitoring temperature differences. If the tare key is pressed for more than 2 seconds DIF = CH1-CH2 will be restored. This function as well as the DIF-display can only be used if two sensors are connected. If the tare function is activated, this will be shown by the tare arrow in the display.

Base Address ('Adr.')

Using the interface converter GRS3105 it is possible to connect several instruments to a single interface. 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.

Channel 1 will be addressed by the base address set, channels 2 and 3 will have the following addresses.

(Example: base address 21 - channel 1 = 21, channel 2 = 22, channel 3 = 23)

Alarm:

3 alarm settings are available: off (off), on with horn sound (on), on - no horn sound (no.So)

You can choose the channel to be monitored by the alarm function:

CH 1: alarm monitoring of channel 1

CH 2: alarm monitoring of channel 2

CH 1.2: alarm monitoring of channels 1 and 2

dif: alarm monitoring of difference channel

If the alarm function (on, no.So) has been activated, an audible alarm signal will be given with the following cases:

- values have fallen below/exceeded the lower/upper alarm limits in the channel to be monitored
- FE 9 or FE11 at the channel to be monitored
- low battery
- FE 7: In case of a system error the horn will be sounded regardless of the alarm setting (even if alarm = off)

If one or more alarm settings have been fulfilled the "alarm" arrow will be shown in the display; in case of access via the interface the 'PRIO'-Flag will appear.

Real Time Clock:

The real time clock is required to put logger data in a time order. If necessary please check the setting:

Setting via keys (p.r.t. configuration of the device): time (minutes – accurate), date, year.

Setting via interface: use suitable software (seconds - accurate) e.g. GMH3050-software.

The clock setting menu will be started automatically when the device is switched on again after a battery change.

Data Logger:

As soon as key "Store" (key 6) is pressed and ,Func = Stor' was chosen a data set will be stored.

The data stored can either be observed on the display (prt. "How to Display Individual Values" below), or be read into a PC via the interface.

When ,CYCL' is set and the logger has been started using key 6 (press for 2 seconds), data sets will be stored till the recording is either stopped or the logger memory is full.

The logger cycle time can be set. Use the interface to input the data stored into a PC.

Storing of Individual Values: "Func Stor"

Data set that can be stored: 99

One data set consists of: measuring value CH1, measuring value CH2, measuring value DIF and time + date

Press "Store"-key to store current values. 'St.XX' will be displayed for a short time, XX representing the number of the data set 1..99.

Upon pressing the "Store"-key (key 6) for 2 seconds the selection for deleting the logger memory will be displayed assumed that there are any logger data.



delete all data sets



delete data set recorded last



do not delete (= cancel procedure)

Use the keys "▲" (key 2) or "▼" (key 5) to make a selection. Use key "Quit" (key 6) to acknowledge selection.



If the logger memory is full a warning will appear on the display:

(warning triangle permanently shown, cyclic display of "LoGG FuLL" and the current measuring value)

How to Display Individual Values:

Individual values can also be displayed without interface which is not possible with the cyclic logger function.

If there are data sets in the logger memory, the additional main menu ,rEAd LoGG' will be offered upon call-up of the menu (press key "Set" (key 4) for 2 sec).

When the "▶"-key (key 3) is pressed the last data set will be displayed. Use "▶"-key (key 3) to change over between the values of one data set (CH1, CH2, DIF, date/time).

To change over from one data set to another use the keys "▲" (key 2) or "▼" (key 5).

Cyclic Logger Function: "Func CYCL"

Data sets that can be stored: 9999

One data set consists of: measuring value CH1, measuring value CH2 and measuring value DIF

The cycle time is set during 'Device configuration'.

Start logger recording:

Press "Store"-key (key 6) for 2 seconds to start recording. Then 'St.XXXX' will be displayed for a short time for every logging; XXXX representing the number of the data set 1..9999.



If the logger memory is full a warning triangle will be shown on the display:

(warning triangle permanently shown, cyclic display of "LoGG FuLL" and the current measuring value)

Stop logger recording:

Press "Store"-key (key 6) for a short time to stop recording. You will then be asked to acknowledge again:



recording to be stopped



recording to be continued

Use the keys "▲" (key 2) or "▼" (key 5) to make your selection. Use "Quit"-key (key 6) to acknowledge your selection.

Please note: If you try to switch off the instrument in the cyclic recording mode you will be asked once again if the recording is to be stopped. The device can only be switched off after the recording has been stopped as the Auto-Power-Off-function is deactivated during recording.

Delete data in logger memory:

Press "Store"-key (key 6) for 2 seconds to display the selection for deleting data, if any, in the logger memory:





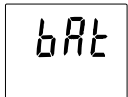
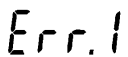

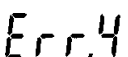
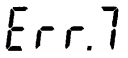

Delete all data sets



do not delete (= cancel procedure)

Use the keys "▲" (key 2) or "▼" (key 5) to make your selection. Use "Quit"-key (key 6) to acknowledge your selection.

Fault and System Messages

Display	Description	Remedy
	No sensor connected sensor/cable damaged	Connect one sensor at least Replace sensor/cable
	Low battery voltage, device will only continue operation for a short time	replace battery
	Low battery voltage If mains operation: wrong voltage	replace battery replace power supply, if fault continues to exist: device damaged
no display or. weird display	Battery voltage too low If mains op.: power supply defective or wrong voltage/polarity System error device defective	replace battery Check/replace power supply Disconnect battery or power supply, wait for a short time, re-connect return to manufacturer for repair
	Values exceeding measuring range Sensor/cable defective	Check: are there any values exceeding the measuring range specified? ->temperature too high Display resolution set to 0.1°? -> set to 'Auto' -> replace
	Values below measuring range Sensor/cable defective	Check: are there any values below the measuring range specified? -> temperature too low Display resolution set to 0.1°? -> set to 'Auto' for DIF-channel and difference<-2040° -> temp. difference too low -> replace
	Values below display range	for DIF-channel and difference <-1999°: exchange sensors CH1<->CH2 (watch out for offset setting!)
	System fault Instrument not within working temperature	switch on again: if fault continues to exist, device is damaged -> return to manufacturer for repair keep working temperature in between -25...50°C
	Value cannot be calculated	One measuring variable required for calculation is missing (no sensor) or incorrect (overflow/underflow)

The Serial Interface

All measuring and setting data of the device can be read and changed by means of the serial interface and a suitable electrically isolated interface adapter (GRS3100 or GRS3105). In order to avoid transmission errors, there are several security checks implemented.

The following **standard software packages** are available for data transfer:

- **GSOFT3050:** Software for temperature display and read out of logger data.
- **EBS9M** 9-channel software to display the temperature (channel 1 and 2) and the difference temp. (channel 3)
- **EASYCONTROL:** Universal multi-channel software (EASYBUS-, RS485-, or GMH3000- 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 **GMH3000-development package** including

- a universally applicable 32bit Windows functions library ('GMH3000.DLL') with documentation that can be used by the most programming languages.
- Programming examples Visual Basic 4.0, Testpoint (Keithley Windows measuring software)

The following interface functions will be supported:

Channel			DII-Code	Name/function
1	2	3		
x	x	x	0	Read nominal value
x	x	x	3	Read system status
x	x	x	6	Read min. value
x	x	x	7	Read max. value
x			12	Read ID-no.
1)	1)	1)	22	Read min. alarm limit
1)	1)	1)	23	Read max. alarm limit
2)			32	Read configuration flag
2)			160	Set configuration flag
x			174	Delete min. value
x			175	Delete max. value
9)			194	Set display unit
x			195	Set decimal point in display
x	x	x	199	Read meas. type in display
x	x	x	200	Read min. display range
x	x	x	201	Read max. display range
x	x	x	202	Read unit of display
x	x	x	204	Read decimal point of display
x			208	Read channel count
x	x		216	Read offset correction
9)	9)		217	Set offset correction
x			218	Read corr. factor (1000..1200)
9)			219	Set corr. factor (1000..1200)
3)	3)	3)	224	Read logger data (cyclic logger)
4)			225	Read logger cycle
5)			226	Set logger cycle
6)			227	Start logger recording
7)			228	Read count of logger data
7)			229	Read logger state
3)			231	Read real time clock
x			233	Set real-time clock
x			234	Set real-time clock
7)			236	Read logger memory size
x			240	Reset unit
x			254	Read program identification
8)			260	Read logger data (individual value logger)

1) *only when alarm is activated for referring channel*

2) *configuration flags:*

50: 0 = logger off

1 = logger on

51: 0 = man. logger

1 = cyclic logger

3) *only when logger function = CYCL, data present and logger stopped.*

4) *only when logger function = CYCL*

5) *only when logger function = CYCL and no data in memory*


6) *only when logger function = Stor, or logger function = CYCL and no data in memory*

7) *only when logger is activated (CYCL or Stor)*

8) *only when logger function = Stor and data in memory*

9) *only when no data in memory*

Specification

Thermoelements	J, K, N, S, T	
Resolution	0,1°C or 1°C	0,1°F or 1°F
Measuring range		
Typ K: (NiCr-Ni)	-199,9... +999,9°C or -220... +1370°C	-199,9... +999,9°F or -364... +2498°F
Typ J: (Fe-CuNi)	-120,0... +700,0°C or -200... +1100°C	-184,0... +999,9°F or -328... +2012°F
Typ N: (NiCrSi-NiSi)	-199,9... +999,9°C or -200... +1300°C	-199,9... +999,9°F or -328... +2372°F
Typ S: (Pt10Rh-Pt)	-50,0... +999,9°C or -50... +1750°C	-58,0... +999,9°F or -58... +3182°F
Typ T: (Cu-CuNi)	-120,0... +400,0°C or -200... +400°C	-184,0... +752,0°F or -328... +752°F
Genauigkeit	(for thermoelements acc. to DIN EN 60584) ±1digit (at nominal temperature)	
Type K: -199,9 ... +999,9°C: ±0,03% of m.v. ±0,05%FS (T≥-60°C); -220 ... +1370°C: ±0,08% of m.v. ±0,1%FS (T≥-100°C);	±0,2% of m.v. ±0,05%FS (T<-60°C); ±1°C ±0,1%FS (T<-100°C)	
Type J: -120,0 ... +700,0°C: ±0,03% of m.v. ±0,08%FS (T≥-80°C); -200 ... +1100°C: ±0,08% of m.v. ±0,1%FS (T≥-150°C);	±0,2% of m.v. ±0,08%FS (T<-80°C); ±1°C ±0,1%FS (T<-150°C)	
Type N: -199,9 ... +999,9°C: ±0,03% of m.v. ±0,05%FS (T≥-60°C); -200 ... +1300°C: ±0,08% of m.v. ±0,1%FS (T≥-100°C);	±0,2% of m.v. ±0,05%FS (T<-60°C); ±1°C ±0,1%FS (T<-100°C)	
Type S: 0,0 ... +999,9°C: ±0,05% of m.v. ±0,08%FS (T≥200°C); -50 ... +1750°C: ±0,1% of m.v. ±0,1%FS (T≥200°C);	±1°C ±0,08%FS (T<200°C); ±1°C ±0,1%FS (T<200°C)	
Type T: -120,0 ... +400,0°C: ±0,03% of m.v. ±0,1%FS (T≥-70°C); -200 ... +400°C: ±1°C (T≥-100°C);	±0,2% of m.v. ±0,1%FS (T<-70°C); ±1°C ±1digit (T<-100°C)	
Temperature drift	0,01%/K	
Point of comparison	±0,3°C	
Nominal temperature	25°C	
Working temperature	-25 to +50°C	
Relative humidity	0 to +95%r.h. (non-condensing)	
Storage temperature	-25 to +70°C	
Sensor connection	2 connection pins for miniature DIN-plug type K	
Display	2 four digit LCDs (12.4mm high and 7 mm high) for temperature, and for min./ max values, hold function, etc. as well as additional pointing arrows.	
Pushbuttons	6 membrane keys altogether for on/off switch, selection of thermoelements, min. and max. value memory, hold-function etc.	
Interface	serial interface (3.5mm jack), serial interface can be directly connected to RS232 interface of a PC via interface adapter GRS3100 or GRS3105 (see accessories).	
Power supply	9V-battery, type IEC 6F22 (included) as well as additional d.c. connector (dia of internal pin 1.9 mm) for external 10.5-12V direct voltage supply.  (suitable power supply: GNG10/3000)	
Power consumption	approx. 1.6 mA	
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.	
Min-/max-value memory	Both the max. and the min. value will be memorized for sensor 1, sensor 2 and the difference.	
Hold-function	Press button to store current values of sensor 1, sensor 2 and their difference	
Min./max alarm	min. and max. values set for measuring values of sensor 1, sensor 2, sensor 1 and 2 or temperature difference are constantly monitored	
Alarm functions	min- / max-alarm, alarm via integrated horn, display and interface.	
Logger function:	2 logger functions: individual value logger (Store) and cyclic logger (Cycle)	
Memory size:	Store: max. 99 data sets,	Cycle: max. 9999 data sets
Cycle time:		Cycle: 1 up to 3600 seconds
Real time clock	Clock with date and year (integrated in device)	
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	
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 (89/336/EWG) additional fault: <1%	