

# Operating Manual

## Digital Quick Response Thermometer

# GMH 3210

### For Thermocouple Probes Type J, K, N, S, T

from Version 1.0

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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 Unit

### Battery Operation

If  $\Delta$  and „bAt“ in lower display are shown, 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.

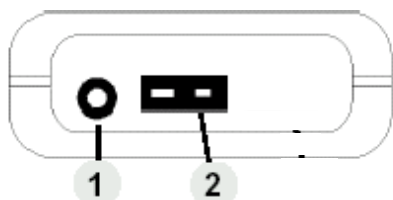
**Hint: We recommend to take out battery if device is not used for a longer period of time!**

### 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 thermocouple sensor plug do not pull at the cable but at the plug.
- Selection of types of thermocouples:** Prior to carrying out a measurement make sure to check if device is set to the thermocouple type used (type is shown on the display shortly after unit has been switched on). Unless the correct thermocouple is set, temperature measurements will be incorrect!
- Selection of Output-Mode:** The output can be used as serial interface or as analog output. This choice has to be done in the configuration menu. If no output is needed, we recommend to switch it 'off', the battery life then is nearly twice as long as with serial or analog output.

## 1.3 Connections



### 1. Output

Operation as interface: Connect to optically isolated interface adapter (accessory: GRS 3100 or GRS3105)

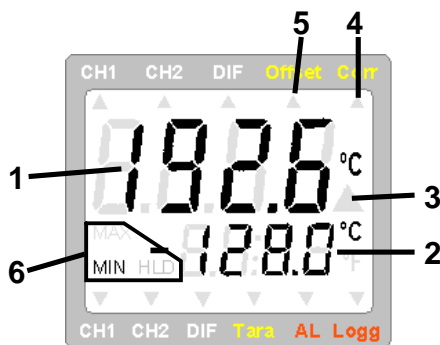
Operation as analog output: Connection via suitable cable.

Attention: The output mode has to be configured (p.r.t 2.7) and influences battery life!

### 2. Probe connection

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

## 1.4 Display Elements



1 = **Main display:** Currently measured temperature

2 = **Secondary display:** Display of min, max or hold values

### Special display elements:

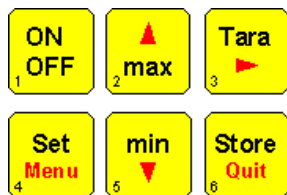
3 = **Warning triangle:** indicates a low battery

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.

## 1.5 Pushbuttons



**button 1: On/Off key**

**button 4: Set/Menü**

press (Menü) for 2 sec.: configuration will activated

**button 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

**button 6: Store/Quit:**

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

Set/Menu: Acknowledge setting, return to measuring.

**button 3:** no function

## 2 Device Configuration

For configuration of the device press "Set"-key (key 4) for 2 seconds, the first menu will be shown. Choose between the individual values that can be set by pressing the "Set"-key (key 4) again. The individual values are changed by pressing the keys "▲" (key 2) or "▼" (key 5). Use key "Store" (key 6) to leave configuration and to store settings.

### 2.1 'Typ': Selection of the Thermocouple-Type



**ni.cr:** type K, NiCr-Ni  
**n:** type N, NiCrSi-NiSi  
**S:** type S, Pt10Rh-Pt  
**t:** type T, Cu-CuNi  
**J:** type J, Fe-CuNi

### 2.2 'Resolution': Selection of Display Resolution (Not for Type S!)



**1°:** Resolution 1°C  
**0.1°:** Resolution 0.1°C  
**Auto:** Resolution is selected automatically

Attention: When type S is selected the resolution is always 1°C!

### 2.3 'Unit': Selection of Temperature Unit °C /°F



**°C:** All temperature values in degrees Celsius  
**°F:** All temperature values in degrees Fahrenheit

### 2.4 'Corr': Selection of Display Correction Factor



**0.950...1.200:** The temperature value (referring to 0°C or 32°F) will be multiplied by this factor. Thus, in case of surface measurements, losses by transfer can be compensated for (>1.000). Furthermore the factor can be used to compensate probe deviations.  
**off:** Factor deactivated (=1.000)

### 2.5 'Offset': Zero Displacement



**-10.0°C...10.0°C**  
**or**  
**-18.0°F...18.0°F:** The zero point of the measurement will be displaced by this value so as to compensate for deviations in the sensor and in the measuring unit.  
**off:** Zero displacement deactivated (=0.0°)

### 2.6 '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:** Power-off function deactivated (continuous operation, e.g. in case of mains operation)

### 2.7 'Out': Function of the Output



- off:** No output function, lowest power consumption  
**SEr:** Output is serial interface  
**dAC:** Output is analog output 0...1V

## 2.8 'Address': Selection of Base Address when Output = Serial Interface



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

## 2.9 'dAC.0Volt': Output Offset When Output = Analog Output



-220...1372°C: (depending on selected range) Input of the temperature at which 0V should be output

## 2.10 'dAC.1Volt': Output When Output = Analog Output



-220...1372°C: (depending on selected range) Input of the temperature at which 1V should be output

# 3 Basics Of Thermocouple Temperature Measurements

- The right thermocouple type has to be selected prior to measuring (p.r.t. Device Configuration). Otherwise the instrument will display a wrong value! The device is optimized for type K usage.
- Temperature differences between the instrument and the probe connector may produce measuring errors, especially when using other types than type K. Therefore wait after connecting or touching the connector until the temperatures have adjusted (can take several minutes, depending on the temperature differences).
- The device is suitable to measure large temperature ranges. But consider the allowable range of the probe!
- When measuring air temperature the probe has to be dry. Otherwise the cold due to the evaporation causes too low measurements.

# 4 Special Functions

## 4.1 Display 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. Independent from this setting, type S measurings are always in 1° resolution!

## 4.2 Zero Displacement ('Offset')

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

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

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.

## 4.3 Display Correction Factor ('Corr')

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 (standard setting: 'off' =1.000), 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.

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**temperature displayed [°C] = temperature measured [°C] \* Corr**  
**or temperature displayed [°F] = (temperature measured [°F]-32°F) \* Corr + 32°F**

## **4.4 Output**

The output can be used as serial interface (for GRS3100 or GRS3105 interface adapters) or as analog output (0-1V). If none of both is needed, we suggest to switch the output off, battery life then is nearly doubled.

### **4.4.1 Interface - Base Address ('Adr.')**

Using the a 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 configurate 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 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 all 'serious' programming languages.
- Programming examples 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	201	Read max. display range
3	Read system status	202	Read unit of display
6	Read min. value	204	Read decimal point of display
7	Read max. value	208	Read channel count
12	Read ID-no.	216	Read offset correction
174	Delete min. value	217	Set offset correction
175	Delete max. value	218	Read corr. Factor (950..1200)
194	Set display unit	219	Set corr. factor (950..1200)
195	Set decimal point in display (255=Auto)	240	Reset
199	Read meas. type in display	254	Read program identification
200	Read min. display range		

#### 4.4.2 Analog 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.

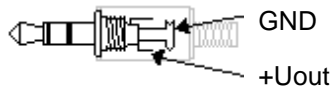
Keep in mind not to connect low-resistive loads to the output, otherwise the output value will be wrong and battery life is decreased. Loads above ca 10kOhm are uncritical.

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, SensErro, etc.) the device will apply slightly above 1V to the output.

plug wiring:



## 5 Fault and System Messages

Display	Meaning	Remedy
	low battery voltage, device will continue to work for a short time If mains operation: wrong voltage	replace battery
	low battery voltage If mains operation: wrong voltage	replace battery Check/replace power supply, if fault continues to exist: device damaged
No display or weird display	low battery voltage If mains operation: wrong voltage	replace battery Check/replace power supply, if fault continues to exist: device damaged
Device does not react on keypress	system error device defective	Disconnect battery or power supply, wait some time, re-connect return to manufacturer for repair
SenS Erro	Sensor error: no sensor connected sensor/cable or device defective	Connect sensor to socket return to manufacturer for repair
Err.1	Value exceeding measuring range sensor/cable defective	Check: Is the value exceeding the measuring range specified? ->temperature too high! -> replace
Err.2	Value below display range sensor/cable defective	Check: Is the value below the measuring range specified? -> temperature too low! -> replace
Err.7	system error Far out of allowable operation temperature	return to manufacturer for repair -25..50°C are allowable

## 6 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.

## 7 Specification

<b>Thermocouple</b>	J, K, N, S or T			
<b>Probe Connection</b>	Socket for flat pin plug, free from thermo voltage for type K			
<b>Resolution</b>	0,1°C or 1°C 1°C	0,1°F or 1°F for types J, K, N, T 1°F for type S		
<b>Meas. Ranges</b>	<b>0,1°C</b>	<b>1°C</b>	<b>0.1F</b>	<b>1°F</b>
<b>type K:</b> (NiCr-Ni)	-65,0... +300,0°C	-220... +1372°C	-85,0... +572,0°F	-364... +2500°F
<b>type J:</b> (Fe-CuNi)	-50,0... +225,0°C	-140... +950°C	-58,0... +437,0°F	-220... +1742°F
<b>type T:</b> (Cu-CuNi)	-65,0... +250,0°C	-220... +400°C	-85,0... +482,0°F	-418... +752°F
<b>type N:</b> (NiCrSi-NiSi)	-65,0... +250,0°C	-100,0... +380,0°C	-200... +1300°C	-148,0... +716,0°F
	-454... +2372°F			
<b>type S:</b> (Pt10Rh-Pt)	-	-50... +1768°C	-	-58... +3214°F
<b>Precision</b> (for thermocouples DIN EN 60584)	±1Digit (at nominal temperature)			
	<b>Range 0,1°C/F</b>	<b>Range 1°C/F</b>		
<b>type K:</b>	±0,03% of m.v. ±0,05%FS	±0,08% of m.v. ±0,1%FS		
<b>type J:</b>	±0,03% of m.v. ±0,08%FS	±0,08% of m.v. ±0,1%FS		
<b>type T:</b>	±0,03% of m.v. ±0,1%FS	±1°C (T>-100°C)	±1°C ±1Digit (T<-100°C)	
<b>type N:</b>	±0,03% of m.v. ±0,05%FS	±0,08% of m.v. ±0,1%FS (T>-100°C)	±1°C ±0,1%FS (T<-100°C)	
<b>type S:</b>	-	±0,1% of m.v. ±0,1%FS (T>200°C)	±1°C ±0,1%FS (T<200°C)	
<b>Temperature drift</b>	0,01%/K			
<b>Point of Comparison</b>	±0,3°C			
<b>Nominal Temperature</b>	25°C			
<b>Ambient Conditions</b>	Temperature -25 to +50°C rel. humidity 0 to 95%r.F. (not condensing)			
<b>Storage Temperature</b>	-25 to +70°C			
<b>Housing</b>	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			
<b>Output:</b>	3.5mm audio plug, stereo			
<b>Selectable as serial interface:</b>	via optically isolated interface adapter GRS3100 or GRS3105 (p.r.t. accessories) directly connectable to RS232-interfaces.			
<b>or analog output:</b>	0..1V, freely scaleable (12bit)			
<b>Power Supply</b>	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)			
<b>Power Consumption</b>	approx. 260µA when output switched off approx. 400µA when output is serial interface (at 1 reading per second) approx. 500µA when output is analog output (without load)			
<b>Display</b>	2 four digit LCDs (12.4mm high and 7 mm high) for temperature, min./ max values, hold function, etc. as well as additional pointing arrows.			
<b>Pushbuttons</b>	6 membrane keys altogether for on/off switch, selection of thermoelements, min. and max. value memory, hold-function etc.			
<b>Min-/Max-Value Memory</b>	Both the max. and the min. value will be memorized.			
<b>Hold Function</b>	Press button to store current value.			
<b>Automatic-Off-Function</b>	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.			
<b>EMC:</b>	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%			