Operating Manual
Quick-Response Double / Difference Thermometer
GMH 3230
For Thermoelement Sensor
Type J, K, N, S or T

as of version 2.5

How to Operate And Maintain Device:

a.) <u>When to replace battery:</u>
If △ 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) <u>Mains operation:</u>
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. <u>**Warning:**</u> Do not use these product as safety or emergency stop devices, or in any other appli-cation 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
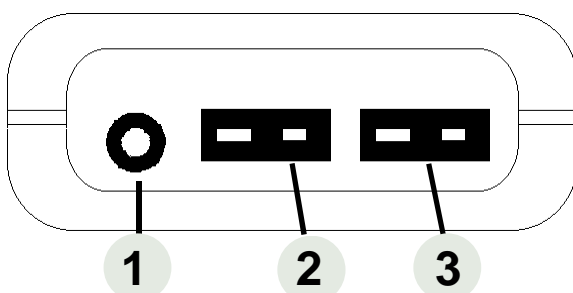
1 **Interface**: Connection for electr. isolated interface adapter (accessories: GRS 3100)
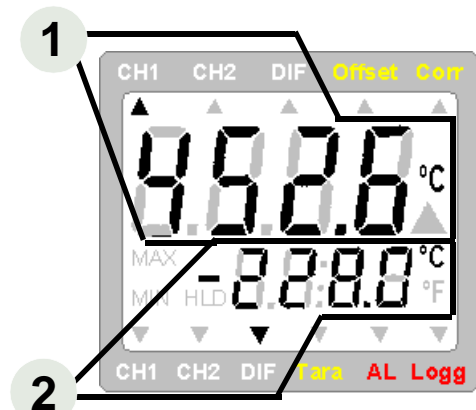
2 **Sensor connection CH2: channel2**

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**:
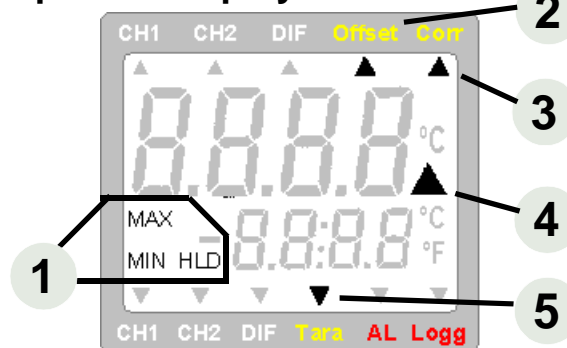CH1: sensor 1, CH2: sensor 2, DIF: sensor1-sensor2

The display desired can be selected by pressing the [Set Menu] 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.
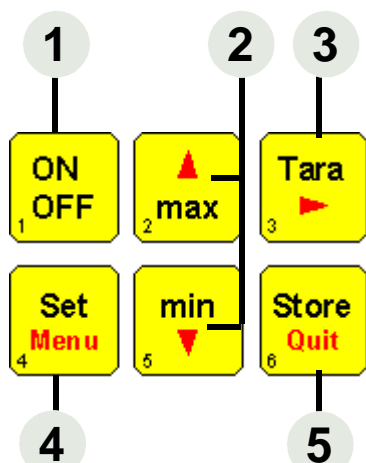
2 **Offset-arrow**: indicates that zero point offset (offset) is activated

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)

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:
 to enter values, and/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 activated

5 **Store/Quit**:
 Measurement: Hold current measuring value ('HLD' in display)
 Set/Menu: Acknowledge setting, return to measuring.
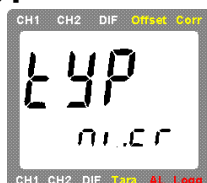
Device Configuration

For configuration of the device press "Set"-key (key 4) for 2 seconds.

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.

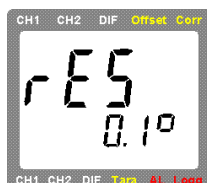## 'Typ': Selection of Thermoelement Type

Enter sensor type used:

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

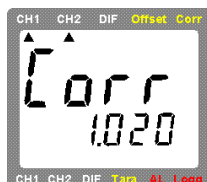## 'Resolution': Selection of Display Resolution

1°:   Resolution 1°C

0.1°: Resolution 0.1°C

Auto: Resolution is selected automatically

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

°C: All temperature values in degrees Celsius

°F: All temperature values in degrees Fahrenheit

'Corr': Selection of Display Correction Factor

0.950...1.200: The temperature value (refering 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. This factor will be applied to both sensor values.

**off**:   Factor deactivated (=1.000)

'Offset': Zero Displacement

-10.0°C...10.0°C and/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. Individual values for each sensor. (Displayed by arrow in the upper left-hand corner)

off: Zero displacement deactivated (=0.0°)

'Power.off': Selection of Power-Off Delay
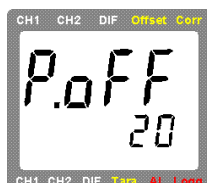
1...120: Power-off delay in minutes. Device will be automatically switched off as soon as this time has elapsed if no key is pressed/no interface communication takes place.

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 comunication. 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)

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 threashold, 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.

temperature displayed = temperature measured - 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.

temperature displayed [°C] = temperature measured [°C] * Corr

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

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 configurate the base addresses accordingly.
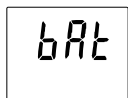Channel 1 will be addressed by the base address set, channels 2 and 3 will have the following addresses.
(Example: base address 21 - channel 1 = 21, channel 2 = 22, channel 3 = 23)
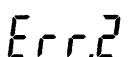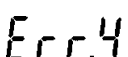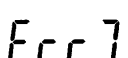
Measuring Temperature With Thermoelements

- 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!

Fault and System Messages

Display	Description	Remedy
SEnS Erro	No sensor connected sensor/cable damaged	Connect one sensor at least Replace sensor/cable
108 -bAt	Low battery voltage, device will only continue operation for a short time	replace battery
bAt	Low battery voltage If mains operation: wrong voltage	replace battery replace power supply, if fault continues to exist: device damaged
no display and/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
Err.1	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
Err.2	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
Err.4	Values below display range	for DIF-channel and difference <-1999°: exchange sensors CH1<->CH2 (watch out for offset setting!)
Err.7	System fault Instrument not witihin 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
Er.11	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/or 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:
-**EBS9M**   9-channel software to display the measuring value (channel 1) and the temperature (channel 2)
-**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 4.0, Testpoint (Keithley Windows measuring software)

The following interface functions will be supported:

Channel			Dll-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.
x			174	Delete min. value
x			175	Delete max. value
x			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
x	x		217	Set offset correction
x			218	Read corr. factor (1000..1200)
x			219	Set corr. factor (1000..1200)
x			240	Reset sensor module
x			254	Read program identification

Specification

Thermoelements	J, K, N, S, T	
Resolution	0,1°C and/or 1°C	0,1°F and/or 1°F

Measuring ranges

Type K: (NiCr-Ni)	-199,9... +999,9°C or -220... +1370°C	-199,9... +999,9°F or -364... +2498°F
Type J: (Fe-CuNi)	-120,0... +700,0°C or -200... +1100°C	-184,0... +999,9°F or -328... +2012°F
Type 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
Type T: (Cu-CuNi)	-120,0... +400,0°C or -200... +400°C	-184,0... +752,0°F or -328... +752°F

Accuracy	(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);	±0,2%of m.v. ±0,05%FS (T<-60°C)
-220 ... +1370°C:	±0,08%of m.v. ±0,1%FS (T≥-100°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);	±0,2%of m.v. ±0,08%FS (T<-80°C)
-200 ... +1100°C:	±0,08%of m.v. ±0,1%FS (T≥-150°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);	±0,2%of m.v.. ±0,05%FS (T<-60°C)
-200 ... +1300°C:	±0,08%of m.v. ±0,1%FS (T≥-100°C);	±1°C ±0,1%FS (T<-100°C)
Type S: 0,0 ... +999,9°C:	±0,05%vof m.v. ±0,08%FS (T≥200°C);	±1°C ±0,08%FS (T<200°C)
-50 ... +1750°C:	±0,1%of m.v. ±0,1%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);	±0,2%of m.v. ±0,1%FS (T<-70°C)
-200 ... +400°C:	±1°C (T≥-100°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
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
Sensor connection	2 connection pins for miniature DIN-plug type K
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. ⎓ᴳ⫞ (suitable power supply: GNG10/3000)
Power consumption	approx. 1.7 mA
Display	2 four digit LCDs (12.4mm high and/or 7 mm high) for temperature, and/or 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.
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
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 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%