User's Manual

Handheld Digital Vacuum- and Barometer

GMH3181-12

0 to 1300 mbar absolute

Version 6.5

CE

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CONTENTS

1 General

1.1 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. Device and sensors have to be handled with care (don't throw, hit, etc.).
3. 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.
4. 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 (e.g. short circuit from mains voltage to output voltage) this may result in hazardous voltages at the device (e.g. at sensor socket or interface).
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 period of time.
   In case of doubt, please return device to manufacturer for repair or maintenance.

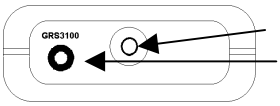
1.2 Operation And Maintainance Advice

- **Battery Operation**
  If ´bAt´ are shown in the secondary display the battery has been used up and needs to be replaced. The device will, however, operate correctly for a certain amount of 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.

  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!

- **Mains Operation With Power Supply**
  Warning: When using a power supply please note that operating voltage has to be 10.5 to 12 V DC. Do not apply overvoltage!! Cheap 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 power supply to the mains make sure that the operating voltage stated at the power supply is identical to the mains voltage.

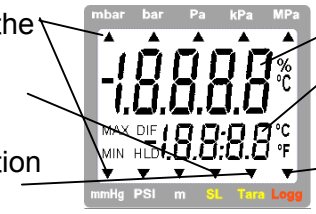
1.3 Connections



Connection for pressure tube
Interface: Connection for el. isolated interface adapter (p.r.t. chapter 4)
The mains adapter socket is located at the left side of the device.

1.4 Display

Units: an arrow points to the chosen measuring unit
SL: appears if sea-level-correction is activated
Tara: appears if tara-function is activated

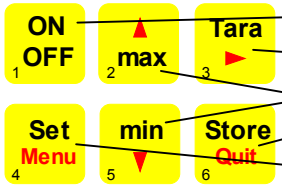


main display: shows measuring value
secondary display: shows min-, max- or hold value

Logg: appears, if logger function is chosen, flashes when logger is running

1.5 Basic Operation

When switching on the device and the logger function is not off the time of the integrated clock will shortly be displayed. If a **zero point adjustment** was carried out the display shows shortly „nuLL Corr".
After changing the battery the clock-setting menu is activated automatically (‚CLOC'). Check the clock and adjust, if necessary (p.r.t. chapter 2).



On-/Off-Switch
Tara: Calling of tara function, zero point adjustment
min/max: Showing the min- resp. max-memory in sec. display
Store/Quit: Calling of hold function resp. calling of logger functions (p.r.t. ch. 3)
Set/Menu: Calling of configuration

Max Memory: Pressing ´max´ (key 2) shows the maximum of the measured values. Pressing it again hides it. To clear the max memory press key ´max´ for >2 seconds.

Min Memory: Pressing ´min´ (key 5) shows the minimum of the measured values. Pressing it again hides it. To clear the min memory press key ´min´ for >2 seconds.

Hold Function: By pressing ´Store/Quit´ (key 6) the last measuring value will be held in the secondary display. Pressing it again hides it. (only when logger = ‚off').

Tare Function: By pressing ´Tara´ (key 3) the display will be set to 0. All measurings from then on will be displayed relatively to the set tare value. When tara function is activated, the arrow "Tara" appears in the display. To deactivate tare function press ´Tara´ for >2 seconds.
Please Note: Activating/deactivating tara clears the max- & min-memories.

2 Configuration

To change device settings, press ***Menu*** (key 4) for 2 seconds. This will call the configuration menu (main display: „SEt"). Pressing key ***Menu*** changes between the menues, pressing ▸ (key 3) jumps to the refering parameters, which can be selected with key ▸ (key 3). The parameters can be changed with ▲ (key 2) or ▼ (key 5).
Pressing ***Menu*** again jumps back to the main configuration menu and saves the settings.
Quit (key 6) finishes the configuration and returns to standard measuring operation.

Menu	Param.	Values	Meaning	C_log	C_dat	Stor
‚Menu'	▸	▲ or ▼				
SEt ConF	**Set Configuration: Generic Configurations**					
	Unit	mbar,bar..	**Unit**: Unit of display	*		*
	SL	oFF/on	**Sea level correction**: on or off	*		*
	Alti	-2000..9999	**Altitude**: Input of altitude above sea level [m] (only if SL on)	*		*
	rAtE		**Rate**: Measuring rate (p.r.t. chapter 2.1)	*		*
		Slo	**Slow** measuring rate (4Hz filtered, low power consumption)	*		*
		FASt	**Fast** measuring rate, filtered (>1000Hz)	*		*
		P.dEt	**Peak detection**: fast measuring rate, unfiltered (>1000Hz)	*		*
	t.AVG	1-120	Averaging period in seconds, used by the averaging function	*		*
		oFF	Averaging function deactivated	*		*
	P.oFF	1-120	**Auto Power Off** time in minutes			
		oFF	Auto Power Off deactivated			
	Out	oFF	Function of the output: No output function, lowest power consumption			
		SEr	Output is serial interface			
		dAC	Output is analogue output 0...1V			
	Adr.	01,11..91	Base **address** of interface			
	dAC.0	0 ... 1300 mbar	Enter desired value at which the analogue output potential should be 0V (if Out = dAC)			
	dAC.1	0 ... 1300 mbar	Enter desired value at which the analogue output potential should be 1V (if Out = dAC)			
SEt CAL	**Set Calibration: Adjustment of Sensor**			*		
	OFFS	-500 ... 500 mbar	The **offset of sensor** will be displaced by this value to compensate for deviations in the probe or in the measuring device.	*		
		oFF	Zero displacement inactive (=0.00)	*		
	SCAL	-2.000 ... 2.000	The measuring **scale of sensor** will be changed by this factor [%] to compensate deviations of temperature probe or measuring device	*		
		oFF	Scale correction factor inactive (=0.000)	*		
SEt AL.	**Set Alarm: Settings of Alarm Function**					
	AL.	on	**Alarm** on, with horn-sound			
		no.So	Alarm on, without horn-sound			
		oFF	Alarm deactivated			
	AL.Lo	0 mbar ... AL.Hi	Min alarm rail (not when AL. oFF, Sensor-Min is the lower display range of connected sensor)			
	AL.Hi	AL.Lo ... 1300 mbar	Max alarm rail (not when AL. oFF, Sensor-Max is the upper display range of connected sensor)			
SEt LoGG	**Set Logger: Configuration of Logger Function**			*		*
	Func	CYCL	**Cyclic**: logger function ‚cyclic logger'	*	*	*
		Stor	**Store**: logger function ‚individual value logger'	*	*	*
		oFF	no logger function	*	*	*
	CYCL	1..3600	Cycle time of cyclic logger [seconds]	*		*
	Lo.Po	on/oFF	**Low-power logger** with very low power consumption (only for cyclic logger and slow measuring rate)	*		*
SEt CLOC	**Set Clock: Setting of Real Time Clock**					
	CLOC	HH:MM	**Clock**: Setting of time hours:minutes			
	dAtE	TT.MM	**Date**: Setting of date day.month			
	YEAr	YYYY	**Year**: Setting of year			

C_log: cyclic logger (active) *C_dat: cyclic logger with data (no active logging)* *C_stor: individual value logger with data*

Note: ***When using the logger function some settings in the menu may not be accessible (*).***
If this settings should be changed, the logger has to be stopped before, eventually the loggerdata has to be cleared. (p.r.t. chapter 3)

2.1 Different Kinds Of Measuring: „rAtE-Slo, -P.dEt, -FASt“

Three different kinds of measuring pressure are supported. Two of them are working with high measuring frequency of more than 1000 measurings per second. If one of them was chosen in the configuration (see above), this will be displayed in the secondary display: „P.dEt“ or „FASt“.

2.1.1 rAtE-Slo: Standard Measuring

Measuring rate 4Hz, averaging and filter functions are active.
Application: Measuring of slowly changing or static pressures, e.g. measuring of leakproofness, athmospheric pressure...
Highest accuracy, high noise immunity (EMI and unstable measuring signals), low power consumption.

2.1.2 rAtE-P.dEt: Peak detection

Measuring rate >1000Hz, the value is displayed unfiltered.
Application with logger function: Measuring of short pressure peaks or fast changing pressures with a resolution of < 1ms. The cyclic logger function records the arithmetic mean value, the highest and the lowest peak of the refering time interval.
Attention: higher power consumption, measuring is sensitive to noise (EMI,..).

2.1.3 rAtE-FASt: Fast filtered measuring

Measuring rate >1000Hz, the value is filtered slighlty (higher noise immunity than P.dEt, small peaks will be filtered out), apart from that identical behaviour like P.dEt.

2.2 Sea Level Correction

The device displays the absolute pressure measured at the sensor. This is not necessarily the same like the values given by weather stations! The weather stations‘ values are giving the pressure at sea level. Usually the sensor is placed above sea level and therefore, if the value at sea level(zero) is to be measured, the pressure loss resulting from the actual level above sea level has to be considered! To correct the measuring display activate the „Sea-Level-Function“ (SL, p.r.t. chapter 2). Then enter the altitude above sea level of the sensor‘s location in meters (Alti, p.r.t. chapter 2). When activated, the display shows the SL-arrow and the device displays the pressure value at sea level.

2.3 Averaging Function

The averaging function concerns the display values (LCD and interface). It is completely independent from the averaging of the logger function, please don't mix them up!
The averaging integrates the measuring values during a selectable period of time and then calulates the average display value. It is independent from the selected kind of measuring (slow, fast, peak detect) .
As long as not enough values are collected (selected avereaging time) to calculate a average value, the upper display shows “----“, the lower display a ‘countdown‘.
During an active low-power-logging procedure the avering is always deactivated

Function of min/max-value memory during averaging:

- If averaging is activated and slow measuring is selected (rAtE-Slo), the min-/max-value memory refers to the average display value.
- If averaging is activated and fast measuring is selected (rAtE-FASt or P.dEt) , the min-/max-value memory refers to the internal measured values (fast peaks can be detected).

2.4 Zero Displacement Sensor ('OFFS')

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

value displayed = value 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. Input is in the display unit.

2.5 Scale Correction Sensor ('SCAL')

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

displayed value = measured value * (1+Scal/100)

Standard setting: 'off' =0.000, i.e. value is not corrected. Together with the zero displacement (see above) this factor is mainly used to compensate for sensor deviations.

2.6 Power Off Time

If there won't be pressed any key and no interface communication takes place for the time of the power off time setting (P.Off), the device will be switched off automatically to save battery power.
If P.oFF = oFF then the automatic switch off is deactivated.

2.7 Output

The output can be used as serial interface (for USB3100, GRS3100 or GRS3105 interface adapters) or as analogue output (0-1V).

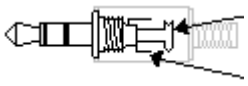
2.7.1 Interface - Base Address ('Adr.')

Up to 10 devices of the GMH3xxx- handheld-family can be connected to a serial interface at once (depending on interface converter, e.g. GRS3105: 5 devices). To get access to each device the base addresses of the devices have to be different. For example choose 01 for the first, 11 for the second device and so on. See also chapter 4.

2.7.2 Analogue Output – Scaling with DAC.0 and DAC.1

Note: Analogue output can not be used during logger recordings
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 3rd contact has to be left floating!
Only stereo plugs are allowed!

2.8 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 (Sens Erro)
- Low battery (bAt)
- Fe 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.

2.9 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 refering menu ‚CLOC' will automatically be started.

3 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 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 3 measurement results each time:
current or mean value (depending on logger setting, see below), min peak and max peak.

Min and max peak are the minimum resp. the maximum of the measured values since the last recording. Using them allows f.e. analysis of fluctuating pressures.
For the evaluation of the data the software GSOFT3050 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 more available, the key 6 is solely used for the operation of the logger functions.

3.1 „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
- min peak, max peak since the last 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.

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

Clear all recordings

Clear the last recording

Clear nothing (cancel menu)

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

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

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 ▶ (key 3) the measurement recorded last will be displayed, changing between the different values refering to the measurement also is done by pressing ▶.
Changing the measurement is done by pressing the keys ▲ or ▼.

3.2 „Func-CYCL“: Automatic Recording With Selectable Logger-Cycle-Time

The Logger-Cycle-Time is setable (p.r.t. Configuration). For example „CYCL“ = 60: A measuring is recorded after each 60 seconds.
When the slow measurement "rAtE-Slo" is chosen, additionaly a low power function is available: „Lo.Po“.
If „Lo.Po“ is on, the device only will take a measurement at the point of time of the recording. In between the recordings the measuring shut's down. This decreases the power consumption enormously and therefore is recommended e.g. for long time recordings where no mains adapter is available.

Max. number of measurings: 10000

Cycle time: 1...3600 seconds (=1h), selectable in the configuration

A measuring contains:

- rAtE SLo: - current measuring value at the time of recording
  - min peak, max peak since the last recording
- rAtE FASt,P.dEt - arithmetic mean value since the last recording
  - min peak, max peak since the last recording

Starting a recording:

By pressing "Store" (key 6) for 2 seconds the logger operation will be called. The display will show: 

By pressing "Store" again the recording will be initiated.

After that the display shows 'St.XXXX' for a short time whenever a measuring is recorded.
XXXX is the number of the measuring 1..10000.

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

The recording automatically will be stopped.

If Low-Power-Logger-Function „Lo.Po = on“ the device switches itself off as soon as the memory gets filled.

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

Stop the recording

Do not stop the recording

The selection can be made by ▲ (key 2) and ▼ (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 is to 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:
By pressing "Store" (key 6) for 2 seconds the logger operation will be called.
The display will show: 

By pressing the keys ▲ (key 2) or ▼ (key 5) the display will change to 
.

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

Clear all recordings

Clear the last recording sequence

Clear nothing (cancel menu)

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

4 The Serial Interface

By means of the serial interface and a suitable electrically isolated interface adapter (GRS3100, GRS3105 or USB3100) the device can be connected to a computer for data transfer.
With the GRS3105 up to 5 devices of the GMH3xxx- series can be connected to one interface (see also manual of GRS3105).
To avoid transmission errors, there are several security checks implemented e.g. CRC.

The following standard software packages are available:

- **GSOFT3050**: Operation and read out of logger function, data display in diagrams and tables
- **EBS9M**: 9-channel software to display the measuring values
- **EASYCONTROL**: Universal multi channel software (EASYBus-, RS485-, or GMH3000- operation possible) for real-time recording and presentation of measuring data of one GMH3xxx device 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 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)

In addition to the operation at a PC the device can be operated with the **GAM3000-device**, to use the alarm function for simple supervision and controlling applications. Just connect a GAM3000 to the interface, activate the alarm function of the GMH and the relais output is operating.

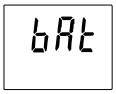
The device has 3 channels:
1: current measuring value (base address)
2: min peak (p.r.t. chapter 3)
3: max peak (p.r.t. chapter 3)

Note: The measuring-/ alarm- and display range values read back from the interface are always in the selected measurement unit (mbar, bar...)!

Supported functions:

Channel			Code	Name/Function	Channel			Code	Name/Function
1	2	3			1	2	3		
x	x	x	0	Read measurement value	x	x	x	201	Read max display range
x	x	x	3	Read system state	x	x	x	202	Read display range - unit
x			6	Read min memory	x	x	x	204	Read display range – decimal point
x			7	Read max memory	x			208	Read # of channels
x	x	x	12	Read ID number	x			214	Read scale adjustment [%]
x			22	Read min alarm rail (AL. - AL.Lo)	x			216	Read offset adjustment
x			23	Read max alarm rail (AL. - AL.Hi)	x			220	Read altitude (only abs. press sensors)
x			32	Read configuration flag BitAlarmOn:1; BitAlarmSound:3; BitCorrectToSealevel:32; BitPeakDetection:33; BitFastFiltered:34; BitLoggerOn:50; BitCyclicLogger:51; BitLowPowerLogger:52	x			221	Set altitude (only abs. press sensors)
					x			222	Read power off time (Conf-P.oFF)
					x			223	Set power off time (Conf-P.oFF)
					x	x	x	224	Logger: Read data of CYCL- Logger
x			102	Set min alarm rail (AL. - AL.Lo)	x			225	Logger: Read cycle time (LoGG - CYCL)
x			103	Set max alarm rail (AL. - AL.Hi)	x			226	Logger: set cycle time (LoGG - CYCL)
x			160	Set configuration flag (refer to 32)	x			227	Logger: start recording
x			174	Clear min memory	x			228	Logger: Read # of recordings made
x			175	Clear max memory	x			229	Logger: Read state
x	x	x	176	Read min measuring range	x			231	Logger: Read stop time
x	x	x	177	Read max measuring range	x			233	Read real time clock (CLOC)
x	x	x	178	Read measuring range – measuring unit	x			234	Set real time clock (CLOC)
x	x	x	179	Read measuring range – decimal point	x			236	Read logger memory size
x	x	x	180	Read kind of measuring of sensor	x			240	Reset
x	x	x	199	Read kind of measuring of display	x			254	Program version
x	x	x	200	Read min display range	x			260	Logger: read data of STOR Logger

5 Error And System Messages

Display	Meaning	What to do?
	Low battery power, device will only continue operation for a short period of time	Replace battery
	Battery empty	Replace battery
	Mains operation without battery: wrong voltage	Check power supply, replace it when necessary
No display or confused characters, device does not react on keypress	Battery empty	Replace battery
	Mains operation without battery: wrong voltage or polarity	Check power supply, replace it when necessary
	System error	Disconnect battery and power supplies, wait shortly, then reconnect
	Device defective	Return to manufacturer for repair
Err.1	Measured value above allowable range	Check: pressure above 1300 mbar? -> measuring value to high
	Sensor defective	Return to manufacturer for repair
Err.2	Measured value below allowable range	-> measuring value to low
	Sensor defective	Return to manufacturer for repair
Err.4	Value is too low to be displayed, tara is set	Check: display below -2000 (tara?)?
Err.9	Measured value far out of allowable range	Check: pressure not within sensor range?
Err.7	System error	Return to manufacturer for repair

6 Calibration Services

Calibration certificates – DKD-certificates – other certificates:
If device should be certificated for its accuracy, it is the best solution to return it to the manufacturer.
Only the manufacturer is capable to do efficient recalibration if necessary to get results of highest accuracy!

7 Specification

Measuring ranges:

Display range:	0 to 1300 mbar absolute
Overload:	max. 4 bar abs. (without destruction or recalibration of sensor being necessary)
Resolution:	1 mbar
Pressure units:	mbar, bar, kPa, MPa, mmHg, PSI, mH_2O (display ‚m'), selectable
Accuracy: (typ.)	±0,2%FS (hysteresis and linearity) ±0,4%FS (temperature dependency 0-50°C)
OPTION higher accuracy:	±0.1%FS (hysteresis and linearity) ±0.4%FS (temperature dependency 0-50°C)
Measuring rate:	slow: 4 meas./sec (ConF-Rate = Slow) fast: >100 meas./sec (ConF-Rate = FASt and P.dEt)
Nominal temperature:	25°C
Sensor:	Piezo-resistive absolute pressure sensor integrated in device. Suitable for air and non-corrosive and non-ionizing gases and liquids. (Not suitable for water – use air buffering)
Connection:	metal pressure port for connection to 6 x 1 mm tube at the top of device (4mm inner tube Ø)
Logger:	2 Functions: individual value logger („Func–Stor") and cyclic logger („Func–CYCL")
Memory: Stor:	99 data sets
CYCL:	10000 data sets (in max. 64 recording sequences)
Cycle time CYCL:	1...3600 seconds
Display:	2 four digit LCDs (12.4mm high and 7 mm high) for measuring values, and for min/ max memories, hold function, etc. as well as additional functional arrows.
Pushbuttons:	6 membrane keys
Output:	3.5 mm audio plug, stereo
Output function:	selectable as serial interface or analog output
Interface:	Serial interface (3.5mm jack) can be connected to RS232 or USB interface of a PC via electrically isolated interface adapter GRS3100, GRS3105 or USB3100 (see accessories).
Analog output:	0 ... 1 Volt, freely scaleable (resolution 12 bit)
Power supply:	9V battery, type: IEC 6F22 (included in scope of supply) 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:	Slow measuring rate: ~ 0.6 mA Fast measuring rate: < 2.5 mA Low-Power-Logger: < 0.1 mA (for cycle time>30s, without interface communication active and no alarm horn sounding) up to 0.4 mA (at cycle time 1s)
Low battery warning:	' bAt '

Additional Functions:

Power-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-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

Housing:	impact-resistant ABS, membrane keyboard, transparent panel, Front side IP65
Dimensions:	142 x 71 x 26 mm (L x W x D) + metal pressure ports 11mm at top of device
Weight:	approx. 165 g
Working temperature:	-20...+50°C
Allowable rel. humidity:	0...95 %RH (not condensing)
Storage temperature:	-20...+70°C
EMC:	The device corresponds to the essential protection ratings established in the Regulations of the Council for the Approximation of Legislation for the member countries regarding electromagnetic compatibility (2004/108/EG).
Additional fault:	<1%

8 Disposal notes

This device must not be disposed as 'residual waste'. To dispose this device, please send it directly to us (adequately stamped). We will dispose it appropriately and environmentally friendly.