Operating Manual
Resistive Material Moisture Measuring
GMH 3830 as of Version 1.5

MPA certified
approved for glued timber construction
acc. to DIN 1052-1

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Contents

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. Transporting the device 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. The circuitry has to be designed most carefully if the device should be connected to other devices. 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:** Operating the device with a defective mains power supply (e.g. short circuit from mains voltage to output voltage) may result in hazardous voltages at the device (e.g. at sensor socket)
5. Whenever there may be 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.
7. **Risk of injury!** The used measuring heads are very sharp, use thoroughly during your measuring to eliminate a possible risk of injury.

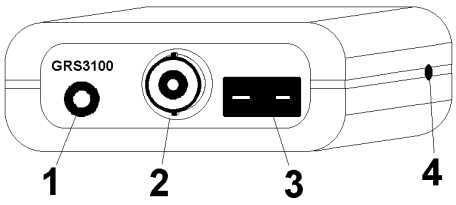
1.2 Operating And Maintenance

- **Battery Operation**
  The battery has been used up and needs to be replaced, if ⚠ and „bAt“ are shown in lower display. The device will, however, continue operating correctly for a certain time.
  The battery has been completely used up, if ´bAt´ is shown in the upper display.
  The battery has to be removed, when storing device above 50°C.
  Hint: We recommend to remove the battery if device is not used for a longer period of time! Risk of Leakage
- **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 over voltage!! Simple 12V-power supplies often have excessive no-load voltage. We, therefore, recommend using regulated voltage power supplies. Trouble-free operation is guaranteed by our power supply GNG10/3000. Prior to connecting the plug power supply with the mains supply make sure that the operating voltage stated at the power supply is identical to the mains voltage.
- Treat device and probes carefully. Use only in accordance with above specification. (do not throw, hit against etc.). Protect plugs and sockets from soiling.
- To disconnect sensor plug do not pull at the cable but at the plug.
- When connecting the probe the plug will slide in smoothly if plug is entered correctly.
- **Selection of Output-Mode**: The output can be used as serial interface or as analogue output. This choice has to be done in the configuration menu.

1.3 Disposal Notice

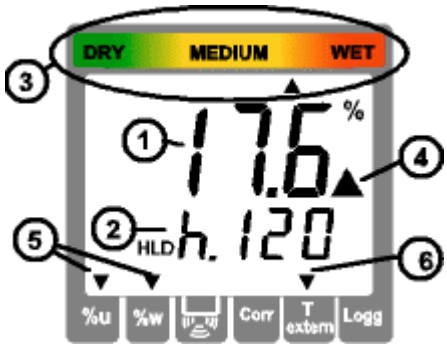
- Dispense exhausted batteries at destined gathering places.
- Send the device directly to us, if it should be disposed. We will dispose the device appropriate and non-polluting.

1.4 Connections



1. **Output:** Operation as interface: Connect to optically isolated interface adapter (accessory: GRS 3100, GRS3105 or USB3100)
   Operation as analogue output: Connection via suitable cable.
   Attention: The output mode has to be configured (p.r.t 2.7) and influences battery life!
2. **Sensor-connection:** BNC
3. **Temperature-probe-connection:** Thermocouple type K (NiCr-Ni) for temperature-compensation with an external temperature-probe
4. The **mains socket** is located at the left side of the instrument.

1.5 Display Elements



1 = Main Display: Currently measured material moisture [percent moisture content]
HLD: Measure value is ‘frozen‘ (Button 6)

2 = Auxiliary Display: Currently selected material (or temperature when pressing Button 3)

Special display elements:

3 = Moisture estimation: Estimation of the material condition: via top arrows: DRY - MEDIUM - WET

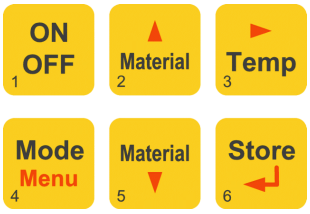
4 = Warning triangle: Indicates low battery

5 = “%u” or “%w” Displays unit: moisture content u or wet basis moisture content w

6 = T external-arrow Appears if an external temperature-probe is connected and automatic temperature compensation is activated.

All remaining arrows have no function in this version.

1.6 Pushbuttons



key 1: **On/Off key**

key 4: **Set/Menu**
press (Menu) for 2 sec.: configuration will activated

key 2, 5: **During measure: select a material**
p.r.t: 4.2 Pre-selection of favourite materials ('Sort')
List of selectable materials:
Appendix A; Appendix B
With manual temperature compensation:
When displaying temperature (call via button 3 ‚Temp‘):
Input of temperature
up/down for configuration:
to enter values or change settings

Key 6: **Store/↵:**
- Measurement:
  with Auto-Hold off: Hold current measuring value ('HLD' in display)
  with Auto-Hold on: Start a new measure, which is ready when 'HLD' appears in the display
- Set/Menu or temperature input:
  confirming of selected input, return to measure

Key 3: **During the measure:** shortly displaying temperature or changing to temperature input.

2 Device Configuration

For configuration of the device press "**Menu**"-key (key 4) for 2 seconds, the first menu will be shown.
Choose between the individual values that can be set by pressing the "**Menu**"-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.

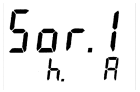
2.1 'Sort': Limitation of the material selection

off: Unrestricted material selection via key 2 and 5

1...8: Material selection in-between 1 up to 8 selectable materials.

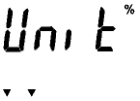
2.2 'Sor.X': Selectable materials (not available if Sort = off)

Depending on the number that had been entered at ‚Sort' menu settings from Sor.1 up to Sor.X will be available.



Select the desired material that should be available during the measure via key 2 and 5, p.r.t: 4.2 Pre-selection of favourite materials ('Sort').

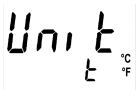
2.3 'Unit %': Selection of moisture unit %u / %w



Arrow points to "%u": Moisture display = moisture content [%u]

Arrow points to "%w": Moisture display = wet-basis moisture content [%u]

2.4 'Unit t': Selection of temperature unit °C /°F



°C: All temperature values are in degrees Celsius

°F: All temperature values are in degrees Fahrenheit

2.5 'ATC': Automatic temperature-compensation

oFF: Atc off: Manual input of the temperature for temperature-compensation via keys.

on: Atc on: temperature-compensation via temperature of the internal temperature measuring or with an external temperature probe.

2.6 'Auto-Hold': Automatically freezing the steady measure value

oFF: Auto HLD off: continuous measuring.

on: Auto-HLD on: when reaching a stable measuring result, this will be frozen with-HLD. When pressing the Store-Key a new measure will be initiated.

2.7 '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 inactive (necessary for continuous operation, e.g. mains operation)

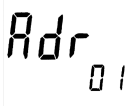
2.8 'Out': Function of the Output

OFF: No output function, lowest power consumption

SEr: Output is serial interface

dAC: Output is analogue output 0...1V

2.9 'Address': Selection of Base Address when Output = Serial Interface



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

2.10 'dAC.0Volt': Output Offset When Output = Analogue Output

0.0...100.0% Enter desired moisture value at which the analogue output potential should be 0V, e.g. at 0,0%

2.11 'dAC.1Volt': Output Scale When Output = Analogue Output

0.0...100.0% Enter desired moisture value at which the analogue output potential should be 1V e.g. at 100,0%

Hint: ***The settings will be set to the settings ex works, if keys 'Set' and 'Store' are pressed simultaneously for more than 2 seconds.***

3 Some Basics Of Precision Material Moisture Measuring

3.1 Moisture Content *u* and Wet-Basis Moisture content *w*

Depending on the Application one of the two units is necessary.
Carpenters, joiners and the like commonly use the moisture content u (sometimes referred to as MC).
When evaluating firewood, wood chips etc., the wet basis moisture content w is needed.
The instrument can be configured to both of the values. Please refer to chapter “configuration“.

Moisture content u or MC (relative to dry weight) = dry basis moisture content (mind the arrow at left bottom!)

The unit is %, sometimes used: % MC. The unit expresses the moisture content like calculated below:

Moisture content u [%] = ($weight_{wet}$ - $weight_{dry}$) / $weight_{dry}$ *100

Or: Moisture content u [%] = ($weight_{water}$) / ($weight_{dry}$) *100

$weight_{wet}$: weight of the wet material
$weight_{water}$: weight of water in the wet material
$weight_{dry}$: oven-dry weight of material

Example: 1kg of wet wood, which contains 500g of water has a moisture content u of 100%

Wet-Basis Moisture Content w (relative to total weight, mind the arrow at left bottom!)

The wet-basis moisture content expresses the ratio of the mass of water to the total mass of the substance. The ratio is represented by the following equation (the unit is % as well):

wet-basis moisture w[%] = ($weight_{wet}$ - $weight_{dry}$) / $weight_{wet}$ *100

Or: wet-basis moisture w[%] = ($weight_{water}$) / $weight_{wet}$ *100

Example: 1kg of wet wood, which contains 500g of water has a moisture content u of 50%

3.2 Special features of the device

466 wood specimens and 28 building materials are stored directly in the memory of the device:
Thus more exact measurements could be reached than with common devices with group selections would ever reach. Even the usage of complex conversion tables for building materials won’t be necessary any more!
Example: Common wood-moisture-measuring-devices use one single group for spruce and oak, in reality the deviation of these characteristic curves is more than 3%! (Base for this statement are complex statistical surveys, considered measuring range 7-25%). This random error will not occur for the whole GMH38xx series, with the help of individual characteristic curves highest resolution is achieved.
Extreme wide measuring range: 0-100% (depending on characteristic curve) percent moisture content in wood.
Moisture estimation: Additionally to the measuring value, an individual moisture estimation will be displayed simultaneously.

3.3 Auto-Hold Function

Particularly when measuring dry wood, electrostatic charges and other similar noise could dither the measuring value. With activated auto-hold function the device will acquire an exact measuring value automatically. During that, the device could be put down to avoid noise through discharge of the clothing etc. After having acquired the measuring value, the display will change to ‘HLD’: The value will be frozen as long as a new measuring is initiated by pressing button 6 (store).

3.4 Automatic temperature-compensation ('Atc')

An exact temperature compensation is important for a reliable wood-moisture-measuring. These devices feature a high quality thermocouple-input for type k thermocouples. Thus you could connect common surface-temperature-probes – The needed measuring-time ‘afield’ will be drastically lowered compared to common (non-surface-)temperature-probes
Temperature compensation is done automatically, depending on the setting and the connected probe.
The corresponding temperature will be shown shortly, by pressing the ‘Temp’ key.

The used temperature-value therefor is:

Menu		Used temperature-value	Aux. Display
Atc on	Temperature-probe connected	Temperature-measuring via connected external probe	Display-arrow ‘T extern‘
	No temperature-probe connected	Temperature-measuring via device-internal sensor	
Atc off	Independent from temperature-probe	Manual input of temperature: To change value, press Temp-Button, then use ▲ (button 2) or ▼ (button 5) to input the temperature confirm selection with ‘Store‘(button 6)	

Table 4.2: Using of the temperature-compensation

Attention: When connecting a probe that is non insulated you must have to observe not touching the wood or the electrodes nearby the unshielded electrode. We suggest using our insulated probe GTF38 (already included in standard case sets SET38HF and SET38BF).

3.5 Measuring In Wood: Measuring With Two Measuring-Pikes

Normally wood is measured with measuring-pikes. Used electrodes: impact-electrode GSE91 or GSG91, reciprocating piston electrode GHE91. For measuring wood, punch in the measuring-pikes across to the wood-grain, having a good contact between the pikes and the wood (measuring along wood-grain deviates minimal)

Reciprocating piston electrode GHE91 with temperature-probe GTF38

Select **correct wood-sort** (refer to Appendix A).
Ensure measuring the **correct temperature** (see chapter 3.4).
Hint: The special GTF38 temperature-probe can be stuck into a hole punched in with the electrode before (see left).Now read the measuring-value or when having activated the auto-hold-function initiate a new measuring by pressing ***Store/↵*** (button 6) .
The measured resistance will be extremely high when measuring dry wood (<15%) thus the measuring will need more time to achieve its final value. Among other things static discharge could momentarily falsify the measuring. Therefore beware of static discharge and wait long enough until a stable measuring value is displayed (unstable: „%“ blinking) or use the auto-hold-function (see chapter 3.3 Auto-Hold Function).
Most accurate measurements can be carried out within the range of **6 to 30%**.
Beyond this range the acquirable accuracy will lessen, but the device will deliver reference values still sufficient for the practitioner.

It is measured between the measuring-pikes insulated among each other. Requirements for an exact measurement:

- choose right correct place to measure: place should be free of irregularities like resin–clusters, knurls, rifts, etc.
- choose correct measure depth: Recommendation for timber: punch in the pikes up to 1/3 of the material thickness.
- Perform multiple measurements: the more measurements will be averaged, the more exact the result will be.
- Pay attention to temperature-compensation: the temperature-probe should be measuring the temperature of the moisture-measuring-place when measuring with external temperature-probe (Atc on).
  Without temperature-probe: let the device adapt to the temperature of the wood (Act on) or enter the exact temperature manually (Act off).

Frequent sources of errors:

- Attention with oven-dried wood: the moisture dispersion may be irregular, often in the core is more moisture than on the edge.
- Surface-moisture: The wood-edge could be more humid than the core if the wood had been stored outside and e.g. was in rain.
- Wood preservative and other treatment could falsify the measuring.
- Fouling at the connections and round the pikes could result in erroneous measurement, especially with dry wood.

3.6 Measuring Other Materials

3.6.1 ‘Hard‘ Materials (concrete or similar): Measuring with brush-type probes (GBSL91 or GBSK91)

Measuring with brush probe GBSL91

Drill two holes with Ø6mm (GBSK91) or Ø 8mm (GBSL91) at intervals of 8 to 10cm into the material to be measured. Do not use edgeless drills: the resulting heat will evaporate the moisture which will result in faulty measures. Wait for at least 10min, blow out the holes to clean them from dust. Apply conductivity compound on the brush-type probes and stick them into the holes. Choose correct material (see **Appendix B: Additional materials**), read the measuring value. Observe that the holes dry out by-and-by, and the device will measure a value too low, if you want to use them several times.
This effect can be compensated by using conductivity compound: insert profuse conductivity compound between the holes and the brush-type probe, and let the electrode stick in the hole for about 30min before measuring (with the device switched off). Temperature-compensation plays no role when using the building material measuring.

3.6.2 ‘Soft‘ Materials (polystyrene or similar): Measuring with Measuring-pikes or -pins

Useable electrodes: impact electrode GSE91 or GSG91, reciprocating piston electrode GHE91.
Procedure as described in chapter measuring in wood.

3.6.3 Measuring bulk cargo, bales and other special measures

Usable probes e.g. injection probe GSF38 or measuring pins GMS 300/91 mounted on GSE91 or GSG91.
Measuring of splints, wood chips, insulating material and similar:
When using injection probes or measuring pins oscillating movements have to be avoided when pushing in the probes. Otherwise hollows between the probes and the material may falsify the measuring. The material should be sufficiently compressed. When in doubt repeat the measuring a few times: the highest measuring value is the most exact one. Especially when using the injection probe pay attention having a foulness-free plastic insulator (situated immediately underneath the measuring-pike).
Measuring bale of straw and hay bale: Always inject the electrodes form the plain side of the bale, never from the round side, the probe can be inserted much more slightly.

3.7 Measuring of materials, having no characteristic curves stored

Choose the representative universal material group „h.A“, „h.b“, „h.c“ and „h.d“(for example corresponding to A,B,C and D of the GHH91) if a conversion table exists.
Attention: The moisture evaluation wet/dry of these material groups is only valid for wood!
Please keep in mind the following when using the temperature-compensation:
Automatic temperature-compensation should always be activated when measuring wood (Act on), with all other materials the automatic temperature-compensation should be switched off (Act off) and a manual temperature of 20°C should be entered.
Additionally at GMH3850: The GMH3850 can store up to 4 additional user characteristic curves. For this the corresponding reference point measurements for the respective material has to be carried out, from which the exact moisture content has to be dedicated with the Darr-Probe or the CM-Method. The Results can be stored in the device with the help of the GMHKonfig-Software, and can be accessed by the device directly .

4 Hints For The Special Functions

4.1 Moisture estimation ('WET' - 'MEDIUM' - 'DRY')

Additionally to the measuring value, an individual moisture estimation will be displayed simultaneously. This moisture estimation is only a guidance value, the final evaluation is depending on the application of the material e.g:
Cement floor pavement ZE, ZFE without additives: Readiness without floor heating at 2,3% with floor heating 1,5%
Anhydrit floor pavement AE, AFE: Readiness without floor heating at 0,5% with floor heating 0,3%*
Also firewood may be already usable while instrument still displays ‘wet’!
Corresponding Standards and Instructions must be observed!
The Device can only complement the skill of a tradesman or investigator but cannot replace it!

4.2 Pre-selection of favourite materials ('Sort')

A pre-selection of different materials (up to 8) can be selected from the menu for an effective working with the device. For example you can set the Menu Sort to 4 and save the desired materials in Sor.1, Sor.2, Sor.3 and Sor.4 if you only measure 4 different materials. Please refer to chapter 2.2 'Sor.X': Selectable materials (not available if Sort = off). Only the 4 desired materials can be selected via the buttons up and down, when exiting the menu, a changing during the measurement can be done comfortably. All materials will be available when setting Sort to off. Sor.1 to Sor.4 will still be available in the ‘background’, when setting the menu Sort to 4 the limited selection of the 4 entered materials will be active again. You only want to measure one material: set the menu Sort to 1 you cannot change to another material, thus a faulty operation is impossible.

5 Output

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

5.1 Interface - Base Address ('Adr.')

By using an electrically isolated interface converter GRS3100, GRS3105 or USB3100 (accessory) the device can be connected to a PC.
With the GRS3105 it is possible to connect up to 5 instruments of the GMH3000 family to a single interface (please also refer to GRS3105-manual). As a precondition the base addresses of all devices must not be identical. In case several devices will be connected via one interface make sure to configure the base addresses accordingly. In order to avoid transmission errors, there are several security checks implemented (e.g. CRC).
The device has 2 channels: - Channel 1: Material-moisture in % and base-address
- Channel 2: Temperature

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

Supported Interface-functions:

1	2	Code	Name/Function	1	2	Code	Name/Function
x	X	0	read nominal value	x	x	202	read unit of display
x	X	3	read system status	x	x	204	read decimal point of display
x		12	read ID-no.	x		205	read extended measuring type in display
x	X	176	read min measuring range	x		208	read channel count
x	X	177	read max measuring range	x	x	214	read scale correction
x	X	178	read measuring range unit	x	x	215	set scale correction
x	X	179	read measuring range decimal point	x	x	216	read zero displacement
x	X	180	read measuring type	x	x	217	set zero displacement
	X	194	set display unit	x		222	read turn-off-delay
x	X	199	read measuring type in display	x		223	Set turn-off-delay
x	X	200	read min. display range	x		240	Reset
X	X	201	read max. display range	x		254	read program identification

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.

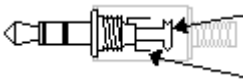
In case you want to develop your own software we offer a **GMH3000-development package** including

- an universal 32bit Windows functions library ('GMH3000.DLL') with documentation that can be used by all 'serious' programming languages.
- programming examples for Visual Basic 6.0™, Delphi 1.0™, Testpoint™, Labview™

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

With the DAC.0 and DAC.1 values the output can be rapidly scaled to Your efforts. Keep in mind not to connect low-resistive loads to the output, otherwise the output value will be wrong. 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:

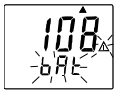
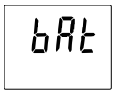


GND

+Uout

Attention!
The 3rd contact has to be left floating!
Only stereo plugs are allowed!

6 Fault and System Messages

Display	Meaning	Remedy
	low battery voltage, device will continue to work for a short time	replace battery
	If mains operation: wrong voltage	replace power supply, if fault continues to exist: device damaged
	low battery voltage	replace battery
	If mains operation: wrong voltage	Check/replace power supply, if fault continues to exist: device damaged
No display or weird display Device does not react on keypress	low battery voltage	replace battery
	If mains operation: wrong voltage	Check/replace power supply, if fault continues to exist: device damaged
	system error	Disconnect battery or power supply, wait some time, re-connect
	device defective	return to manufacturer for repair
----	Sensor error: no material connected (meas. Value below permissible range), no valid signal	Connect meas. material
	charge at the probe, device will discharge (resp. at dry wood)	Wait until probe has discharged
	Sensor broken or device defective	return to manufacturer for repair
Err.1	Value exceeding measuring range	Check: Is the value exceeding the measuring range specified? ->temperature too high!
	Wrong probe connected	Check probe
	Probe or device defective	return to manufacturer for repair
	Non-floating probe near the unshielded electrode	Insulate probe or measure at shielded electrode
Err.2	Value below display range	Check: Is the value below the measuring range specified? -> temperature too low!
	Wrong probe connected	Check probe
	Probe, cable or device defective	return to manufacturer for repair
Err.7	system error	return to manufacturer for repair

7 Application in the glued timber construction acc. to DIN 1052-1 (MPA certified)

The instrument with its curve h.460 (Fir) was certified by the MPA Stuttgart (Otto Graf institute) for applications in the glued timber construction according to DIN 1052-1 with the following equipment:

- measuring cable GMK38
- reciprocating piston electrode GHE91 (recommended) or impact electrode GSE91

8 Inspection of the accuracy / Adjustment Services

Accuracy can be inspected with the testing adapter GPAD 38 (extra equipment).
To check precision select material characteristic curve ".rEF", choose as moisture display „%u" and connect the testing adapter to the needles. The device must display the printed value for the GMH38xx. If the precision is no more corresponding to the imprint of the GPAD 38, we suggest to send the device to the manufacturer for a new adjustment.

9 Specification

Measuring	**Channel1**	**Channel2**
Principle	Resistive material-moisture-measuring matching DIN EN 13183-2: 2002	Temperature-measuring thermocouple type K or internal temperature-measuring
Char. curve	466 different kinds of wood 28 different building materials	matching DIN EN 60584-1: 1996, ITS90
Probe connection	BNC Plug	floating connector for mini-blade-terminal
Meas. range	0.0...100.0% percent moisture content (depending on characteristic curve) equal to ca. 3kOhm ... 2TerraOhm	thermocouple: -40.0... +200.0°C / -40.0... + 392.0°F int. temp.-Meas.: –30.0...75.0°C / –22.0...167.0°F
Resolution	0.1% percent moisture content	0.1°C / 0.1°F
Estimation	Estimation of the material condition in 9 steps from DRY to WET	
Accuracy Device without probe	±1Digit (at nominal-temperature)	
	Wood: ±0.2% moisture content (deviation from characteristic curve, range 6..30%) building mat.: : ±0.2% moisture content (dev. from char. curve, range depending on char. curve)	Type K: ± 0.5% m.v. ± 0.3°C int. t.-measuring: ± 0.3°C (is type K reference junction)
Temperature drift	< 0.005% percent moisture content per 1K	0.01% per 1K

Nominal temperature 25°C

Ambient Temperature -25 ... +50°C (-13 .. 122°F)
Relative humidity 0 ... 95 %RH (non condensing)

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

Housing Dimension: 142 x 71 x 26 mm (L x B x D)
impact resistant ABS, membrane keyboard, transparent panel.
Front side IP65, integrated pop-up-clip for table top or suspended use

Weight approx. 155 g

Output: 3.5mm audio plug, stereo
Selectable as serial interface: via optically isolated interface adapter GRS3100, GRS3105 or USB3100 (p.r.t. accessories) directly connectable to RS232- or USB-interfaces.
or analogue output: 0..1V, freely scaleable (resolution 13bit, accuracy 0.05% at nominal temperature, cap. load <1nF)

Power Supply 9V-Battery, type IEC 6F22 (included) as well as additional d.c. connector (diameter of internal pin 1.9 mm) for external 10.5-12V direct voltage supply. (suitable power supply: GNG10/3000)

Power Consumption

output off	approx. 2.5mA
output serial interface:	approx. 2.7mA
analogue output:	approx. 3.0mA

Display Two 4 digits LCD's (12.4mm high and 7 mm high) for material moisture temperature or characteristic curve, hold function, etc. as well as additional pointing arrows.

Pushbuttons 6 membrane keys for on/off switch, menu operation, characteristic curve, hold-function etc.
Hold Function Press button to store current value.
Automatic-Off-Function Device will be automatically switched off if no key is pressed/no interface communication takes place for the time of the power-off delay. The power-off delay can be set to values between 1 and 120 min.; it can be completely deactivated.

EMC: The device corresponds to the essential protection ratings established in the Directives of the European Parliament and of the council on the approximation of the laws of the memberstates relating to the electromagnetic compatibility (2004/108/EC).
EN61326 +A1 +A2 (Appendix B, class B), additional error: < 1% FS

Appendix A: Sorts of wood

Select kind of wood you want to measure, enter number on the device, e.g. birch = h. 60

Identification	Number	Comment	Range
Group A	h. A	Wood-group A (equal to GHH91 selector “A”)	0..82%
Group B	h. B	Wood-group B (equal to GHH91 selector “B”)	1..95%
Group C	h. C	Wood-group C (equal to GHH91 selector “C”)	2..107%
Group D	h. D	Wood-group D (equal to GHH91 selector “D”)	3..121%
AS/NZS 1080.1	h. AS	Australian reference characteristic curve	4..91%
Group Spruce-Pine-Fir	h.402	Softwood-Group	6..99%
Fir, Picea abies Karst.	**h.460**	**applications in the glued timber construction, MPA certified**	**6..101%**
Wood chips GSF38	**h.461**	**Softwood chips with probe GSF38 or GSF38TF**	**5..145%**
GMH38 reference	.rEF	Internal reference for determining additional characteristic curves / calculation tables (without temperature-compensation)	

Abura	Hallea ciliata	h.2	7..50%
Afrormosia	Pericopsis elata	h.3	6..47%
Afzelia	Afzelia spp.	h.4	8..42%
Agba	Gossweilerodendron balsamiferum	h.426	6..64%
Albizia / Iatandza, New Guinea	Albizia falcatara	h.8	5..88%
Albizia / Iatandza, Solomon Island	Albizia falcatara	h.9	4..72%
Alder, Blush	Solanea australis	h.10	5..65%
Alder, Brown	Caldcluvia paniculosa	h.11	7..69%
Alder, Common	Alnus glutinosa	h.131	2..107%
Alder, Rose	Caldcluvia australiensis	h.12	6..71%
Alerce	Fitzroya cupressoides	h.13	7..61%
Amberoi	Pterocymbium beccarii	h.14	5..67%
Amoora, New Guinea	Amoora cucullata	h.15	3..94%
Andiroba	Carapa guianensis	h.16	5..59%
Antiaris, New Guinea	Antiaris toxicaria	h.7	6..83%
Apple, Black	Planachonella australis	h.17	7..62%
Ash Silvertop	Eucalyptus sieberi	h.27	2..90%
Ash, American	Fraxinus americana	h.132	5..79%
Ash, Bennet's	Flindersia bennettiana	h.18	6..76%
Ash, Crow's	Flindersia australis	h.19	7..69%
Ash, European	Fraxinus excelsior	h.133	7..56%
Ash, Hickory	Flindersia ifflaiana	h.20	6..71%
Ash, Japanese	Fraxinus mandshurica	h.134	4..79%
Ash, Red	Flindersia excelsa	h.21	5..67%
Ash, Scaly	Ganophyllum falcatum	h.22	5..90%
Ash, Silver (Northern)	Flindersia schottina	h.23	7..70%
Ash, Silver (Queensland)	Flindersia bourjotiana	h.24	6..88%
Ash, Silver (Southern)	Flindersia schottina	h.25	7..82%
Ash, Silver, New Guinea	Flindersia amboinensis	h.26	5..82%
Aspen, Hard	Acronychia laevis	h.28	5..66%
Ayan	Distemonanthus benthamianus	h.285	7..54%
Balau	Shorea laevis	h.31	4..54%
Balau, red	Shorea guiso	h.32	4..68%
Balsa	Ochroma pyramidale	h.33	4..91%
Basralocus / Angelique	Dicorynia guianensis	h.34	6..55%
Basswood	Tilia americana	h.228	4..85%
Basswood, Fijian	Endospermum macrophyllum	h.35	4..63%
Basswood, Malaysian	Endospermum malacense	h.36	5..116%
Basswood, New Guinea	Endospermum medullosum	h.37	5..76%
Basswood, Silver	Polyscias elegans	h.38	7..72%
Basswood, Solomon Island	Polyscias elegans	h.39	4..65%
Bean, Black	Castanosperum australe	h.40	6..87%
beech, damped	Fagus sylvatica	h.87	6..55%
beech, european -	Fagus sylvatica	h.86	5..85%
Beech, Myrtle	Nothofagus cunninghamii	h.41	6..76%
Beech, New Zeeland Red (hearted untreated)	Nothofagus fusca	h.42	7..87%
Beech, New Zeeland Red (sapwood boron)	Nothofagus fusca	h.43	2..97%
Beech, New Zeeland Red (sapwood untreated)	Nothofagus fusca	h.44	5..84%
Beech, Silky	Citronella moorei	h.45	8..66%
Beech, Silver	Nothofagus menziesii	h.46	8..58%
Beech, Silver (sapwood tanalith)	Nothofagus menziesii	h.47	6..76%
Beech, Silver (sapwood untreated)	Nothofagus menziesii	h.48	4..92%
Beech, Wau	Elmerrilla papuana	h.49	7..96%
Beech, White (Fiji)	Gmelina vitiensis	h.50	5..77%
Beech, White (Queensland)	Gmelina leichardtii	h.51	6..81%
Bintangor / Calophyllum, Fijian	Calophyllum leucocarpum	h.53	5..81%
Bintangor / Calophyllum, Malaysian	Calophyllum curtisii	h.54	6..76%
Bintangor / Calophyllum, New Guinea	Calophyllum papuanum	h.55	4..98%
Bintangor / Calophyllum, Phillipines	Calophyllum inophyllum	h.56	6..78%
Bintangor / Calophyllum, Solomon Islands	Calophyllum kajewskii	h.57	6..85%
Binuang	Octomeles sumatrana	h.130	5..73%
Birch, American	Betula lutea	h.59	7..72%
Birch, European	Betula pubescens	h.60	5..96%
Birch, White	Schizomeria ovata	h.58	7..75%
Bishop Wood (Fiji)	Bischofia javanica	h.61	5..73%
Blackbutt	Eucalyptus pilularis	h.62	4..92%
Blackbutt, Western Australia	Eucalyptus patens	h.63	6..88%
Blackwood	Acacia melanoxylon	h.64	6..75%
Bloodwood, Red	Corymbia gunmifera	h.66	7..78%
Bollywood	Litsea reticulata	h.67	5..78%
Bossime	Drypetes spp,	h.70	7..62%

Box Grey	Eucalyptus moluccana	h.75	8..73%
Box Grey Coast	Eucalyptus bosistoana	h.76	7..76%
Box, Black	Eucalyptus lafgiflorens	h.71	5..92%
Box, Brush (Location Unknown)	Lophostemon confertus	h.74	5..53%
Box, Brush (N.S.W.)	Lophostemon confertus	h.72	4..55%
Box, Brush (Queensland	Lophostemon confertus	h.73	7..46%
Box, Kanuka	Tristania laurina	h.77	6..78%
Boxwood, New Guinea	Xanthophyllum papuanum	h.78	5..69%
Boxwood, Yellow	Planchonella pholmaniana	h.79	7..62%
Brachychiton	Brachychiton carrthersii	h.80	5..55%
Bridelia	Bridelia minutiflora	h.81	5..103%
Brigalow	Acacia harpohylla	h.82	5..83%
Brownbarrel	Eucalyptus fastigata	h.83	5..80%
Bubinga	Guibourtia demeusii	h.84	7..70%
Buchanania	Buchanania arborescens	h.85	4..76%
Burckella, Solomon Island	Burckella obovata	h.88	4..59%
Butternut, Rose	Blepharocarya involucrigera	h.89	5..69%
Camphorwood, New Guinea	Cinnamomum spp,	h.90	6..74%
Campnosperma (Malaysia)	Campnosperma curtisii	h.91	8..95%
Campnosperma (Solomon Island)	Campnosperma kajewskii	h.92	3..78%
Cananga (Phillipines)	Canagium odoratum	h.93	7..62%
Canarium Solomon Island	Canarium salomonese	h.97	4..65%
Canarium, African	Canarium Scheinfurthii	h.94	7..80%
Canarium, Fijian	Canarium oleosum	h.95	5..77%
Canarium, New Guinea	Canarium vitiense	h.96	5..75%
Candlenut	Aleurites moluccana	h.98	0..168%
Carabeen, Yellow	Sloanea woollsii	h.99	6..67%
Cathormion, New Guinea	Cathormion umbellatum	h.100	4..56%
Cedar , Amercan	Cedrela odorata	h.102	8..67%
Cedar, incense	Calocedrus decurrens	h.65	5..96%
Cedar, White	Melia azedarach	h.101	7..86%
Cedar, Yellow	Chamaecyparsis nootkatensis	h.457	4..91%
Celtis, New Guinea	Celtis spp,	h.103	5..67%
Celtis, Solomon Island	Celtis philippinesis	h.104	4..56%
Cheesewood, White (Queensland) /Asian Alstonia	Alstonia scholaris	h.105	5..77%
Chengal (Malaysia)	Neobalanocarpus heimii	h.106	4..76%
Cherry, American	Prunus serotina	h.216	5..97%
Cherry, European	Prunus avium	h.217	7..68%
Cleistocalyx	Cleistocalyx mirtoides	h.107	5..85%
Coachwood	Ceratopetalum apetalum	h.108	4..84%
Coondoo, Blush	Planchonella laurifolia	h.109	6..60%
Cordia, New Guinea	Cordia dichotoma	h.110	5..51%
Corkwood, Grey	Erythrina vespertillio	h.111	6..57%
Courbaril	Hymenaea coubaril	h.112	7..53%
Cudgerie, Brown	Canarium australasicum	h.113	7..67%
Cupiuba	Goupia glabra	h.147	6..56%
Curupixá	Micropholis	h.114	6..52%
Cypress	Cupressus spp,	h.456	5..89%
Cypress, Northern	Callitris intratropica	h.115	6..78%
Cypress, Rottnest Island	Callitris preisii	h.116	7..80%
Cypress, White	Callitris glaucophylla	h.117	6..86%
Dakua, Salusalu (Fiji)	Decussocarpus vitiensis	h.118	6..83%
Dibetou/African walnut	Lovoa trichilioides	h.119	7..68%
Dillenia (Solomon Island)	Dillenia salomonese	h.120	4..65%
Doi (Fiji)	Alphitonia zizphoides	h.121	5..72%
Duabanga, New Guinea	Duabanga moluccana	h.124	4..72%
Ebony, african	Diospyros spp,	h.125	6..55%
Ekki	Lophira alata	h.29	4..73%
Elm, European	Ulmus spp,	h.374	7..51%
Elm, White	Ulmus americana	h.373	5..69%
Evodia, White	Melicope micrococca	h.135	5..60%
Figwood (Moreton Bay)	Ficus macrophylla	h.139	7..56%
Fir, alpine	Abies lasiocarpa	h.410	6..80%
Fir, amabilis	Abies amabilis	h.411	4..91%
Fir, Douglas	Pseudotsuga menziesii	h.122	5..91%
Fir, Douglas (New Zealand) (sapwood treated)	Pseudotsuga menziesii	h.140	6..73%
Fir, Douglas (New Zealand) (sapwood untreated)	Pseudotsuga menziesii	h.141	5..108%
Fir, Douglas (New Zealand) (truewood untreated)	Pseudotsuga menziesii	h.142	3..99%
Fir, grand	Abies grandis	h.412	4..91%
Fir, Spruce	Abies magnifica	h.413	5..97%
Fir, white / Fir, silver	Abies alba	h.414	5..93%
Fir, MPA	**Picea abies Karst.**	**h.460**	**6..101%**
Galip	Canarium indicum	h.143	5..64%
Garo-Garo	Matrixiodendron pschyclados	h.144	5..67%
Garuga	Garuga floribunda	h.145	6..53%
Goncalo Alvez	Astronium spp,	h.146	6..45%
Greenheart	Ocotea rodiaei	h.148	6..100%
Greenheart, Queensland	Endiandra compressa	h.149	7..82%
Guarea, black	Guarea cedrata	h.68	7..94%
Guarea, white	Guarea cedrata	h.69	9..67%
Guariuba	Clarisia racemosa	h.150	8..57%
Gum, Black	Nyssa sylvatica	h.162	7..76%
Gum, Blue, Sidney	Eucalyptus saligna	h.152	7..76%
Gum, Blue, Southern	Eucalyptus globulus	h.151	6..79%
Gum, Grey	Eucalyptus punctata	h.153	5..89%
Gum, Grey, Mountain	Eucalyptus cypellocarpa	h.154	6..79%
Gum, Maiden's	Eucalyptus maidenii	h.155	7..79%
Gum, Manna	Eucalyptus viminalis	h.156	4..80%
Gum, Mountain	Eucalyptus dalrympleana	h.157	3..89%
Gum, Pink	Eucalyptus fasciculosa	h.158	6..85%
Gum, Red, American	Liquidambar styraciflua	h.166	5..92%
Gum, Red, Forest	Eucalyptus tereticomis	h.159	7..82%
Gum, Red, River	Eucalyptus camaldulensis	h.160	7..94%
Gum, Rose / Gum, Saligna	Eucalyptus grandis	h.161	7..81%
Gum, Shining	Eucalyptus nitens	h.163	5..83%
Gum, Spotted (Victoria) (Lemon-Scented)	Corymbia spp,	h.164	4..72%
Gum, Sugar	Eucalyptus cladocalyx	h.165	6..79%

Gum, White Dunn's	Eucalyptus dunnii	h.167	4..72%
Gum, Yellow	Eucalyptus leucoxylon	h.168	7..73%
Handlewood, Grey	Aphanante phillipinensis	h.169	5..66%
Handlewood, White	Strebulus pendulinus	h.170	7..58%
Hardwood, Johnstone River	Bakhousia bancroftii	h.171	5..62%
Hemlock / Hemlock, Western	Tsuga heterophylla	h.172	8..54%
Hemlock, Chinesische	Tsuga chinensis	h.173	5..75%
Hevea	Hevea Brasiliensis	h.174	7..71%
Hickory	Carya spp.	h.175	6..69%
Hollywood, Yellow	Premna lignum-vitae	h.176	7..67%
Horizontal	Anodopetalum biglandulosum	h.177	7..84%
Incensewood	Pseudocarapa nitidula	h.178	8..58%
Iroko	Chlorophora excesla	h.179	7..46%
Ironbark, Grey	Eucalyptus drephanophylla	h.180	7..88%
Ironbark, Grey	Eucalyptus paniculata	h.181	5..86%
Ironbark, Red	Eucalyptus sideroxylon	h.182	8..79%
Ironbark, Red, Broad Leaved	Eucalyptus fibrosa	h.183	8..81%
Ironbark, Red, Narrow Leaved	Eucalyptus cerbra	h.184	5..86%
Jarrah	Eucalyptus marginata	h.185	5..92%
Jelutong	Dyera costulata	h.186	0..104%
Jequitibá	Cariniana spp,	h.187	5..64%
Kahikatea (New Zealand) (Boron)	Dacrycarpus docrydiodies	h.188	7..63%
Kahikatea (New Zealand) (Thanalith)	Dacrycarpus docrydiodies	h.189	6..73%
Kahikatea (New Zealand) (untreated)	Dacrycarpus docrydiodies	h.190	6..74%
Kamarere (Fiji)	Eucalyptus deglupta	h.191	5..66%
Kamarere (New Guinea)	Eucalyptus deglupta	h.192	5..83%
Kapur	Dryobalanops spp,	h.193	7..73%
Karri	Eucalyptus diversicolor	h.194	5..79%
Kauceti	Kermadecia vitiensis	h.200	4..57%
Kauri	Agathis australis, boroneensis	h.201	5..78%
Keledang	Artocarpus lanceifolius	h.202	0..132%
Kempas	Koomapassia excelsa	h.203	4..89%
Keranji (Malaysia)	Dialium platysepalum	h.204	5..51%
Keruing	Dipterocarpus spp,	h.205	6..64%
Kiso	Chisocheton schumannii	h.218	6..54%
Lacewood, Yellow	Polyalthia oblongifolia	h.219	5..68%
Laran	Anthocephalus chinensis	h.223	7..67%
Larch	Larix decidua	h.221	5..69%
Larch, American / Larch, Western	Larix occidentalis	h.220	5..98%
Larch, Japanese	Larix kaempferi	h.222	5..99%
Lauan, Red	Shorea negrosensis	h.224	5..62%
Leatherwood	Eucryphia lucida	h.225	6..79%
Lightwood	Acacia implexa	h.226	7..62%
Limba	Terminalia superba	h.227	6..56%
Lime, European	Tilia vulgaris	h.229	4..78%
Louro, Red	Ocotea rubra	h.231	5..76%
Macadamia	Floyda praealta	h.232	7..59%
Magnolia	Magnolia acuminata/grandiflora	h.233	6..88%
Mahogany, Brush	Geissos benthamii	h.242	7..57%
Mahogany, Miva	Dysoxylum muelleri	h.243	8..73%
Mahogany, New Guinea	Dysoxylum spp,	h.241	6..74%
Mahogany, Red	Eucalyptus botryoides	h.244	7..91%
Mahogany, Rose	Dysoxylum fraseranum	h.245	7..65%
Mahogany, Southern	Eucalyptus botryoides	h.246	5..82%
Mahogany, White	Eucalyptus acmenoides	h.247	6..93%
Mahogony Khaya	Khaya spp,	h.235	7..82%
Mahogony, American	Swietenia spp,	h.234	6..84%
Mahogony, Phillipines	Parashorea plicata	h.236	5..93%
Mahogony, Phillipines	Shorea almon	h.237	4..67%
Mahogony, Sapelli / Sapele	Entandrophragma cylindricum	h.238	5..99%
Mahogony, Sipo / Utile	Entradrophragma utilie	h.239	6..110%
Mahogony, Tiama / gedu nohor	Entadrophragma angolense	h.240	10..54%
Mako	Trischospermum richii	h.248	3..68%
Makoré	Thieghemmella africana	h.123	6..86%
Makorè	Thieghemella heckelii	h.249	7..80%
Malas	Homalium foetidum	h.250	5..72%
Malletwood	Rhodamnia argentea	h.251	5..68%
Malletwood, Brown	Rhodamnia rubescens	h.252	5..70%
Manggachapui	Hopea acuminata	h.253	6..87%
Mango	Mangifera minor	h.254	4..68%
Mango, Phillipines	Mangifera altissima	h.255	7..93%
Mangosteen (Fiji)	Garcinia myrtifolia	h.256	5..68%
Mangrove, Cedar	Xylocarpus australasicus	h.257	6..82%
Maniltoa (Fiji)	Maniltoa grandiflora	h.258	6..58%
Maniltoa (New Guinea)	Maniltoa pimenteliana	h.259	6..58%
Mansonia	Mansonia altissima	h.260	7..80%
Maple, New Guinea	Flindersia pimentelianan	h.261	6..87%
Maple, Queensland	Flindersia brayleyana	h.262	5..136%
Maple, Rose	Cryptocarya erythroxylon	h.263	6..64%
Maple, Scented	Flindersia laevicarpa	h.264	7..57%
Mararie	Pseudoweinwannia lanchanocarpa	h.265	8..75%
Marri	Eucalyptus calophylla	h.266	5..64%
Masiratu	Degeneria vitiensis	h.267	5..67%
Massandaruba	Manilkara kanosiensis	h.268	4..65%
Matai	Podocarpus spicatus	h.269	6..73%
Mengkulang	Heritiera spp,	h.270	5..67%
Meranti, Buik from 1999	Shorea platiclados	h.271	4..61%
Meranti, Dark Red	Shorea spp,	h.272	5..94%
Meranti, Nemesu from 1999	Shorea pauciflora	h.274	4..91%
Meranti, Seraya from 1999	Shura curtisii	h.275	5..62%
Meranti, Tembaga from 1999	Shorea leprosula	h.276	3..72%
Meranti, White	Shorea hypochra	h.277	4..94%
Meranti, Yellow	Shorea multiflora	h.273	0..111%
Merawan	Hopea sulcala	h.278	4..90%
Merbau	Intsia spp,	h.279	6..84%
Mersawa	Anisoptera laevis	h.280	4..96%
Messmate	Eucalyptus obliqua	h.281	8..75%
Moabi	Baillonella toxisperma	h.282	6..83%
Mora	Mora excelsa	h.283	5..59%
Moustiqaire	Cryptocarya spp,	h.284	4..77%
Musizi	Maesopsis eminii	h.286	7..94%
Neuburgia	Neuburgia collina	h.287	7..75%
Nutmeg (Fiji)	Myrstica spp,	h.290	5..74%

Nutmeg (New Guinea)	Myrstica buchneriana	h.291	5..78%
Nyatoh	Palaquium spp,	h.292	4..71%
Oak, European	Quercus robur L.,	h.126	4..87%
Oak, Japanese	Quercus spp,	h.127	4..91%
Oak, New Guinea	Castanopsis acuminatissima	h.293	4..90%
Oak, Red	Quercus spp,	h.128	5..91%
Oak, Silky, Fishtail	Neorites kevediana	h.294	3..59%
Oak, Silky, Northern	Cardwellia sublimia	h.295	5..83%
Oak, Silky, Red	Stenocarpus salignus	h.296	6..67%
Oak, Silky, Southern	Grevillea robusta	h.297	5..64%
Oak, Silky, White	Stenocarpus sinuatus	h.298	6..64%
Oak, Tasmanian	Eucalyptus regnans	h.299	7..87%
Oak, Tulip, Blush	Argyrodendron actinophyllum	h.300	6..60%
Oak, Tulip, Brown	Argyrodendron trifoliolatum	h.301	9..60%
Oak, Tulip, Red	Argyrodendron peralatum	h.302	9..87%
Oak, Tulip, White	Petrygota horsfieldii	h.303	5..69%
Oak, White-	Quercus spp,	h.129	5..81%
Obah	Eugenia spp,	h.304	5..66%
Obeche	Triplochiton scleroxylon	h.1	5..50%
Odoko	Scottellila coriancea	h.305	6..72%
Olive	Olea hochstetteri	h.306	7..80%
Olivillo	Atextoxicon puncttatum	h.307	5..70%
Opepe	Nauclea diderrichii	h.52	7..73%
Padauk, African	Pterocarpus soyauxii	h.308	4..79%
Palachonella, Fijian	Planchonella vitiensis	h.347	6..61%
Palachonella, New Guinea	Planchonella kaernbachiana	h.348	4..71%
Palachonella, New Guinea	Planchonella thyrsoidea	h.349	2..67%
Palachonella, Solomon Island	Planchonia papuana	h.350	4..57%
Paldao	Dracontomelum dao	h.309	4..86%
Panga Panga	Millettia stuhlmannii	h.312	6..45%
Papuacedrus	Papuacedrus papuana	h.314	6..88%
Parinari, Fijian	Oarinari insularum	h.315	4..78%
Penarahan	Myristica iners	h.316	6..94%
Peppermint, Broad-Leaved	Eucalyptus dives	h.317	6..94%
Peppermint, Narrow-Leaved	Eucalyptus australiana	h.318	8..76%
Peroba, White	Paratecoma peroba	h.319	7..60%
Persimmon	Diospyros pentamera	h.320	5..70%
Perupok (Malaysia)	Kokoona spp,	h.321	1..135%
Perupok (Malaysia)	Lophopetalum subovatum	h.322	8..98%
Pillarwood	Cassipourea malosano	h.323	4..79%
Pine / Pine, Stone	Pinus pinea	h.345	6..87%
Pine, Aleppo	Pinus halepensis	h.324	8..76%
Pine, Austrian	Pinus nigra	h.212	5..106%
Pine, Beneguet	Pinus kesya	h.325	8..104%
Pine, Black	Prumnoptys amarus	h.326	5..76%
Pine, Bunya	Pinus bidwillii	h.327	8..69%
Pine, Canary Island	Pinus canariensis	h.328	6..80%
Pine, Celery-Top	Phyllocladus aspenifolius	h.329	7..71%
Pine, Hoop	Araucaria cunninghamii	h.330	7..79%
Pine, Huon	Dacrydium franklinii	h.331	8..70%
Pine, King William	Athrotaxis selaginoides	h.332	7..67%
Pine, Klinki	Araucaria hunsteinii	h.333	4..91%
Pine, Loblolly-	Pinus taeda	h.209	5..91%
Pine, Longpole-	Pinus contorta	h.207	5..96%
Pine, Maritime	Pinus pinaster	h.334	8..74%
Pine, Parana Red	Araucaria angustifolia	h.335	6..39%
Pine, Parana White	Araucaria angustifolia	h.336	7..58%
Pine, Pitch-, american	Pinus palustris	h.211	6..65%
Pine, Pitch-, caribbean	Pinus caribaea	h.210	6..93%
Pine, Radiata	Pinus radiata	h.337	5..100%
Pine, Radiata (New Zealand) (sapwood aac)	Pinus radiata	h.338	7..78%
Pine, Radiata (New Zealand) (sapwood boliden)	Pinus radiata	h.339	6..85%
Pine, Radiata (New Zealand) (sapwood boron)	Pinus radiata	h.340	6..69%
Pine, Radiata (New Zealand) (sapwood tanalith)	Pinus radiata	h.341	5..73%
Pine, Radiata (New Zealand) (sapwoodt untreated)	Pinus radiata	h.342	5..91%
Pine, Red	Pinus resinosa	h.343	2..99%
Pine, Scotts	Pinus sylvestris L.	h.206	6..94%
Pine, Shortleaf	Pinus echinata	h.213	5..96%
Pine, Slash (Queensland)	Pinus elliottii	h.344	6..86%
Pine, Southern	Pinus echinata	h.214	5..97%
Pine, Southern, yellow / Pine, Ponderosa	Pinus ponderosa	h.208	5..96%
Pine, Sugar	Pinus lambertiana	h.215	4..97%
Pine, western white	Pinus monticola	h.406	5..98%
Pittosporum (Tasmania)	Pittosporum bicolor	h.346	4..82%
Planchonia	Pleiogynium timorense	h.351	5..73%
Pleiogynium / Podo	Podocarpus neriifolia	h.352	7..57%
Podocarp, Fijian	Decussocarpus vitiensis	h.353	6..79%
Podocarp, Red	Euroschinus falcata	h.354	6..83%
Poplar, Black	Populus nigra	h.313	4..91%
Poplar, Pink	Euroschinus falcata	h.355	6..67%
Quandong, Brown	Eurocarpus coorangooloo	h.356	5..75%
Quandong, Silver	Elaecarpus angustifolius	h.357	5..65%
Quandong, Solomon Island	Elaecarpus spaericus	h.358	3..67%
Qumu	Acacia Richii	h.359	5..67%
Raintree (Fiji)	Samanea saman	h.360	5..49%
Ramin	Gonystylus spp,	h.361	6..54%
Redwood / Sequoia	Sequoia sempervirens	h.362	5..88%
Rengas	Gluta spp,	h.363	4..85%
Resak (Malaysia)	Cotylelobium melanoxylon	h.364	3..94%
Rimu (non-truewood boron)	Dacrydium cupresinum	h.365	7..65%
Rimu (non-truewood tanalith)	Dacrydium cupresinum	h.366	7..65%
Rimu (non-truewood untreated)	Dacrydium cupresinum	h.367	8..69%
Rimu (truewood untreated)	Dacrydium cupresinum	h.368	8..44%
Robinia	Robinia pseudoacacia	h.369	2..72%
Roble Pellin	Nothofagus obliqua	h.370	6..72%

Rock maple	Acer saccharum	h.6	5..92%
Rosewood, Brasilian	Dalbergia nigra	h.311	5..58%
Rosewood, Indian	Dalbergia latifolia	h.310	4..91%
Rosewood, New Guinea	Pterocarpus indicus	h.371	5..66%
Rosewood, Phillippines	Pterocarpus indicus	h.372	10..54%
Sapupira	Hymenolobium excelsum	h.375	5..68%
Sasauria (Fiji)	Dysoxylum quercifolium	h.376	4..69%
Sassafras	Doryphora sassafras	h.377	6..70%
Sassafras, Southern	Atherospherma moschatum	h.378	7..66%
Satinash, Blush	Acmena Hemilampra	h.379	3..84%
Satinash, Grey	Syzygium gustavioides	h.380	5..82%
Satinash, New Guinea	Syzygium butterneranum	h.381	5..68%
Satinash, Rose	Syzygium francisii	h.382	5..59%
Satinay	Syncarpia hilii	h.383	4..92%
Satinbox	Phenbalium saquameum	h.384	5..92%
Satinheart, Green	Geijera salicifolia	h.385	8..51%
Satinwood, Tulip	Rhodosphaera rhodanthema	h.386	6..94%
Scentbark	Eucalyptus aromapholia	h.387	5..70%
Schizomeria, New Guinea	Schizomeria serrata	h.388	5..81%
Schizomeria, Solomon Island	Schizomeria serrata	h.389	4..60%
Sepetir	Sindora coriaceae	h.390	1..88%
Sheoak, Fijian Beach	Casuarina nodiflora	h.391	6..71%
Sheoak, River	Casuarina cunninghamiana	h.392	7..59%
Sheoak, Rose	Casuarina torulosa	h.393	8..58%
Sheoak, Western Australia	Allocasuarina fraserana	h.394	7..64%
Silkwood, Bolly	Cryptocarya ablata	h.395	8..53%
Silkwood, Silver	Flindersia acuminata	h.396	7..71%
Simpoh (Phillippines)	Dillenia philippinensis	h.397	5..86%
Sirus, White	Ailainthus peekelii	h.398	5..74%
Sirus, White	Ailainthus triphysa	h.399	7..70%
Sloanea	Sloanea spp,	h.400	5..77%
Spondias	Spondias mariana	h.401	4..72%
Spruce, European	Picea abies Karst.	h.136	6..101%
Spruce, Norway /Norway Spruce	Picea abies	h.137	6..105%
Spruce, Sitka	Picea sitchensis	h.138	5..98%
Sterculia, Brown	Sterculia spp,	h.230	4..91%
Stringybark, Brown	Eucalyptus capitellata	h.403	6..83%
Stringybark, Darwin	Eucalyptus tetrodonta	h.404	5..81%
Stringybark, Yellow	Eucalyptus muelleriana	h.405	9..77%
Suren	Toona cilata	h.407	6..103%
Sweet chestnut	Castanea sativa	h.199	2..107%
Sycamore	Acer pseudoplatanus	h.5	7..57%
Sycamore, Satin	Ceratopetalum succirubrum	h.408	7..63%
Tallowwood	Eucalyptus microcorsis	h.409	4..92%
Tatajuba	Bagassa guianesis	h.30	7..44%
Taun Maleisien	Pometia pinnata	h.195	0..105%
Taun New Guinea	Pometia pinnata	h.196	6..103%
Taun Phillipines	Pometia pinnata	h.197	7..99%
Taun Solomon Island	Pometia pinnata	h.198	4..70%
Tawa	Beilschmiedia tawa	h.415	8..51%
Tawa (sap & heart boron)	Beilschmiedia tawa	h.416	6..61%
Tawa (sap & heart untreated)	Beilschmiedia tawa	h.417	7..64%
Teak	Tectona grandis	h.418	6..80%
Terap	Artocarpus elasticus	h.419	2..169%
Terentang	Campnosperma brevipetiolata	h.420	5..77%
Terminalia Braun	Terminalia microcarpa	h.421	3..71%
Terminalia Gelb	Terminalia complanata	h.422	3..87%
Tetrameles	Tetrameles nudiflora	h.423	5..70%
Tingle, Red	Eucalyptus jacksonii	h.424	5..110%
Tingle, Yellow	Eucalyptus guilfolei	h.425	5..105%
Tornillo	Cedrelinga catenaeformis	h.427	5..71%
Totara	Podocarpus totara	h.428	7..63%
Touriga, Red	Calophyllum constatum	h.429	8..73%
Tristiropsis, New Guinea	Tristiropsis canarioides	h.430	6..70%
Tulipwood	Harpullia pendula	h.432	7..76%
Turat	Eucalyptus gomophocephala	h.431	7..71%
Turpentine	Syncarpia glomulifera	h.433	5..91%
Vaivai-Ni-Veikau	Serianthes myriadenia	h.434	5..61%
Vatica, Phillippines	Vatica, manggachopi	h.435	7..63%
Vitex, New Guinea	Vitex cofassus	h.436	5..78%
Vuga	Metrosideros collina	h.437	6..56%
Vutu	Barringtonia edulis	h.438	4..55%
Walnut, American	Juglans nigra	h.288	5..87%
Walnut, Blush	Beilschmiedia obtusifolia	h.439	8..64%
Walnut, European	Junglans regia	h.289	7..59%
Walnut, Queensland	Endiandra palmerstonii	h.440	6..101%
Walnut, Rose	Endiandra muelleri	h.441	3..78%
Walnut, White	Cryptocarya obovota	h.442	7..63%
Walnut, Yellow	Beilschmiedia bancroftii	h.443	5..66%
Wandoo	Eucalyptus wandoo	h.444	7..87%
Wattle, Hickory	Acacia penninervis	h.445	7..64%
Wattle, Silver	Acacia dealbata	h.446	7..73%
Wengé	Millettia laurentii	h.448	7..55%
Western Red Cedar	Thuja plicata	h.449	6..56%
Whitewood, American	Liriodendron tulipifera	h.447	5..99%
Woodchips GSF38 probe		h.461	5..145%
Woolybutt	Eucalyptus longifolia	h.450	7..80%
Yaka	Dacrydium nausoriensis/nidilum	h.451	6..69%
Yasi-Yasi I (Fiji)	Syzygium effusum	h.452	4..71%
Yasi-Yasi II (Fiji)	Syzygium spp,	h.453	5..82%
Yate	Eucalyptus cornuta	h.454	6..73%
Yertschuk	Eucalyptus considenia	h.455	7..88%

Appendix B: Additional materials

Select material you want to measure, enter number on the device, e.g. concrete b25 = b. 6

Measuring of building materials

Material	Number	Range	Moisture estimation
Concrete			
Concrete 200kg/m³ B15 (200 kg Concrete per 1m³ sand)	b. 5	0,7..3,3%	yes
Concrete 350kg/m³ B25 (350 kg Concrete per 1m³ sand)	b. 6	1,1..3,9%	yes
Concrete 500kg/m³ B35 (500 kg Concrete per 1m³ sand)	b. 7	1,4..3,7%	yes
gas-aerated concrete (Hebel)	b. 9	1,6..173,3%	yes
gas-aerated concrete (Ytong PPW4, gross density 0,55)	b. 27	1,6..53,6%	yes
Screed			
Anhydrit screed AE, AFE	b. 1	0,0..30,3%	yes
Ardurapid screed-concrete	b. 2	0,6..3,4%	no
Elastizell screed	b. 8	1,0..24,5%	yes
Screed-plaster	b. 11	0,4..9,4%	yes
Wood-concrete screed	b. 13	5,3..20,0%	yes
Screed-concrete ZE, ZFE without additives	b. 21	0,8..4,6%	yes
Screed-concrete ZE, ZFE with bitumen additives	b. 22	2,8..5,5%	yes
Screed-concrete ZE, ZFE with synthetic additives	b. 23	2,4..11,8%	yes
Miscellaneous			
Asbestos cement panels	b. 3	4,7..34,9%	no
Bricks clay bricks	b. 4	0,0..40,4%	no
Plaster	b. 10	0,3..77,7%	yes
Plaster synthetic	b. 12	18,2..60,8%	yes
On-wall plaster	b. 20	0,0..38,8%	no
Lime mortar KM 1:3	b. 14	0,4..40,4%	yes
Lime sand bricks (14 DF (200), gross density 1,9)	b. 28	0,1..12,5%	yes
Limestone	b. 15	0,4..29,5%	yes
MDF	b. 16	3,3..52,1%	yes
Cardboard	b. 17	9,8..136,7%	yes
Stone-timber	b. 18	10,5..18,3%	yes
Polystyrene	b. 25	3,9..50,3%	yes
soft-fibre-panel-wood, bitumen	b. 26	0,0..71,1%	yes
Concrete mortar ZM 1:3	b. 19	1,0..10,6%	yes
Concrete bounded fake boards	b. 24	3,3..33,2%	yes

The accuracy of measuring building materials depends on manufacturing and using. The used additives may vary from manufacturer to manufacturer, therefore deviating measure results may occur. The given measuring-range is the theoretically measurable range.

Estimation of additional materials

Following materials may be well estimated with the help of the device, but you won't reach such high accuracy than with materials listed in appendix A and B.

Material	Number	Comment
Hay, flax	h. 458	Injection probe GSF38
Straw, grain	h. 459	Injection probe GSF38
Cork	h. A	
Fibre board	h. C	
Wood fibre insulating wall panel	h. C	
Wood fibre hard disks	h. C	
Kauramin-fake boards	h. C	
Melamine-fake boards	h. A	
Paper	h. C	
Phenolic resin-fake boards	h. A	
Textiles	h. C (D)	