# Operating Manual
# Resistive Material Moisture Measuring
# GMH 3850 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

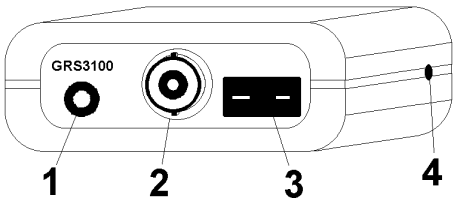
- **Battery Operation**
  The battery has been used up and needs to be replaced, if ⚠ and „bAt“ are shown in lower display. The device will, however, continue operating correctly for a certain time.
  The battery has been completely used up, if ´bAt´ is shown in the upper display.
  The battery has to 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

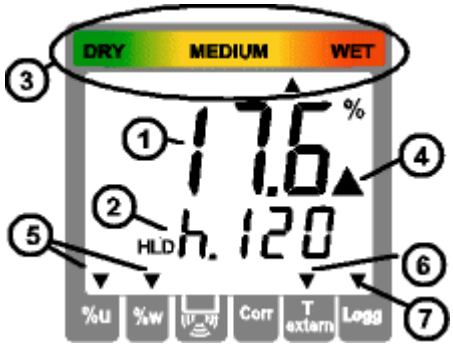
- Dispense exhausted batteries at destined gathering places.
- Send the device directly to us, if it should be disposed. We will dispose the device appropriate and non-polluting.

## 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

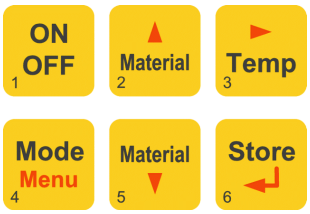
**5 = "%u" or "%w"** Displays unit: moisture content u or wet basis moisture content w

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

**7 = Logg-arrow** Shown if logger function is selected, flashes if cyclic logger is running

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
  refer to chapter 3.4 Auto-Hold Function
  or **calling of the logger functions** (refer to chapter 5)
- 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

**Note: Some menu items will be shown depending on the actual device configuration (e.g. there are some items disabled when the logger contains data). Please note the hints by the menu items.**

For configuration of the device press "**Menu**"-key (key 4) for 2 seconds, the main menu will be shown (main display: “SEt”). Choose the desired menu branch by pressing the "**Menu**"-key (key 4). By pressing “ ▸ ” (key 3) the referring parameters can be chosen. The referring values are changed by pressing the keys "▲" (key 2) or "▼" (key 5) (Choice of parameter: “ ▸ ”). Pressing **“Menu”** (key 4) again will jump back to the main menu selection and stores the settings. Use key " **Store/↵**" (key 6) to leave configuration.

| Menu | Parameter | Values | Meaning | | |
|---|---|---|---|---|---|
| key **Menu** | key ▸ | key ▲ or ▼ | | | p.r.t. |
| **Set Sort** | **Set Sort: limitation of the material selection** | | | | |
| SEt Sort | Sort | **off**: | Unrestricted material selection via key 2 and 5 | * | **4.2** |
| | | **1...8**: | Material selection in-between 1 up to 8 selectable materials | | |
| | Sor.1 ....Sor.8 | | selectable materials (not available if Sort = off)<br>Select the desired material that should be available during the measure via key 2 and 5. | * | **4.2** |
| **Set Conf** | **Set Configuration: Generic Settings** | | | | |
| SEt ConF | Unit % ▾ ▾ | Arrow bottom left points to **“%u”** | Moisture display = moisture content [%u] | * | |
| | | Arrow bottom left points to **“%w”** | Moisture display = wet-basis moisture content [%u] | | |
| | Unit t | **°C** | All temperature values are in degrees Celsius | | |
| | | **°F** | All temperature values are in degrees Fahrenheit | | |
| | Atc | **oFF** | Atc off: temperature input for compensation via keys | * | **3.3** |
| | | **on** | Atc on: temperature compensation via internally measured temperature or external probe | * | |
| | Auto HLD oFF | **oFF** | Auto HLD off: continuous measuring. | * | **3.4** |
| | | **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. If logger is switched on (‚Func CYCL‘, ‚Func Stor‘): device works like setting would be “auto-HLD off” | | |
| | P.oFF | **1...120** | Power-off delay in minutes.<br>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 (continuous operation, e.g. mains operation) | | |
| | Out | **oFF** | Function of the output: No output function, lowest power consumption | | **6** |
| | | **SEr** | Output is serial interface | | |
| | | **dAC** | Output is analogue output 0...1V | | |
| | Adr. | **01, 11 .. 91** | Base Address when Output = Serial Interface :<br>Base address of device for interface communication. | | **6.1** |
| | dAC.0 | **0.0 ... 100.0%** | Enter desired moisture value at which the analogue output potential should be 0V | | **6.2** |
| | dAC.1 | **0.0 ... 100.0%** | Enter desired moisture value at which the analogue output potential should be 1V | | **6.2** |
| **Set Logg** | **Set Logger: Configuration Of Logger Function** | | | | |
| SEt Logg | Func | **CYCL** | **Cyclic**: logger function ‚cyclic logger‘ | * | **5** |
| | | **Stor** | **Store**: logger function ‚individual value logger‘ | | |
| | | **oFF** | no logger function | | |
| | CYCL | **0:30 ... 60:00** | Cycle time of cyclic logger [minutes:seconds] | * | **5.2** |
| **Set CLOC** | **Set Clock: Setting Of Real Time Clock** | | | | |
| SEt CLOC | CLOC | **HH:MM** | **Clock**: Setting of time hours:minutes | | |
| | YEAr | **YYYY** | **Year** | | |
| | dAtE | **TT.MM** | **Date**: day.month | | |

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

***(*) If the logger memory contains data already, the menus/parameters marked with (*) can not be invoked! If these should be altered the logger memory has to be cleared before!***

***If the manual logger contains data (Logger: ‘Func Stor’), the first menu displayed will be: ‘rEAd Logg’ please refer to chapter 5.1***

# 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 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

The used temperature-value therefor is:

| Menu | Used temperature-value | | Aux. Display |
|---|---|---|---|
| Atc on | Temperature-probe connected | Temperature-measuring through connected probe | Display-arrow ‘T extern‘ |
| | No temperature-probe connected | Device-internal temperature-measuring | |
| Atc off | Independent from temperature-probe | Manual input of temperature: shortly 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).**

## 3.4 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).

**Attention: If the logger is switched on ('Func CYCL' or 'Func Stor'), the auto-hold function can not be used. The device works like it is set to Auto-HLD = off.**

## 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 3.3).
**Hint:** The special GTF38 temperature-probe can be stuck into a hole punched in with the electrode before (see picture on 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 3.4 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 depth: Recommendation for trimmed 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 (GMS 300/91)

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 Device Configuration.
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.

## 4.3 Individually Programmable Characteristic Curves

There are 4 individually programmable characteristic curves integrated.
By using them there can be used other material curves than the already integrated ones.
The programmable curves can be read and programmed by the software GMHKonfig.
As standard they are pre set with the REF-curve. This curve is the base of the determination of user specific curves.
Each curve is defined by a table with two columns (measuring value REF [%] / display value [%]) with 20 rows.
The name of the curve , which is displayed in lower display, can be set individually. Characters which cannot be displayed are displayed as a space character.
Each curve contains also limit values for wet and dry estimation.
As temperature compensation there is a choice between the standard compensation for wood or linear compensation. If there should be used no temperature compensation should be used: Choose linear compensation and enter 0 as compensation factor.

Linear temperature compensation:

MC compensated(T) = MC uncompensated * (1+ compensation factor/10000 * (T-20°C)
MC = moisture content

# 5 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 at 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 1 measurement result each time
For the evaluation of the data the software GSOFT3050 (V1.7 or higher) 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 and auto hold functions are no longer available, key 6 is solely used for the operation of the logger functions.

## 5.1 „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.

The logger stores the current measuring, independent from the stability of the value.

The material curve can be altered like during a normal measuring.

Max. number of measurings: 99
A measuring contains:
- current measuring value at the time of recording
- temperature value at the time of recording
- material curve at the time of 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.

**When 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 data referring to the measurement also is done by pressing ▶.
Changing the measurement is done by pressing the keys ▲ or ▼.

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

The Logger-Cycle-Time is selectable (p.r.t. Configuration). For example „CYCL“ = 1:00: A measuring is recorded after each 60 seconds.

**Special feature** of this logger function: The device will change to a **‘sleeping state’** during the measurings (lower display shows a count-down to the next measuring). Just before a new measuring should be recorded, the devices wakes up and measures until a stable measuring value is evaluated. This value will be stored, the device enters the sleeping state again. This procedure reduces the battery consumption dramatically, with a fresh zinc carbon battery the device is capable of recording more than a month without an additional mains adapter.

When the cyclic logger contains data (independent if running or stopped), the material cannot be changed.

The value measured during the last recording is shown in the upper display. During the pauses no measuring is done!

An adequate message is stored, if no stable value could been measured during the interval.

| | |
|---|---|
| Max. number of measurings: | 10000 |
| Cycle time: | 0:01...60:00 (minutes:seconds, min 1s, max 1h), selectable in the configuration |
| A measuring contains: | - current measuring value at the time of recording<br>- temperature at the time of recording |
| Recording time: | > 1 month (with output activated: OUT = SEr)<br>> 3 months (with output deactivated: OUT = off)<br>With mains adapter: limited just by memory and cycle time, up to 416 days |

**Starting a recording:**
By pressing "Store" (key 6) for 2 seconds the recording will be initiated. After that the display shows ‘St.XXXX‘ for a short time whenever a measuring is recorded. XXXXX is the number of the measuring 1..9999.

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

The recording automatically will be stopped.

**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 should 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:**
When „Store“ is pressed for 2 seconds, the choice for clearing the logger memory will be displayed:

Clear all recordings

Clear nothing (cancel menu)

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

# 6 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.

## 6.1 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 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 universally applicable 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™

**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)!***

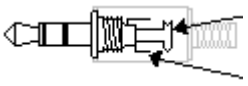
Supported Interface-functions:

| 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 |

## 6.2 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 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:**

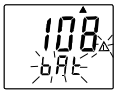
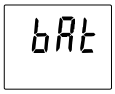


GND

+Uout

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

# 7 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<br><br>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 |

# 8 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

# 9 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.

# 10 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<br>28 different building materials<br>4 individually programmable material curves | matching DIN EN 60584-1: 1996, ITS90 |
| **Probe connection** | BNC Plug | floating connector for mini-blade-terminal |
| **Meas. range** | 0.0...100.0 % moisture content<br>(depending on characteristic curve)<br>equal to ca. 3kOhm ... 2TerraOhm | thermocouple: -40.0... +200.0°C / -40.0... + 392.0°F<br>int. temp.-Meas.: -30.0...75.0°C / -22.0...167.0°F |
| **Resolution** | 0,1% 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%)<br>building mat.: : ±0.2% moisture content (dev. from char. curve, range depending on char. curve) | Type K: ± 0.5% m.v. ± 0.3°C<br>int. t.-measuring: ± 0.3°C (is type K reference junction) |
| **Temperature drift** | < 0.005 % 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)

**Real time clock:** Integrated clock with date and year

**Logger:** 2 Functions: individual value logger („Func–Stor“) and cyclic logger („Func–CYCL“)
Memory: Stor: 99 data sets; CYCL: 10000 data sets
Cycle time CYCL: 0:30...60:00 (minutes:seconds, min 1s, max 1h)

**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 |
| cyclic logger sleeping state with output deactivated: | < 0.1mA |
| cyclic logger sleeping state with activated serial interface: | < 0.3mA |

**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% |
| Woolybutt | Eucalyptus longifolia | h.450 | 7..80% |
| Woodchips GSF38 probe | | h.461 | 5..145% |
| 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 |
|---|---|---|
| Concrete | | |
| Concrete 200kg/m³ B15 (200 kg concrete per 1m³ sand) | b. 5 | 0,7..3,3% |
| Concrete 350kg/m³ B25 (350 kg concrete per 1m³ sand) | b. 6 | 1,1..3,9% |
| Concrete 500kg/m³ B35 (500 kg concrete per 1m³ sand) | b. 7 | 1,4..3,7% |
| gas-aerated concrete (Hebel) | b. 9 | 1,6..173,3% |
| gas-aerated concrete (Ytong PPW4, gross density 0,55) | b. 27 | 1,6..53,6% |
| Screed | | |
| Anhydrit screed AE, AFE | b. 1 | 0,0..30,3% |
| Ardurapid screed-concrete | b. 2 | 0,6..3,4% |
| Elastizell screed | b. 8 | 1,0..24,5% |
| Screed-plaster | b. 11 | 0,4..9,4% |
| Wood-concrete screed | b. 13 | 5,3..20,0% |
| Screed-concrete ZE, ZFE without additives | b. 21 | 0,8..4,6% |
| Screed-concrete ZE, ZFE with bitumen additives | b. 22 | 2,8..5,5% |
| Screed-concrete ZE, ZFE with synthetic additives | b. 23 | 2,4..11,8% |
| Miscellaneous | | |
| Asbestos cement panels | b. 3 | 4,7..34,9% |
| Bricks clay bricks | b. 4 | 0,0..40,4% |
| Plaster | b. 10 | 0,3..77,7% |
| Plaster synthetic | b. 12 | 18,2..60,8% |
| On-wall plaster | b. 20 | 0,0..38,8% |
| Lime mortar KM 1:3 | b. 14 | 0,4..40,4% |
| Lime sand bricks (14 DF (200), gross density 1,9) | b. 28 | 0,1..12,5% |
| Limestone | b. 15 | 0,4..29,5% |
| MDF | b. 16 | 3,3..52,1% |
| Cardboard | b. 17 | 9,8..136,7% |
| Stone-timber | b. 18 | 10,5..18,3% |
| Polystyrene | b. 25 | 3,9..50,3% |
| soft-fibre-panel-wood, bitumen | b. 26 | 0,0..71,1% |
| Concrete mortar ZM 1:3 | b. 19 | 1,0..10,6% |
| Concrete bounded fake boards | b. 24 | 3,3..33,2% |

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) | |