

# Operating Manual

## Resistive material moisture measuring instrument

# GMR 100

as of Version 1.1

### with integrated measuring needles

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### precise measurements in

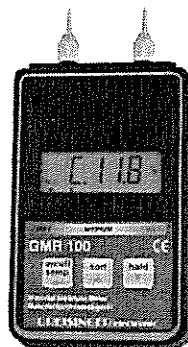
- cut wood, chip board, veneer
- firewood, wood briquette

### with accessory:

- cardboard, cork, textiles, paper,
- gas concrete, cast, cement mortar, wash floor, concrete etc.

### User

- Users of regenerative fuels (tiled stoves, wood firing, pellet firing)
- Architect, expert, inspector, building contractor, painter, interior decorator, carpenter,
- parquet joiner, floor tiler, wood works, timber, desiccation plant, building repair companies, textile industry etc



# 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. 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 or the device is not working as specified
  - the device has been stored under unsuitable conditions for a longer time
 In case of doubt, please return device to manufacturer for repair or maintenance.
5. **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.
6. **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

- If the symbol "LO BAT" is displayed at the left side of display, the battery is weak, measuring can be continued for a short period. If "bAT" is displayed in the main display the battery is used up and needs to be replaced. Measuring is no more possible.
- The battery has to be removed, when storing device above 50°C.

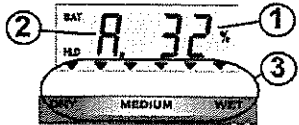
*Hint: We recommend removing the battery if device is not used for a longer period of time! Risk of Leakage*

- Treat device and probes carefully. Use only in accordance with above specification. (do not throw, hit against etc.). Protect from soiling, especially around the needles.
- After switching on the instrument a segment test (all segments) is displayed, followed by the measuring unit and, if activated, the auto power off function (please refer to configuration)

## 1.3 Disposal Notice

- Dispose 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 Display Elements



<p>1: main display</p> <p>2: group display</p> <p>3: moisture estimation</p>	<p>Currently measured material moisture or water content</p> <p>4 different wood groups (A, B, C, D)</p> <p>1 universal construction material group E (tables)</p> <p>1 construction material group (P)=Plaster</p> <p>Estimation of material condition via arrows:                  DRY - MEDIUM - WET</p> <p>BAT: Indicates low battery</p> <p>HLD: Measure value is 'frozen' (Key 3)</p>
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## 1.5 Pushbuttons



- key 1: **On/Off key**  
 Press long: off;  
 Press short: Show temperature compensation
- key 2: **sort**  
 Choose wood group A, B, C, D, E.  
 When showing Temp. compensation: increase temperature

**Key 6: hold**  
 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  
 p.r.t. chapter 2.2 Auto-Hold function  
 When showing Temp. compensation: decrease temperature

## 2 Some Basics Of Precision Material Moisture Measuring

### 2.1 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**

The unit is %, sometimes used: % MC.

The unit expresses the moisture content like calculated below:

$$\text{Moisture content } u [\%] = (\text{weight}_{\text{wet}} - \text{weight}_{\text{dry}}) / \text{weight}_{\text{dry}} * 100$$

Or: Moisture content  $u$  [%] =  $(\text{weight}_{\text{water}} / (\text{weight}_{\text{dry}}) * 100$

$\text{weight}_{\text{wet}}$ : weight of the wet material

$\text{weight}_{\text{water}}$ : weight of water in the wet material

$\text{weight}_{\text{dry}}$ : 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)**

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):

$$\text{wet-basis moisture } w[\%] = (\text{weight}_{\text{wet}} - \text{weight}_{\text{dry}}) / \text{weight}_{\text{wet}} * 100$$

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

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

### 2.2 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 key 3 (hold).

### 2.3 Temperature compensation

The temperature compensation is important for a reliable wood-moisture-measuring. Therefore the instrument features a manual temperature compensation input.

When pressing temp (key 1) shortly, the temperature value appears for some seconds. Now the value can be edited via  $\blacktriangle$  (key 2) or  $\blacktriangledown$  (key 3)

### 2.4 Measuring in wood

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).

**DO NOT HIT ONTO THE DEVICE OR PUNCH THE NEEDLES IN PEPPY**

The device may be damaged.

Select **correct wood-sort** (see Appendix A).

Ensure to have entered the **correct temperature** (see chapter 2.3).

Now **read** the measuring-value or when having activated the auto-hold-function initiate a new measuring by pressing **hold** (key 3).

The measured resistance will be extremely high when measuring dry wood (<15%) thus the measuring will need more time to achieve its terminal 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 2.2 Auto-Hold function).

When measuring very wet wood (e.g. >50% $u$ ) the measuring value may suffer from polarisation effects (steadily decreasing measuring value). In this case the value 5 seconds after the insertion of the electrodes respectively after switching on the instrument is valid.

Very accurate measures can be carried out within the range of **6 to 30%**.

Beyond this range the 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 correct place to measure: place should be free of irregularities like resin-clusters, knurls, rifts, etc.
- choose correct measure 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: enter the exact temperature manually.
- 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.

## 2.5 Measuring in plaster

Press needles into the plaster to detect moisture. Select material „P.“. The more moisture the plaster is containing, the higher is the display, also keep an eye on the moisture estimation (see chapter below). Attention: Because of the different consistencies of plasters and the influence damage by moisture, the precision of the measuring is not as high as the precision when measuring in wood! However 'precise measuring values' aren't necessary in the most cases -> when moisture appears, it makes large changes in the measuring value compared to dry parts e.g. of the measured wall, moist sections can easily be detected by the instrument. Also changes in the state (increasing/decreasing moisture) can be monitored by periodical measurements.

## 2.6 Moisture estimation ('WET' - 'MEDIUM' - 'DRY')

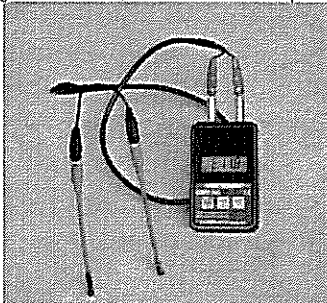
Additionally to the measuring value, an individual moisture estimation will be displayed simultaneously: The decision either wet or dry has no longer be affiliated from literature and tables for the most applications. This moisture estimation is only a guidance value, mainly for joiners/carpenters/floorers use, the final evaluation is depending on the application of the material. E.g. 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!

## 2.7 Measuring other materials

### 2.7.1 'Hard' materials (concrete or similar):

The needles are not intended for measuring hard building materials. For measuring those materials we suggest you the adapter cable GMK3810 and the brush probes GBSL91 or GBSK91.

Unscrew the needle holder and mount the adapters for the banana jacks. The red jack has to be connected to the right-hand socket, this decreases susceptibility of electromagnetic interference.



Measuring with brush probe GBSL91

Drill two holes with  $\varnothing 6\text{mm}$  (GBSK91) or  $\varnothing 8\text{mm}$  (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 material group E, read value and convert it via table in Appendix B. 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.

### 2.7.2 'Soft' Materials:

The most important thing is a good contact between the materials and the measuring needles. Whenever this is not possible because of the material texture, we suggest you to use the adapter cable GMK3810 with appropriate electrodes, such as impact electrode GSE91 or GSG91, reciprocating piston electrode GHE91.

Unscrew the needle holder and mount the adapters for the banana jacks. The red jack has to be connected to the right-hand socket, this decreases susceptibility of electromagnetic interference.

Procedure as described in chapter measuring in wood.

### 2.7.3 Measuring bulk cargo, bales and other special measures

Usable probes: measuring pins GMS 300/91 mounted on GSE91 or GSG91 with adapter cable GMK3810 (red connector to the right-hand socket).

**Measuring of splints, wood chips, insulating material and similar:**

When using 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.

## 3 Configuration of the instrument

To configure the instrument proceed as follows:

Switch off the instrument.

Press the "Mode" key while pressing the "on/off" key shortly.

Keep "Mode" key pressed (ca. 3 sec) until "P oF" appears in the display.

### I.) Auto Power Off Time "P oF":

The auto power off time is entered in minutes. If no key is pressed during a measuring, the instrument switches itself off automatically after the entered period of time.

3. Press "up" (also "Mode") or "down" (also "Hold") key, the currently selected time will be displayed (off, 1...120min).

4. Enter the desired time by pressing "up" or "down" key.

Possible input: off: The auto power off function is deactivated (permanent operation).  
1...120: auto power off time in minutes.

5. Confirm the value by pressing "On/Off" key: The display shows now "HLD Auto".

### II.) Hold Function "HLD Auto":

6. Press "up" or "down" key, the currently selected Hold-Function will be displayed

HLD oFF: AutoHold function deactivated: pressing hold-key freezes Measuring and releases it again

HLD on: AutoHold function activated: hold-key starts new measuring, the display will be 'frozen' as soon as a stable measuring value was detected.

7. Enter the desired function by pressing "up" or "down" key.

8. Confirm the hold-function by pressing "On/Off" key: The display shows now "Uni.t".

### III.) Display Unit of temperature "Uni.t":

6. Press "up" or "down" key, the currently selected unit for all temperature values will be displayed:

Temperature unit °C or °F

9. Enter the desired unit by pressing "up" or "down" key.

10. Confirm the unit by pressing "On/Off" key: The display shows now "Uni.%".

### IV.) Display Unit of moisture measuring "Uni.%":

11. Press "up" or "down" key, the currently selected unit for the Moisture measuring will be displayed:

Temperature unit °C or °F

Moisture content u: ,u' or wet-basis moisture w: ,h2o'

12. Enter the desired unit by pressing "up" or "down" key.

13. Confirm the unit by pressing "On/Off" key

14. The vales will be stored, the instrument will restart afterwards.

**Please note:** *if during the configuration no key is pressed within 60 seconds, the configuration will be aborted. Eventually made changes won't be stored!*

## 4 System Messages

Er. 1 = measuring range has been exceeded

- = Sensor error: No material connected (measuring value below permissible range), no valid signal or: charge at the probe, device will discharge (resp. at dry wood)

Er. 7 = System fault - the device has detected a system fault (defective or far outside allowable ambient temperature range)

Er.11 = Sensor error or value could not be calculated.

If "BAT" is displayed at the left side of display, the battery is weak, measuring can be continued for a short period.

If "bAt" is displayed in the main display the battery is used up and needs to be replaced. Measuring is no more possible.

## 5 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 "E." and set to moisture content "u".

Connect the testing adapter to the needles. The device must display the printed value for the GMR100.

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.

## 6 Specification

### Measuring

<b>Principle</b>	Resistive material-moisture-measuring via integrated, exchangeable needles matching DIN EN 13183-2: 2002
<b>Char. curve</b>	4 different wood groups (A, B, C, D) 1 universal construction material group (E, tables) 1 construction material group (P)=Plaster
<b>Meas. range</b>	0.0 – 100 % moisture content in wood, depending on group 0.0 – 4.4 % moisture content in plaster
group A	0,0 – 82 %
group B	1,1 – 94 %
group C	2,2 – 100 %
group D	3,2 – 100 %
<b>Resolution</b>	0.0...19.9%: 0,1% moisture content 20...100%: 1% moisture content
<b>Estimation</b>	Estimation of the material condition in 6 steps from DRY to WET
<b>Accuracy (Device)</b>	±1Digit (at nominal-temperature) Wood: ±0.2% moisture content (deviation from groups characteristic curve A, B, C, D, range 6..30%) Construction: ±0.2% moisture content (deviation from group E)
<b>Temperature drift</b>	< 0.02% moisture content per 1K
<b>Nominal temperature 25°C</b>	
<b>Ambient</b>	Temperature -25 ... +50°C (-13 .. 122°F) Relative humidity 0 ... 95%r.F. (non condensing)
<b>Storage temperature</b>	-25 ... +70°C (-13 ... 158°F)
<b>Housing</b>	Dimension: 110 x 67 x 30 mm (L x B x D) + Needles 28mm impact resistant ABS, membrane keyboard, transparent panel. Front side IP65
<b>Weight</b>	approx. 155 g
<b>Power Supply</b>	9V-Battery, type IEC 6F22 (included)
<b>Power Consumption</b>	1.8mA
<b>Display</b>	ca. 11 mm high, 4½-digit LCD-display with additional segments for simultaneous display of moisture, wood group and wet/dry evaluation.
<b>Pushbuttons</b>	3 membrane keys for on/off switch, menu operation, wood group selection, hold-function etc.
<b>Hold Function</b>	Press key to store current value.
<b>Automatic-Off-Function</b>	Device will be automatically switched off if no key is pressed/no interface communication takes place for the time of the power-off delay. The power-off delay can be set to values between 1 and 120 min.; it can be completely deactivated.
<b>EMC:</b>	The device corresponds to the essential protection ratings established in the 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: Groups of wood

abura	<i>Halea ciliata</i>	B	karri	<i>Eucalyptus diversicolor</i>	C
african alstonia	<i>Alstonia congensis</i>	C	keruing	<i>Dipterocarpus (spp.)</i>	C
african canarium	<i>Canarium schweinfurthii</i>	C	khaya	<i>Khaya ivorensis</i>	C
african walnut	<i>Lovoa trichilioides</i>	D	kokrodo	<i>African afrormosia</i>	A
afrormosia	<i>Pericopsis elata</i>	A	kosipo (= omu)	<i>Entandrophragma candollei</i>	C
afzelia	<i>Afzelia spp.</i>	B	lapacho (= ipe)	<i>Tabebuia (spp.)</i>	B
agba	<i>Gossweilerodendron balsamiferum</i>	C	larch	<i>Larix decidua</i>	C
alder		C	limba	<i>Terminalia superba</i>	C
alder, common	<i>Alnus glutinosa</i>	C	lime	<i>Tilia cordata</i>	B
alder, red	<i>Alnus rubra</i>	C	lime, american		B
alerce	<i>Fitzroya cupressoides</i>	C	logwood	<i>Haemataxon Campechianum</i>	C
alstonia	<i>Alstonia congensis</i>	C	mahogany	<i>Swietenia macrophylla</i>	C
andiroba	<i>Carapa guianensis</i>	C	makore	<i>Tieghemella africana</i>	C
ash	<i>Fraxinus excelsior</i>	C	makoré (african pear)	<i>Tieghemella heckelii</i>	C
ash, american	<i>Fraxinus americana</i>	B	maple		C
ash, japanese		B	maritime pine	<i>Pinus pinaster</i>	C
ash, pau amarela		B	meléze		C
balsa	<i>Ochroma lagopus</i>	C	mockernut	<i>Carya alba</i>	B
basralocus	<i>Dicorynia paraensis</i>	C	niangon	<i>Heritiera utilis</i>	B
beech	<i>Fagus sylvatica</i>	B	niové	<i>Staudtia stipitata</i>	B
berlinia	<i>Berlinia bracteosa</i>	C	niové bidinkala		A
birch		C	oak, american red	<i>Quercus rubra</i>	B
black afara		B	oak, american white	<i>Quercus alba</i>	B
briar	<i>Erica arborea</i>	C	oak, common	<i>Quercus robur</i>	C
ceder		B	oak, european	<i>Quercus petraea</i>	C
ceiba	<i>Ceiba pentandra</i>	C	oak, holm	<i>Quercus ilex</i>	C
cembra pine	<i>Pinus cembra</i>	C	oak, sessile	<i>Quercus petraea</i>	C
cherry tree	<i>Prunus (spp.)</i>	C	obeche	<i>Triplochiton scleroxylon</i>	B
chestnut, horse	<i>Aesculus hippocastanum</i>	C	okoumé	<i>Aucoumea klaineana</i>	B
chestnut, sweet	<i>Castanea sativa</i>	C	omu	<i>Entandrophragma candollei</i>	C
common beech	<i>Fagus sylvatica</i>	B	oregon pine	<i>Pseudotsuga menziesii</i>	C
cypress	<i>Cupressus (spp.)</i>	B	parana pine	<i>Araucaria angustifolia</i>	B
cypress, c. lusit		B	patagonian cypress	<i>Fitzroya cupressoides</i>	C
cypress, real		C	pear	<i>Pyrus communis</i>	B
dahoma	<i>Piptadeniastrum africanum</i>	B	pencil cedar	<i>Juniperus</i>	C
daniellia (= ogea)	<i>Daniellia ogea</i>	C	pine	<i>Pinus sylvestris</i>	C
douglas fir	<i>Pseudotsuga menziesii</i>	C	plum tree		C
douka (= makore)	<i>Tieghemella africana</i>	C	poplar	<i>Populus (spp.)</i>	C
ebony		B	purpleheart	<i>Peltogyne (spp.)</i>	C
ekki	<i>Lophira alata</i>	C	red oak, american	<i>Quercus rubra</i>	B
elm	<i>Ulmus</i>	C	red sandelwood		C
emien (= african alstonia)	<i>Alstonia congensis</i>	C	rio rosewood	<i>Dalbergia nigra</i>	B
european aspen	<i>Populus tremula</i>	C	rosewood	<i>Dalbergia (spp.)</i>	B
fromager (= ceiba)	<i>Ceiba pentandra</i>	C	spruce	<i>Picea (spp.)</i>	C
gaboon	<i>Aucoumea klaineana</i>	B	stone pine	<i>Pinus pinea</i>	C
hevea	<i>Hevea brasiliensis</i>	A	teak	<i>Tectona grandis</i>	B
hickory	<i>Carya (spp.)</i>	B	tola, branca		C
hickory, bitternut		B	tola, real		A
hickory, poplar		C	tola, red		A
hickory, swap		B	trembling poplar	<i>populus tremula</i>	C
holm oak	<i>Quercus ilex</i>	C	walnut		C
hornbeam	<i>Carpinus betulus</i>	C	western red cedar	<i>Thuja plicata</i>	C
ilomba	<i>Pycnanthus angolensis</i>	B	white birch		C
imbuia	<i>Ocotea porosa</i>	A	white maple		C
ipe	<i>Tabebuia (spp.)</i>	B	white oak, american	<i>Quercus alba</i>	B
iroko	<i>Chlorophora excelsa</i>	B	white poplar	<i>Populus alba</i>	C
izombé	<i>Testulea gabonensis</i>	C	willow	<i>Salix (spp.)</i>	B
jacarouba	<i>Calophyllum brasiliense</i>	C	yellow birch	<i>Betula alleghaniensis</i>	C
jarah	<i>Eucalyptus marginata</i>	C	yellow pine		C
kambala (= iroko)	<i>Chlorophora excelsa</i>	B			

Cardboard	B	Melamine-fake boards	A	Wood fibre insulating wall panel	C
Cork	A	Paper	A		
Fibre board	C	Phenolic resin-fake boards	C	Textiles	C (D)
Kauramin-fake boards	C	Wood fibre hard disks	C		

## Appendix B: Conversion Table for Building Materials

### Switch instrument to group "E" Moisture content "u"

% Display "E"	1 : 3	Lime mortar	Cement- mortar	Gypsum- plaster	Cement- wash floor	Cement- wash floor	Cement- plastic additive	Cement- blumen additive	Ardrapid Cement- wash floor	Anhydrit- wash floor	Gypsum wash floor	Wood- cement wash floor	Elastizel wash floor	Concrete 200 kg cement/m <sup>3</sup>	Concrete 350 kg cement/m <sup>3</sup>	Concrete 500 kg cement/m <sup>3</sup>	Gas concrete (Hebel)	Cement- bound Chipboard	Softfibre- wood, Blumen	Styopor
85,0	19,2	7,0	3,4	18,0	3,4	6,0	4,8	2,9	5,8	6,4	16,0	13,4	2,8	3,1	3,0					
80,0	12,0	5,5	3,0	14,0	3,0	4,5	4,6	2,4	4,5	4,5	14,2	11,7	2,3	2,7						
75,0	9,5	4,7	2,5	11,0	2,5	3,7	3,7	2,0	3,1	3,0	12,8	10,3	2,0	2,5		70,0				
65,0	7,3	4,0	2,5	8,7	2,5	3,5	4,2	1,9	1,9	2,5	11,7	8,7	1,8	2,4	2,5	53,8	24,0			
60,0	6,4	3,7	2,5	7,0	2,5	3,4	4,0	1,6	1,6	2,3	11,0	6,7	1,7			40,1				
58,0	6,0	3,6	2,5	6,5	2,5	3,4	4,0	1,6	1,6	2,3	10,8	6,4				34,7				
56,0	5,5	3,4	2,5	6,0	2,5	3,4	3,9	1,2	1,2	2,0	10,5	5,8					22,0			
54,0	5,1	3,4	2,5	5,8	2,4	3,3	3,9	1,5	1,5	2,0	10,3	5,5		1,5	2,0	26,9				
52,0	4,5	3,2	2,5	5,3	2,5	3,3	3,9	1,4	1,4	2,0	10,0	5,3				21,0				
50,0	4,3	3,1	2,5	5,0	2,5	3,3	3,9	1,4	1,4	2,0	10,0	5,1		1,4						
48,0	4,0	3,0	2,5	4,8	2,5	3,3	3,9	1,4	1,4	2,0	9,8	5,1								
46,0	3,6	2,8	2,5	4,5	2,3	3,3	3,8	1,3	1,3	1,5	9,5	4,6				17,6	20,0			
44,0	3,5	2,7	2,5	4,1	2,3	3,3	3,8	1,3	1,3	1,5	9,5	4,4								
42,0	3,1	2,6	2,5	3,8	2,1	3,3	3,7	1,2	1,2	1,3	9,2	4,2		1,3	1,7		18,0			
40,0	2,9	2,6	2,5	3,4	2,1	3,3	3,7	1,2	1,2	1,3	9,0	4,0								
38,0	2,7	2,5	2,5	3,0	2,0	3,0	3,7	1,2	1,2	1,3	9,0	3,8				12,0		30,1		
36,0	2,5	2,4	2,5	2,8	2,0	3,0	3,6	1,1	1,1	1,0	8,6	3,5					17,0	28,0		
34,0	2,3	2,3	2,5	2,6	1,9	3,0	3,6	1,1	1,1	1,0	8,4	3,3				10,0	15,5	28,0		
32,0	2,1	2,2	2,5	2,4	1,9	3,0	3,6	1,1	1,1	1,0	8,1	2,8		1,2		8,0	14,8	26,0		
30,0	1,9	2,2	2,5	2,1	1,7	3,0	3,5	1,0	0,2	0,7	7,9	2,5								
28,0	1,8	2,1	2,5	2,0	1,6	2,8	3,4	0,9	0,1	0,7	7,5	2,0								
26,0	1,6	2,0	2,5	1,6	1,6	2,8	3,4	0,9	0,1	0,7	7,3	2,0								
24,0	1,4	1,9	2,5	1,4	1,4	2,7	3,3	0,7	0,1	0,5	6,8	1,8		1,0	1,5		14,2	25,0		
22,0	1,3	1,7	2,5	1,2	1,2	2,7	3,3	0,7	0,1	0,5	6,8	1,8								
20,0	1,2	1,6	2,5	1,0	1,5	2,7	3,2	0,5	0,1	0,5	6,8	1,8								
18,0	1,0	1,5	2,5	0,8	1,3	2,7	3,2	0,6	0,1	0,4	6,5	1,4								
16,0	0,9	1,4	2,5	0,5	1,3	2,7	3,1	0,6	0,1	0,4	6,5	1,4								
14,0	0,8	1,3	2,5	0,3	1,3	2,7	3,1	0,6	0,1	0,4	6,5	1,4								
12,0	0,7	1,2	2,5	0,3	1,3	2,7	3,1	0,6	0,1	0,4	6,5	1,4								
10,0	0,6	1,1	2,5	0,3	1,3	2,7	3,1	0,6	0,1	0,4	6,5	1,4								
8,0	0,5	1,0	2,5	0,3	1,3	2,7	3,1	0,6	0,1	0,4	6,5	1,4								
6,0	0,5	1,0	2,5	0,3	1,3	2,7	3,1	0,6	0,1	0,4	6,5	1,4								
4,0	0,4	0,9	2,5	0,3	1,3	2,7	3,1	0,6	0,1	0,4	6,5	1,4								
2,0	0,3	0,8	2,5	0,3	1,3	2,7	3,1	0,6	0,1	0,4	6,5	1,4								

Example: Display value for lime mortar 38 % = 2.1 % actual value