Schaller
Messtechnik / humimeter.com

Moisture meter

Operating Manual

humimeter BMA-2

Moisture meter for measuring the moisture content of biomass

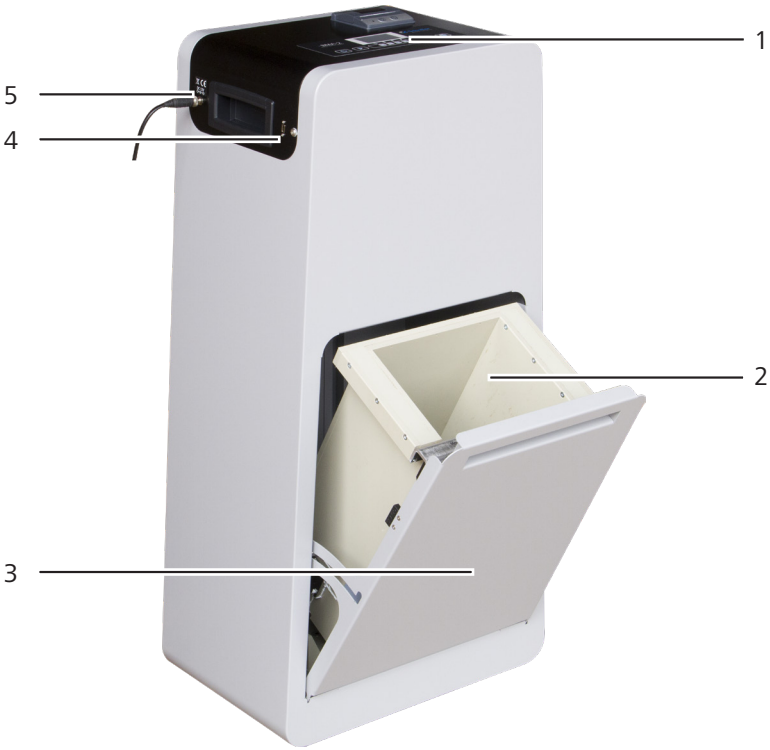
78,0 °F | 6,16% | 456 kg/m³ | −27,3 td | 0,64 aw | 51,9 %r.H. | 14,8 %abs | 100,4 g/m² | 09 m/s | 4,90 Ugl | 1

Version 4.1

Always read this operating manual before using the humimeter BMA-2!

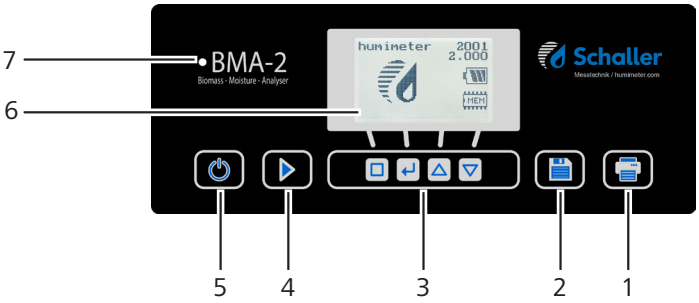
Your humimeter BMA-2 at a glance

The main unit



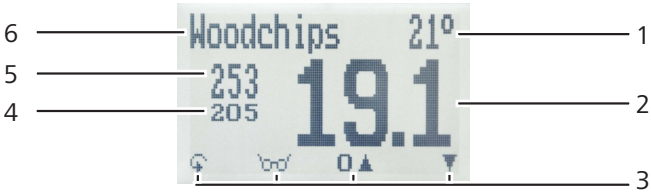
No.	Name
1	Control panel and display
2	Measuring chamber
3	Drawer
4	USB port
5	Power supply

The control panel



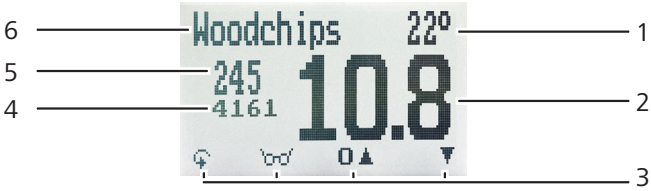
No.	Name
1	Print button
2	Save button
3	Control buttons for display
4	Start button
5	On/off button
6	Display
7	LED light
	solid blue: ready for use
	flashing blue: measurement in progress
	flashing red: fault (see"11. Faults")

The display



No.	Name
1	Temperature
2	Moisture content in % (see "6.1 How moisture is defined")
3	Display symbols
4	Atro weight/m³ (optional)
5	Bulk density (optional)
6	Calibration curve

Overview display with calorific value display



Nr	Bezeichnung
1	Temperature
2	Water content in % (see "6.1 How moisture is defined")
3	Display symbols
4	MJ/m³ (optional display)
5	Bulk density (optional display)
6	Product description

The display symbols

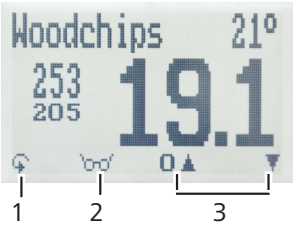
Symbol	Name
	Enter
	Up
	Down
	Back
	Enter numbers
	Enter letters
	Continue / go right
	Left
	Yes

Symbol	Name
	No
	Change input level
	OK
	Change menu
	Enter data
	View measurements
	Delete measurements

The menus

The device has two different menus: product selection menu and main menu:

Product selection menu



No.	Name
1	Open main menu
2	Show the last recorded values
3	For changing the calibration curve

Main menu

The main menu comprises the following menu items:

- **Edit Logs:**
  Manual Logs, Clear Logs
- **Print Logs:**
  Last Log, All Logs, Clear Logs
- **Send Logs:**
  Manual Logs, Clear Logs
- **Options:**
  Bluetooth, Date/Time, Language, Unlock, °C/°F, BL On Time, Auto Off Time, Materialcalibration, Password, Reset
- **Status**

Table of contents

1. Introduction

1.1 Information about this operating manual

This operating manual is designed to enable you to use the humimeter BMA-2 safely and effectively. It is part of the device, has to be stored nearby and must be easily accessible to users at all times.

All users are required to carefully read and make sure that they have understood this operating manual before using the humimeter BMA-2. All of the safety and operating instructions detailed in this manual have to be observed to ensure the safety of the device.

1.2 Limitation of liability

All of the information and instructions provided in this operating manual have been compiled on the basis of the current standards and regulations, the state of the art, and the extensive expertise and experience of Schaller GmbH.

Schaller Messtechnik GmbH does not accept any liability for damage associated with the following, which also voids the warranty:

- Non-observance of this operating manual
- Improper use
- Inadequately qualified users
- Unauthorised modifications
- Technical changes
- Use of unapproved spare parts

This fast measuring procedure can be affected by a range of different factors. For this reason, we recommend periodically checking the device's measurements with a standardised oven-drying method.

We, as the manufacturer, do not accept any liability for any incorrect measurements and associated consequential damage.

1.3 Symbols used in this manual

All of the safety information provided in this manual is shown with a corresponding symbol.

WARNING

It is essential to observe this warning. Non-compliance can lead to serious irreversible or fatal injury.

CAUTION

It is essential to observe this warning. Non-compliance can lead to injury.

ATTENTION

It is essential to observe this warning. Non-compliance can lead to damage to property or equipment.

Information

This symbol indicates important information that enables users to use the device more efficiently and cost-effectively.

1.4 Customer service

For technical advice, please contact our customer service department at:

Schaller Messtechnik GmbH
Max-Schaller-Straße 99
A - 8181 St.Ruprecht an der Raab

Telephone: +43 (0)3178 28899
Fax: +43 (0)3178 28899 - 901

E-mail: info@humimeter.com
Internet: www.humimeter.com

2. For your safety

The device complies with the following European directives:

- Restriction of Hazardous Substances in Electrical and Electronic Equipment (RoHS)
- Electrical equipment (Low Voltage Directive, LVD)
- Electromagnetic Compatibility Directive (EMC)
- Machinery

The device corresponds to state-of-the-art technology. However, it is still associated with a number of residual hazards.

These hazards can be avoided through strict observance of our safety information.

2.1 Proper use

- Easy to use device for quickly measuring the moisture content of wood chips and other biomass fuels
- The device must only be used for taking measurements on the products defined in the following sections of this manual (see "6. Calibration curves").
- Optionally, it is possible to determine the bulk density and absolute dry weight (ATRO).

2.2 Improper use

- The device must not be used in ATEX.
- The device is not suitable for measuring frozen material or material with a temperature of more than +50 °C.
- The device is not waterproof and must be protected from water and fine dust (IP40).

2.3 User qualifications

The device must only be operated by people who can be expected to reliably take the measurements. The device must not be operated by people whose reaction times may be slowed due to, e.g. the use of drugs, alcohol or medication.

All persons using this device must have read, understood and follow the instructions provided in the operating manual.

2.4 Danger from electric current

WARNING

Electric shock

Danger to life due to electric shock when operating with a defective mains cable or defective device.

► Disconnect the device from the power supply and secure it against being switched on again.

Observe the following safety instructions to avoid hazards from electric current:

- Do not use a damaged power cable.
- A damaged power cable may only be replaced by the manufacturer, customer service or a similarly qualified person.
- Do not open any firmly screwed covers from the housing of the unit.
- Do not use the device if it shows any externally visible damage, e.g. to the housing, controls or connection cables, or if it malfunctions.
- A defective device may only be replaced by the manufacturer, customer service or a similarly qualified person. Do not repair the device yourself.
- Do not make any changes to the device, its components or accessories.

2.5 General safety information

The following safety information has to be observed at all times to avoid damage to objects and injury to people:

- Do not reach into the interior of the device during operation.
- Keep the device and its power cable away from children under the age of 8.
- Disconnect the device from the power supply if it is to be left unattended for an extended period of time.
- Attention: Danger of tipping! Ensure that the device stands on a stable and level surface.

All of the device's technical features have been inspected and tested before delivery. Every device has a serial number. Do not remove the tag with the serial number.

3. On receipt of your device

3.1 Taking the device out of its packaging

- Take the device out of its packaging.
- Next, make sure that it is not damaged and that no parts are missing.
- Do not discard the packaging! In case of shipping the device, the original packaging must be used.

» We refuse any liability for damages during transport using inadequate packaging.

3.2 Making sure that all of the components have been included

Make sure that all of the components have been included by checking the package contents against the following list:

- humimeter BMA-2
- Measuring chamber (12 liters)
- Power supply unit 24VDC 5A with Schuko plus
- 2 pieces of plastic buckets (13 liters)
- humimeter USB data interface module - USBcable or download using humimeter.com/software
- Operating manual

Optional accessories:

- Data package

» Built-in printer

- ATRO package, including:

» Built-in printer

» Display of bulk density and ATRO ton/m³ (only for wood chip characteristic curves)

» Display of the calculated calorific value in MJ/m³ based on the stored literature value (only for wood chip characteristic curves)

- External battery - Is described in a separate operating manual.
- Bluetooth module - Described in a separate operating manual.
- Test equipment - Described in a separate operating manual.
- Transport wheels

3.3 Setting up the device

Note the following:

- Do not leave the device out in the rain. The device and measuring chamber are not waterproof.
- Do not position the device in damp rooms..
- Place the device on a stable, level and dry surface.
- Do not expose the device to large quantities of dust.
- Do not expose the device to extreme temperatures.
- Protect the device from strong mechanical shocks and loads.
- Keep a sufficient distance of about 10 cm from the wall and other objects.
- Lay the power cable so that it cannot be damaged by edges or hot surfaces.

CAUTION

Danger of tipping

Risk of injury due to tipping device

► Place the device on a stable and level surface.

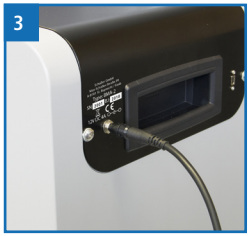
4. Using the device - Basics

4.1 Inserting the measuring chamber

1. Open the drawer of the device by lifting and pulling the handle towards you (figure 1).
2. Hang the empty measuring chamber in the drawer.

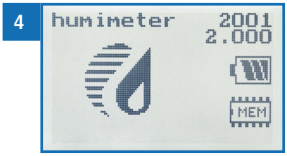
   » The handle and the suspension of the measuring chamber must hang in the plastic brackets of the drawer (figure 2).
3. Close the drawer. If necessary, push its handle downwards to fully close it.

4.2 Plugging in the device



1. Make sure that the socket you want to use has the same electrical voltage as described on the name plate of the power supply unit.
2. Plug the power cable into the device (figure 3).
3. Plug the power cable into the power socket.

4.3 Switching the device on



» After plugging in the power cable, the device switches on automatically Or

- Press  for 3 seconds.

» The display will then show the status indicator **humimeter** (figure 4).

4.4 Automatic drawer check

» After switching on, the device goes through a sensor check of the drawer. The display will show the message **Check Door**.

» The display shows **Open Door** (figure 5).

• Now the drawer has to be lifted first and then opened.

» The display shows **Close Door** now (figure 6).

• So close the drawer.

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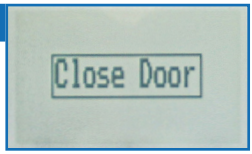

4.5 Automatic adjustment

» After switching on, the device goes through a self-adjustment. The display shows the message **Adjust?** (figure 7).

• Confirm by pressing ✓.

» The adjustment is effected. The display will appear as shown in figure 8.

» Once completed, the device will show the measuring window (figure 9).

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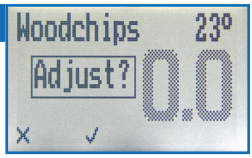

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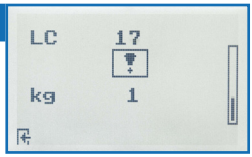

4.6 Taking a measurement

• For information on how to take a measurement, see section "5. The measuring process".

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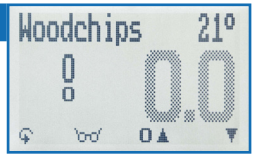

4.7 Switching the device off

• Press ⏻ for 3 seconds.

5. The measuring process

5.1 Preparing a measurement

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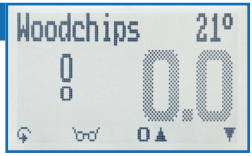

To do so: The display has to show the measuring window (figure 10).

1. Open the drawer of the device by lifting and pulling the handle towards you (figure 11).
2. Take out the measuring chamber.
3. Completely fill the measuring chamber with the material being measured. Use the included plastic bucket and fill the measuring chamber from the side with the metal plate (figure 12).
4. Wipe off the material at the upper edge of the measuring chamber evenly.
5. Hang the filled measuring chamber in the drawer (figure 13).
   - » The handle and the suspension of the measuring chamber must hang in the plastic brackets of the drawer.
6. Close the drawer. If necessary, push its handle downwards to fully close it.

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13

5.2 Taking a measurement

1. Select the required calibration curve (see "6. Calibration curves") by pressing the or button Or
2. Press the or button for 3 seconds.
   - » The display will now show the calibration curve overview (figure 14).
3. Select the required calibration curve (**Woodchips, Coarse chips, Softwood chips, Softwood coarse, Fine woodchips, Pellets, Miscanthus, Shavings Softwood, Sawdust Softwood, Sawdust Hardwood, Corn cob, Empty 1**). To do so, press or and confirm by pressing Or

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4. Keep  or  pressed to scroll through the types and confirm by pressing  .

5. Press  to start the measurement.

   » The LED is blinking in blue during the entire measurement.

   » The display shows the active measurement process (figure 15).

   » After completion of the measurement, the LED is shining in blue.

   » The display now shows the measured values (figure 16).

   » The displayed value flashes when the moisture content exceeds the measuring range of the selected calibration curve. A flashing value signals lowered accuracy of the measurement. The measuring range limit of the wood chip calibration curves is 60 % moisture content.

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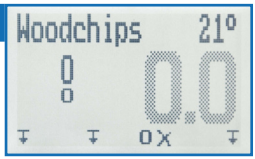

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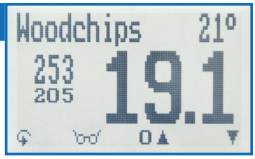


6. Once the reading has been taken, it can be saved on the device (see "5.3 Saving individual readings" or "5.4 Saving several readings (a measurement series) at the same time").

7. Open the drawer and carefully remove the measuring chamber.

8. Empty the measuring chamber completely.

Information - Measuring accuracy

To increase the measuring accuracy, take three measurements of the same material. When saving the individual readings, the device will automatically calculate the readings' average (see "5.4 Saving several readings (a measurement series) at the same time").

Information - Incorrect readings

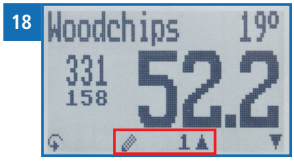
Always make sure to select the correct calibration curve for the material you are measuring. This prevents taking incorrect readings (see "11. Faults").

5.3 Saving individual readings

To do so: A measurement has been taken. The display will now appear as shown in figure 17.

1. Press .

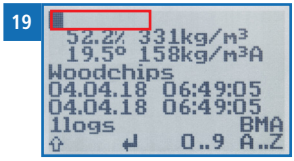
   » The display will now appear as shown in figure 18.



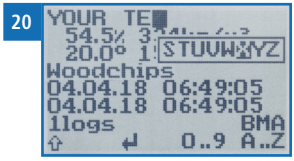
2. Press to enter a name for the saved reading and to finish the measuring process.

   » The display will now appear as shown in figure 19.

3. The data you have inputted can be overwritten at any time.



4. Inputting letters:
   Press and hold A..Z to quickly scroll to the required letter and either press it for 3 seconds or press to confirm the selected letter (figure 20).



5. Inputting numbers:
   Press and hold 0..9 to quickly scroll to the required number and either press it for 3 seconds or press to confirm the selected number.

6. Moving forward/back:
   Press to switch to another input level.
   Press or to move forward or back.

7. Confirm your entry by pressing .

   » The data you entered has been saved.

5.4 Saving several readings (a measurement series) at the same time

1. Take several readings of the same material (see "5. The measuring process").
2. Press  after each measurement.
   » The display will now appear as shown in figure 21. The marked number shows the number of readings that have already been saved.
3. Press  to enter a name for the saved series of measurements and to finish the measuring process.
   » The display will now appear as shown in figure 22.
4. The data you have inputted can be overwritten at any time.
5. Inputting letters:
   Press and hold  to quickly scroll to the required letter and either press it for 3 seconds or press  to confirm the selected letter (figure 23).
6. Inputting numbers:
   Press and hold  to quickly scroll to the required number and either press it for 3 seconds or press  to confirm the selected number.
7. Moving forward/back:
   Press  to switch to another input level.
   Press  or  to move forward or back.
8. Confirm your entry by pressing  .
   » The data you entered has been saved.
   » The device automatically determines the average moisture content of the saved measuring values.

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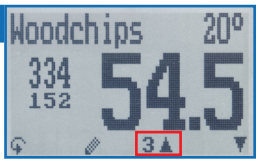

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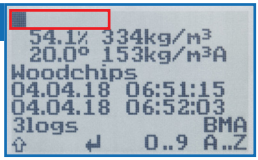

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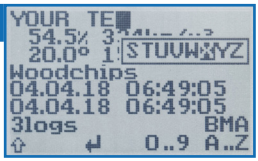
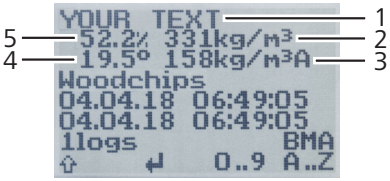


» The display will show the following information:



No.	Name
1	Name of the measurement series (editable)
2	Bulk density [kg/m³] (average) (optional)
3	Dry weight (atro)/m³ [kg/m³] (average) (optional)
4	Temperature (average)
5	Moisture content (average)

5.5 Printing measured values

To do so: The integrated printer and a paper roll is required (figure 24). Both are included in the equipment packages: Data package and ATRO package.

Options: The current measurement or already saved readings can be printed.

5.5.1 Printing the current measurement

To do so: A measurement has been taken. The display appears as shown in figure 25.

1. Press  .

» The display will show the message **Print** (figure 26).

» The current measurement will be printed (Printout figure 27).

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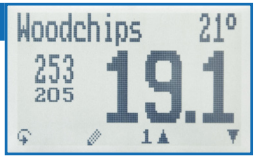

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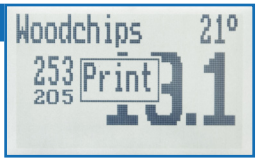

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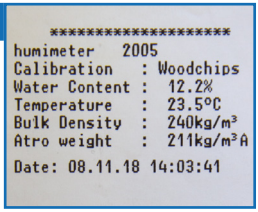

5.5.2 Printing already saved readings

To do so: You must have taken and saved one or several readings.

1. Press .
2. Select **Print Logs** (figure 28). To do so, press or and confirm by pressing .
3. Select **Last Log** (figure 29) to print the last recorded measurement series. To do so, press or and confirm by pressing Or
4. Select **All Logs** (figure 30) to print all recorded measurement series. To do so, press or and confirm by pressing .
   - » The display will show the message **Print**.
   - » The selected measurement series will be printed (Printout figure 31).
5. Press to leave the **Print Logs** menu.
6. Press to leave the main menu.

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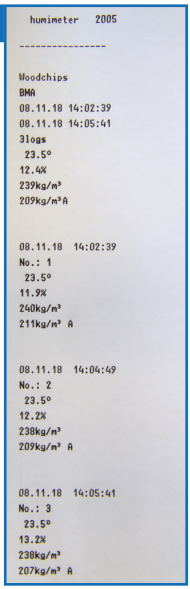


Information

Make sure to regularly clear the data memory (see "5.9 Deleting all measured values (data log)"). This helps to save printing paper.

5.6 Calculation of calorific value

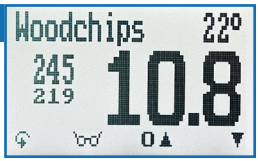
To do so: To carry out a calorific value calculation using the humimeter BMA-2, the "Standard calorific value" parameter must be set in accordance with these instructions. After measuring the material, the calculated calorific value in MJ/m³ appears instead of the Atro/m³ (figure 32 vs. figure 36).

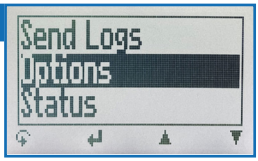
» A calorific value calculation can only be carried out for the wood chip calibration curves available in the appliance if the ATRO package is activated.

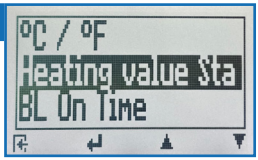
- If no calorific value has been entered, the Atro/m³ value is displayed (figure 32).
- In order to obtain an adequate estimate of the calorific value, the charecteristic literature value of the material to be measured, the main type of wood used at 0% water content must first be specified. (Recommended values are given in the chapter "6.2 Definition of calorific value")
- To do this, press .
- Navigate to **Options** (figure 33). To do this, press or and confirm with .
- Now navigate to **Calorific value standard** (figure 34). To do this, press or and confirm with .
- Now enter the average calorific value at 0% water content in the unit kWh/kg from the literature (figure 35).

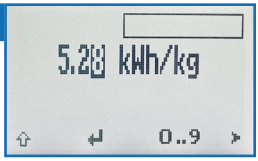
» To do this, press 0..9 and hold to quickly navigate to the desired number and remain on the desired number for 3 seconds.

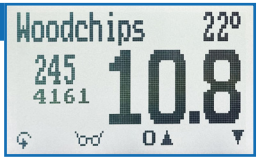
- Confirm the entry with .
- The BMA-2 now automatically switches to the calorific value calculation.
- Press the button and the button to return to the measured value display. The display now shows the calorific value (figure 36).
- If desired, this result can also be printed (see "5.5 Printing measured values") (figure 37).

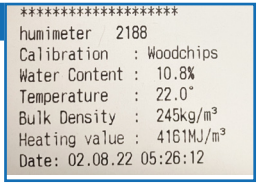
32


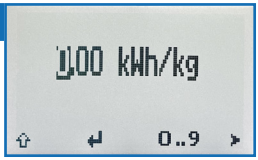
33


34


35


36


37


38


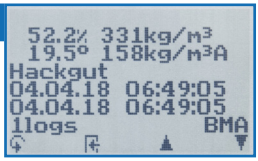
- To return to the Atro/m³ value, the calorific value must be changed back to 0.00 kWh/kg (figure 38).
- The device then automatically switches back to the atroweight display (figure 32).

5.7 Viewing individual readings

To do so: You must have saved a reading (e.g. **1 log**).
The display will now show .

1. Press .
2. Select the required reading. To do so, press or .
   » The display will now appear as shown in figure 39.
3. Press to leave this screen.

39

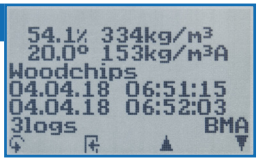


5.8 Viewing individual readings from a series of measurements

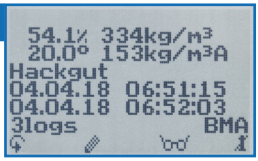
To do so: You must have saved a reading (e.g. **3 log**).
The display will now show .

1. Press .
2. Select the required reading. To do so, press or .
   » The display will now appear as shown in figure 40.
3. Press to switch to another input level.
   » The display will now appear as shown in figure 41.
4. Press again.
   » The display will now appear as shown in figure 42.
5. Navigate to the required reading (**No.: 1, No.: 2, No.: 3**). To do so, press .
6. Press to leave this screen.

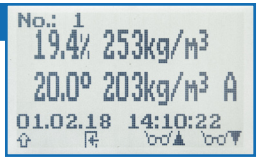
40



41



42



5.9 Deleting all measured values (data log)

To do so: You must have taken and saved one or several readings.

1. Press .
2. Select **Edit Logs** (figure 43). To do so, press or and confirm by pressing .
3. Select **Clear Logs** (figure 44). To do so, press or and confirm by pressing .

» The display will show the message **clear?**

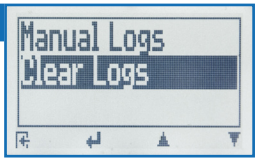
4. Confirm by pressing .

» The data log has been deleted.

5. Press to leave the **Edit Logs** menu.
6. Press to leave the main menu.

43

44



5.10 Deleting individual measurement series

To do so: You must have saved a measured value (e.g. **1 log**) or a series of measurements (e.g. **3 logs**). The display will now show .

1. Press .
2. Select the required reading. To do so, press or .

» The display will now appear as shown in figure 45.

3. Press to switch to another input level.

» The display will now appear as shown in figure 46.

4. Press .

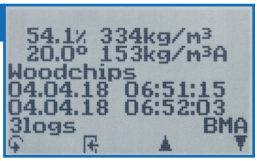
» The display will show the message **clear?** (figure 47).

5. Confirm by pressing .

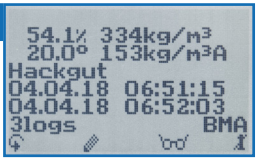
» The measurement has been deleted.

6. Press to leave this screen.

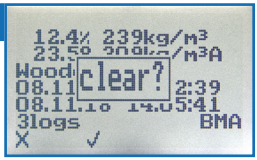
45



46



47



6. Calibration curves

Product name	Calibration curve	Measuring range
Woodchips	See "6.4.1 Wood chips"	5 % - 70 %
Coarse chips	See "6.4.2 Coarse wood chips"	5 % - 70 %
Softwood chips	See "6.4.3 Softwood chips"	5 % - 70 %
Softwood coarse chips	See "6.4.4 Softwood coarse chips"	5 % - 70 %
Fine woodchips	See "6.4.5 Fine wood chips"	5 % - 70 %
Pellets	Wood pellets Ø 6 mm	5 % - 14 %
Miscanthus	Chopped miscanthus (P16)	5 % - 35 %
Shaving Softwood	Shavings from softwood	5 % - 45 %
Sawdust Softwood	Sawdust from softwood	10 % - 60 %
Sawdust Hardwood	Sawdust from hardwood	10 % - 60 %
Corn cob	Corn cobs (chopped or whole cobs)	10 % - 40 %
Empty 1	Free curve for special products	
Empty 2	Free curve for special products	
Empty 3	Free curve for special products	
Reference	! Only for testing the moisture meter !	

6.1 How moisture is defined

The device measures and shows a material's moisture content. The moisture content readings it displays are calculated in relation to the material's overall mass:

$$\%WG = \frac{M_n - M_t}{M_n} \times 100$$

M_n: Mass of the sample with average moisture content

M_t: Mass of the sample with zero moisture content

%WG: Moisture content (in accordance with EN ISO 18134-2)

6.2 Definition of calorific value

The calorific value, or heating value, is a physical quantity that indicates how much heat is released when a particular fuel is burned. They are usually measured in units such as kilojoules per kilogram (kJ/kg) or megajoules per cubic meter (MJ/m³).

The main difference between the upper (calorific value) and the lower (heating value) lies in the consideration of the condensation heat of the water vapor contained in the fuel.

1. **Heating value (also referred to as lower heating value or lower calorific value):**The lower calorific value assumes that the water vapor produced during the combustion of the fuel does not condense, but leaves the system with the exhaust gases. The lower calorific value therefore does not take into account the latent heat that is released when the water vapor condenses. Therefore, the lower calorific value is always less than or equal to the upper calorific value.
2. **Gross calorific value (also referred to as upper calorific value or higher calorific value):** The calorific value takes into account the latent heat that is released during the condensation of the water vapor contained in the fuel. This means that the calorific value indicates the maximum available heat energy that can be obtained from the combustion of the fuel.

Wood type	Energy content (lower calorific value/heating value) at 0 % water content
Poplar	5,0
Willow	5,28
Fir	5,28
Spruce	5,0
Alder	5,0
Pine	5,28
Larch	5,28
Maple	5,0
Ash	5,0
Beech	5,0
Birch	5,0
Oak	5,0

Table: These are sample values from various literary sources and empirically determined values. These serve as a guide and can be adjusted or adapted by the customer and their experience if necessary.

6.2.1 Calculation of the calorific value in the humimeter BMA-2

After setting the calorific value standard in the option see menu item "5.6 Calculation of calorific value" your meter switches to the calorific value calculation.

The humimeter BMA-2 determines the water content in the material and corrects the calorific value from the literature by the water content contained. This means that the humimeter BMA-2 calculates the corrected calorific value on the basis of the water content and the determined bulk density and outputs this calorific value in the unit MJ/m³.

This makes it possible to adequately estimate the calorific value for your material on the basis of the stored empirical value / reference value.

The display is in the unit MJ/m³, as this provides a direct reference to the SI units.

Modified units:

1. The unit MJ/kg is calculated by dividing by the bulk density, taking into account the bulk density determined in the humimeter BMA-2

   » MJ/m³ divided by kg/m³ = MJ/kg

2. The unit kWh/kg or kWh/m³ is calculated by dividing by 3.6, again taking into account the bulk density determined in the humimeter BMA-2

   » MJ/m³ divided by 3,6 = kWh/m³
   » MJ/kg divided by 3,6 = kWh/kg

Example calculation and conversion in modified units:

Standard calorific value for willow at 0% water content (0% wood moisture) entered in the measuring device

Your humimeter BMA-2 determines:

» a water content for your wood chips of 10.8%

» and a bulk density of 245kg/m³.

From this, your humimeter BMA-2 calculates an adequate estimate of the calorific value of 4161MJ/m³.

1. Conversion to MJ/kg:

4161 MJ/m³ divided by 245kg/m³ (bulk density)

$$\frac{4161}{245} = \frac{MJ/m^3}{kg/m^3} = 16{,}98\ MJ/kg$$

2. Conversion to kWh/m³:

4161 MJ/m³ divided by the factor 3,6 (60 x 60 /1000)

$$\frac{4161}{3{,}6} = \frac{MJ/m^3}{s} = 1155{,}83\ kWh/m^3$$

3. Conversion to kWh/kg:

4161 MJ/m³ divided by 245kg/m³ (bulk density) und den Faktor 3,6 (60 x 60 /1000)

$$\frac{4161}{245 * 3{,}6} = \frac{MJ/m^3}{s * kg/m^3} = 4{,}72\ kWh/kg$$

6.3 Definition of wood chips types (Norm EN ISO 17225-1)

The given numbers, in accordance with EN ISO 17225-1, refer to the particle sizes that fit through the round screen openings.

- P16 at least 75% of the mass between 3.15 and 16mm
- P31 at least 75% of the mass between 8 and 31.5mm
- P45 at least 75% of the mass between 8 and 45mm
- P63 at least 75% of the mass between 8 and 63mm

6.4 Selection of calibration curve for wood chips

The calibration curves for wood chips depend on the wood type (hardwood, soft-wood), the size of the chips (size classes according to norm EN ISO 17225-1) as well as on the content of fine fraction.

If you are not sure which calibration curve is the best suited for your material, it is recommended to carry out a reference measurement by kiln-drying (according to EN ISO 18134-2).

Schaller GmbH will be happy to advise you on the selection of the right calibration curve. Please send a picture of your wood chips, placing a measuring tape to the material, to support@schaller-gmbh.at. You will receive a recommendation from us immediately.

6.4.1 Wood chips

For wood chips with fine fraction, consisting of at least one third hardwood. The fine fraction mainly derives from barks, small branches and bushes. For wood chips sizes from P31 to P45. See example pictures 48 and 49.

If your wood chips contain few fine fraction or no fine fraction or if the wood chips contain a higher proportion of softwood, use one of the following calibration curves.

6.4.2 Coarse wood chips

For coarse wood chips without fine fraction, consisting of at least one third hardwood. This curve is predominantly suited for measuring wood chips deriving from logs and full trees. For wood chips sizes from P45 to P63. See example pictures 50 und 51.

If your wood chips contain a higher proportion of softwood, use one of the following calibration curves.

6.4.3 Softwood chips

For wood chips with fine fraction, mainly (more than two thirds) consisting of softwood (spruce, fir, pine, larch). The fine fraction mainly derives from barks, small branches and bushes. For softwood chips sizes from P16 to P45. See example pictures 52 and 53.

If your wood chips contain few fine fraction or no fine fraction, use one of the following calibration curves.

6.4.4 Softwood coarse chips

For coarse wood chips without fine fraction, mainly (more than two thirds) consisting of softwood (spruce, fir, pine, larch). This curve is predominantly suited for measuring wood chips deriving from logs and full trees as well as sawmill residues. For wood chips sizes from P45 to P63. See example pictures 54 and 55.

6.4.5 Fine wood chips

For fine wood chips with a high proportion of fine fraction, where at least two thirds of the content are of a particle size below 16 mm (P16). The fine fraction mainly derives from barks, small branches and bushes (e.g. forest residue, fine short rotation coppice). See example picture 56 and 57.

For wood chips purely from ash trees, wood chips sizes from P16 to P45, also choose this calibration curve.

Example pictures wood chips

48

49

Example pictures coarse wood chips

50

51

Example pictures softwood chips

52

53

Example pictures softwood coarse chips

54

55

Example pictures fine wood chips

56

57

6.5 Notes for the measurement of wood shavings

The weight of the measured shavings must be at least 380 g. Otherwise the shavings in the chamber have to be compressed to 380 g.

6.6 Notes for bulk density and dry weight (atro)/m³

For determining the bulk density according to norm EN 14961 a round bucket is used.

As the humimeter BMA-2 device uses a rectangular measuring chamber, a compensation factor is stored in the device. This compensation factor has been optimised for wood chips and therefore can differ when measuring other material types. The bulk density of biomass material during transport can change considerably (compacting), when measuring the volume a material cone has to be considered.

An eventual discrepancy of the bulk density directly influences the displayed dry weight (atro)/m³.

6.7 Notes for comparative measurement with oven-drying method

The device uses a much higher sample quantity than the drying oven (12-fold to 20-fold quantity of kiln-drying method). Furthermore, to determine a more accurate average moisture value in case of inhomogeneous material, there can be effected several measurements within a short time.

Considering a sampling error due to the considerably smaller sample quantity as well as the content of volatile matters, resin etc. (that are not water), the kiln-drying method will practically reach an accuracy of approx. +/- 3 %. Therefore, if the measuring values of these two very different methods of determining the water content are compared, differences of +/- 3 % can be considered to be normal.

In the standard EN ISO 18134-2 is declared that the drying oven method provides no absolute values, but only comparable values.

7. Using the LogMemorizer program

To do so: The device is provided with USB interface, and the USB stick with LogMemorizer software and USB cable are available. Otherwise, you can also install the software at humimeter.com/software or by scanning the QR code.

7.1 Installing/Opening the program

1. Insert the USB stick with the LogMemorizer program into the USB port on your computer or

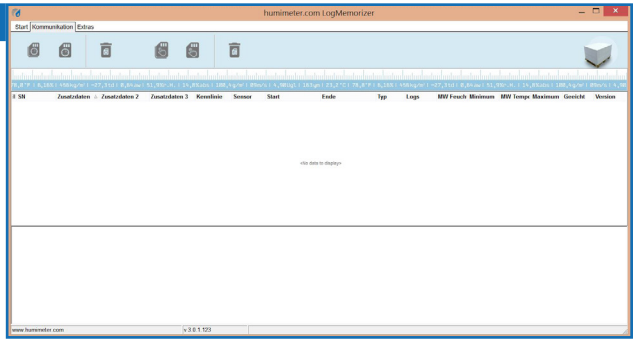
» download the LogMemorizer software at humimeter.com/software or use the QR code.

2. Open the **setup** application.

3. Follow the installation instructions.

1. Open LogMemorizer.

58



» The screen will now display the LogMemorizer's interface (figure 58).

- Before using the LogMemorizer program, the USB COM port must be configured as follows under the menu item Settings (figure 60).

» Device: Select the COM port to which you have connected the humimeter BMA-2 with the USB cable (in this example COM7)

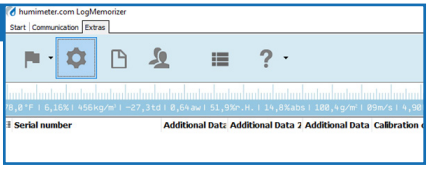
» Baud rate: 115200

» Data bits: 8

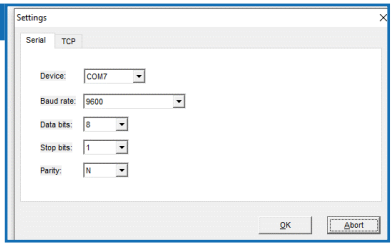
» Stop bits: 1

» Parity: N

59



60



For more information on LogMemorizer, please refer to the separate LogMemorizer operating manual supplied with the device.

7.2 Exporting measuring values to a computer

To do so: LogMemorizer must be installed. And you must have taken and saved one or several moisture readings.

Options: You can export moisture readings from the humimeter BMA-2 and initiate the export at your computer.

Exporting moisture readings from the humimeter BMA-2

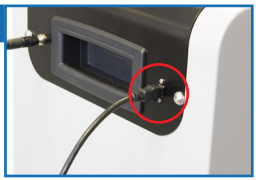
Connect the humimeter BMA-2 to your computer using the supplied USB cable.

1. Insert the USB Mini B connector into the humimeter BMA-2 (figure 61).
2. Insert the USB connector into the computer.
3. Open LogMemorizer on your computer.
4. Switch on the humimeter BMA-2.
5. Press  .
6. Select **Send Logs** (figure 62). To do so, press  or  and confirm by pressing  .
7. Select **Manual Logs** (figure 63). To do so, press  or  and confirm by pressing  .

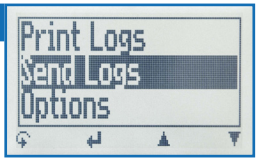
» The display will then show the message **Send** (figure 64).

» All of the measuring values saved on the humimeter BMA-2 will now be sent to your computer.

61

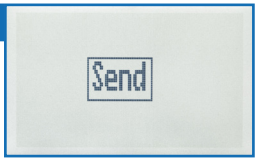


62



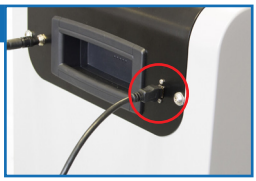
63

64



Initiating the data export at your computer

Connect the humimeter BMA-2 to your computer using the supplied USB cable:

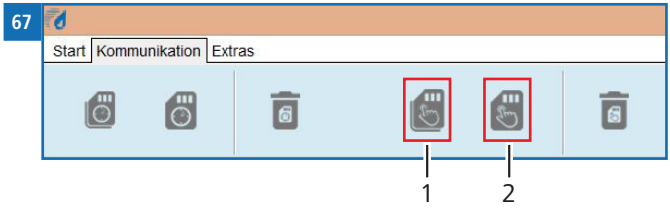


1. Insert the USB Mini B connector into the humimeter BMA-2 (figure 65).
2. Insert the USB connector into the computer.
3. Open LogMemorizer on your computer.
4. Switch on the humimeter BMA-2.
5. Open the **Communication** tab in LogMemorizer (figure 66).

6. Select and click on one of the buttons shown in figure 67:

» **Import all manual logs** (for importing all manually saved readings) or

» **Import most recent manual log** (for importing the most recent manually saved logs).

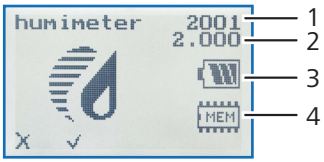


No.	Name
1	Import all manual logs
2	Import most recent manual log

» The measuring values saved on the humimeter BMA-2 will now be sent to your computer.

8. Checking the device's status

1. Press .
2. Select **Status**. To do so, press or and confirm by pressing .
   » The display will then show the status indicator **humimeter**.
   » The display will show the following information:



No.	Name
1	Serial number
2	Software version
3	Battery status
4	Memory status

3. Confirm by presssing .
4. Press to leave the main menu.

9. Configuring the device

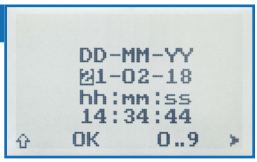
9.1 Turning on Bluetooth

The information on Bluetooth is provided in a separate operating manual.

9.2 Adjust the date/time

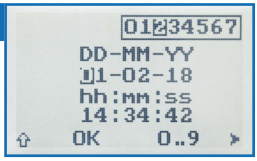
1. Press .
2. Select **Options**. To do so, press or and confirm by pressing .
3. Select **Date/Time**. To do so, press or and confirm by pressing .
   - » The display will now appear as shown in figure 68.
   - » The format for the date is **DD-MM-YY** (Day-Month-Year).
   - » The format for the time is **hh:mm:ss** (Hour:Minutes:Seconds).

68



4. Inputting numbers:
   Press and hold 0..9 to quickly scroll to the required number and either press it for 3 seconds or press to confirm the selected number (figure 69).

69



5. Moving forward:
   To move forward between **DD-MM-YY** and **hh:mm:ss**, press .
6. Moving back:
   Press to switch to another input level. To move backward between **DD-MM-YY** and **hh:mm:ss**, press .
7. Confirm the date/time by pressing OK.
   - » The settings have been saved.
8. Press to leave the **Options** menu.
9. Press to leave the main menu.

9.3 Selecting a language

1. Press .
2. Select **Options**. To do so, press or and confirm by pressing .
3. Select **Language**. To do so, press or and confirm by pressing .
4. Navigate to the required language. To do so, press or and confirm by pressing .

» The settings have been saved.

5. Press to leave the **Options** menu.
6. Press to leave the main menu.

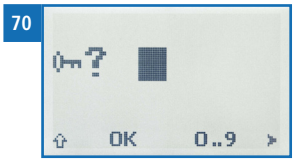
9.4 Activating options

To do so: Some of the options are deactivated.

1. Press .
2. Select **Options**. To do so, press or and confirm by pressing .
3. Select **Unlock**. To do so, press or and confirm by pressing .

» The display will now appear as shown in figure 70.

» On delivery, the four-digit password is the device's serial number.



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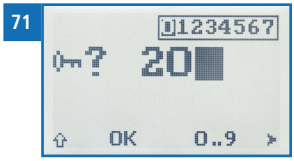


71

4. Inputting numbers:
   Press and hold 0..9 to quickly scroll to the required number and either press it for 3 seconds or press to confirm the selected number (figure 71).
5. Moving back:
   Press to switch to another input level.
   To move back, press .
6. Confirm the four-digit password by pressing OK.

» The settings have been saved.

» The **°C/°F**, **BL On Time**, **Auto Off Time**, **Materialcalib.**, **Password**, **Reset** options are now activated.

7. Press  to leave the **Options** menu.
8. Press  to leave the main menu.

9.5 Deactivating options

Once the device has been switched restarted, the **°C/°F**, **BL On Time**, **Auto Off Time**, **Materialcalib.**, **Password**, **Reset** options will be deactivated again.

9.6 Selecting °C/°F

To do so: All of the options must be activated (see "9.4 Activating options").

1. Press  .
2. Select **Options**. To do so, press  or  and confirm by pressing  .
3. Select **°C/°F**. To do so, press  or  and confirm by pressing  .
4. Navigate to the required temperature scale, i.e. Celsius (**°C**) or Fahrenheit (**°F**). To do so, press  or  and confirm by pressing  .

» The settings have been saved.

5. Press  to leave the **Options** menu.
6. Press  to leave the main menu.

9.7 Reducing the device's power consumption

9.7.1 Configuring the display illumination time

To do so: All of the options must be activated (see "9.4 Activating options").

1. Press  .
2. Select **Options**. To do so, press  or  and confirm by pressing  .
3. Select **BL On Time**. To do so, press  or  and confirm by pressing  .
4. Select the required display illumination period (30 seconds/2 minutes/5 minutes/10 minutes). To do so, press  or  and confirm by pressing  .

» The settings have been saved.

5. Press  to leave the **Options** menu.
6. Press  to leave the main menu.

9.7.2 Set the device to turn off automatically

To do so: All of the options must be activated (see "9.4 Activating options").

1. Press  .
2. Select **Options**. To do so, press  or  and confirm by pressing  .
3. Select **Auto Off Time**. To do so, press  or  and confirm by pressing  .
4. Select the period of time you want the device to stay switched on (4 minutes, 6 minutes, 10 minutes, 30 minutes). To do so, press  or  and confirm by pressing  .

» The settings have been saved.

5. Press  to leave the **Options** menu.
6. Press  to leave the main menu.

9.8 Configuring the material calibration function

The type calibration function is described in a separate operating manual.

9.9 Changing the password

To do so: All of the options must be activated (see "9.4 Activating options").

1. Press  .
2. Select **Options**. To do so, press  or  and confirm by pressing  .
3. Select **Password**. To do so, press  or  and confirm by pressing  .

   » The display will show the current password.

4. Overwrite the current password. To do so, press and hold  to quickly scroll to the required number and either press it for 3 seconds or press  to confirm the selected number.

   Moving back:
   Press  to switch to another input level.
   To move back, press  .

5. Confirm the new four-digit password by pressing  .

   » The settings have been saved.

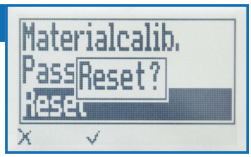
6. Press  to leave the **Options** menu.
7. Press  to leave the main menu.

9.10 Resetting the device to its factory settings

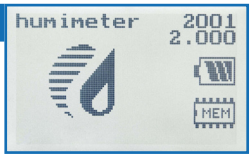
To do so: All of the options must be activated (see "9.4 Activating options").

1. Press .
2. Select **Options**. To do so, press or and confirm by pressing .
3. Select **Reset**. To do so, press or and confirm by pressing .
   » The display will then show the message **Reset?** (figure 72).
4. Confirm by pressing .
   » The device will now be reset to its factory settings. All of your personal settings will be lost.
   » The display will show the status indicator **humimeter** (figure 73).
   » Resetting the device will not affect the saved measuring values.

72



73



10. Cleaning and maintenance

Regularly cleaning and maintaining the device will ensure that it will have a long service life and stay in good condition.

10.1 Care instructions

- Do not leave the device out in the rain. The device and measuring chamber are not waterproof.
- Do not position the device in damp rooms.
- Place the device on a stable, level and dry surface.
- Do not expose the device to large quantities of dust.
- Do not expose the device to extreme temperatures.
- Protect the device from strong mechanical shocks and loads.
- Keep a sufficient distance of about 10 cm from the wall and other objects.
- Lay the power cable so that it cannot be damaged by edges or hot surfaces.

10.2 Cleaning the device

ATTENTION

Do not clean with fluids

Water or cleaning fluid getting inside the device can destroy the device.

► Only clean with dry materials.

ATTENTION

Damage due to improper cleaning

Damage to the golden contacts on the weighing plate (figure 74) can destroy the device.

► Do not touch the golden contacts during cleaning.

Measuring chamber

- Clean the measuring chamber with a cloth or a soft brush.

Interior

» The weighing plate (figure 74) must always be free of wood chips or dirt.

- Remove the outer covers to enable thorough cleaning (Bild 75).

» To do this, loosen two screws on each side (Bild 74).

- Remove wood chips or dirt with the vacuum cleaner.

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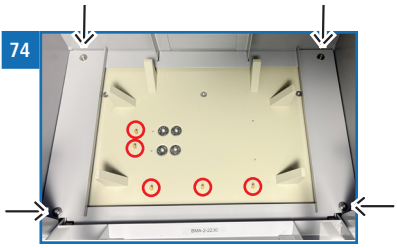
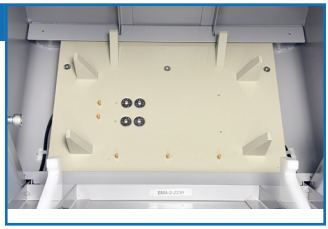


75

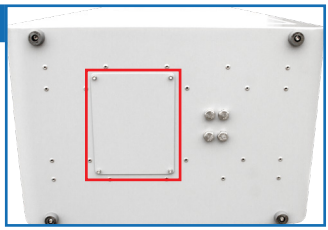


Weighing cell

» At the bottom of the device there is a cover (figure 76).

- Unscrew the cover after approx. 200 measurements.
- Remove wood chips or dirt with the vacuum cleaner.

76



10.3 Replacing the printer paper roll

To do so: The integrated printer and a paper roll is required. Both are included in the equipment packages: Data package or ATRO package.

1. Lift the tab of the printer all the way up (figure 77).

» The printer cover pops open.

2. Remove the empty paper roll.
3. Place a new, opened paper roll into the printer (figure 78).
4. Keep hold of the beginning of the paper roll and close the printer cover.

» The printer is now ready to use again (figure 79).

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10.4 Checking the calibration

The device's calibration should be checked regularly.

To do so: The test medium (figure 80) for checking the measuring device is required. The device's calibration check is described in a separate operating manual.

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11. Faults

If the measures listed below fail to remedy any faults or if the device has faults not listed here, please contact Schaller GmbH.

Fault	Cause	Remedy
Measuring error	The temperature of the material being measured is too low or high. I.e. the material's temperature is lower than 0 °C or higher than +50 °C.	The temperature of the material being measured has to be between 0 °C and +50 °C.
	Frozen material or material mixed with snow Accuracy decreases significantly	The material must not be frozen or mixed with snow.
	Wrong calibration curve	Check whether you have selected the right calibration curve (product) before taking a reading (see "5.2 Taking a measurement").
	Mouldy or rain wet material Accuracy decreases significantly	Only measure dry, not mouldy material.
	Insuffient material in the measuring chamber	Ensure that the measuring chamber is completely filled with material; there must not be less nor more material in it.
	Wrong filling procedure	The measuring chamber has to stand on the ground when filling it. Always use the included bucket for the filling.
	Wrong filling direction	Always fill the measuring chamber from the side with the metal plate.
LED flashing red	Drawer not closed correctly	Close the drawer completely. Press ✓ to confirm the error message.

Fault	Cause	Remedy
	Measuring chamber is not in the device while taking a measurement	Put the filled measuring chamber into the device. Press ✓ to confirm the error message.
	Measuring chamber empty while taking a measurement	Put the filled measuring chamber into the device. Press ✓ to confirm the error message.
	Measuring chamber wrongly positioned while taking a measurement	Put the filled measuring chamber correctly into the device. Press ✓ to confirm the error message.
	Motor overloaded while compressing the material	Check the content of the measuring chamber. Press ✓ to confirm the error message.
Incorrect adjustment (the exclamation mark on the display does not go away)	Material in the measuring chamber during adjustment	Empty the measuring chamber completely.
	Pollution of contacts of the measuring chamber	Clean the contacts of the measuring chamber according to "12.1 Cleaning the contacts of the measuring chamber".
Data transfer to Log Memorizer failed	Interface has not been configurated	The interface only has to be configurated once. To do so, press the F1 key on your computer and read the Help file of the Log Memorizer program.

14. Device information

14.1 EC declaration of conformity

CE KONFORMITÄTSERKLÄRUNG
DECLARATION OF CONFORMITY

Name/ Adresse des Herstellers: *Name/ address of manufacturer:*	**Schaller Messtechnik GmbH** **Max-Schaller-Straße 99** **A – 8181 St. Ruprecht**
Produktbezeichnung: *Product designation:*	**humimeter**
Typenbezeichnung: *Type designation:*	**BMA ; BMA2**
Produktbeschreibung: *Product description*	**Messgerät zur Bestimmung des Wassergehalts in Biomasse** ***Measuring instrument for determining the water content in biomass***

Das bezeichnete Produkt erfüllt die Bestimmungen der Richtlinien:
The designated product is in conformity with the European directives:

EMV - Richtlinie 2014/30/EC	***EMC Directive 2014/30/EU***
RoHS - Richtlinie 2011/65/EG	***RoHS-Directive 2011/65/EU***
Niederspannungsrichtlinie 2014/35/EU	***Low Voltage Directive 2014/35/EU***
Maschinenrichtlinie 2006/42/EG	***Machinery Directive 2006/42/EG***

Die Übereinstimmung des bezeichneten Produktes mit den Bestimmungen der Richtlinien wird durch die vollständige Einhaltung folgender Normen nachgewiesen:
Full compliance with the standards listed below proves the conformity of the designated product with the provisions of the above-mentioned EC Directives:

EN 61326–1:2013	Elektrische Mess-, Steuer-, Regel- und Laborgeräte - EMV-Anforderungen *Electrical equipment for measurement, control, and laboratory use – EMC requirements*
EN IEC 63000:2019-05 *ersetzt / replaced* **EN 50581:2012**	Technische Dokumentation zur Beurteilung von Elektro- und Elektronikgeräten hinsichtlich der Beschränkung gefährliche Stoffe. *Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances.*

EN ISO 12100:2011 **EN ISO 12100:2013**	Allgemeine Gestaltungsleitsätze - Risikobeurteilung und Risikominderung *Safety of machinery - General principles for design - Risk assessment and risk reduction*
EN ISO 13857:2020-04	Sicherheit von Maschinen - Sicherheitsabstände gegen das Erreichen von Gefahrstellen mit den oberen Gliedmaßen und unteren Gliedmaßen *Safety of machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs*
DIN EN ISO 13854:2020-01 *ersetzt / replaced* **EN 349**	Sicherheit von Maschinen – Mindestabstände zur Vermeidung des Quetschens von Köperteilen *Safety of machinery - Minimum gaps to avoid crushing of parts of the human body*
EN ISO 13849-1	Sicherheit von Maschinen – Sicherheitsbezogene Teile von Steuerungen – Teil 1: Gestaltungsleitsätze *Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design*

Für das angeführte Produkt ist eine vollständige Dokumentation mit Betriebsanleitung in Originalfassung vorhanden.

For the above mentioned product a complete documentation with manual of instruction in original version is available.

Bei Änderungen, die nicht vom Hersteller spezifiziert sind, verliert diese Konformitätserklärung die Gültigkeit.

In case of any changes not agreed upon with the manufacturer, this declaration of conformity loses its validity.

St. Ruprecht a.d. Raab, 31.07.2022

Schaller Messtechnik / humimeter.com
Schaller Messtechnik GmbH
Dipl.-Ing. Schaller Straße 99
AT-8181 St. Ruprecht a.d. Raab
www.humimeter.com | info@humimeter.com

Bernhard Maunz
Rechtsverbindliche Unterschrift des Ausstellers
Legal binding signature of the issuer

DECLARATION OF CONFORMITY

Name/ address of manufacturer:	**Schaller Messtechnik GmbH** **Max-Schaller-Straße 99** **A – 8181 St. Ruprecht**
Product designation:	**humimeter**
Type designation:	**BMA ; BMA2**
Product description	**Measuring instrument for determining the water content in biomass**

The designated product is in conformity with the following directives:

- **Electromagnetic Compatibility Regulations 2016 Great Britain**
- **RoHS-Directive 2011/65/EU Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment**
- **Supply of Machinery (Safety) Regulations 2008 Great Britain**
- **Electrical Equipment (Safety) Regulations 2016 Great Britain**

Full compliance with the standards listed below proves the conformity of the designated product with the provisions of the above-mentioned Directives:

EN 61326–1:2013	Electrical equipment for measurement, control, and laboratory use – EMC requirements
EN IEC 63000:2019-05 replaced **EN 50581:2012**	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances.

EN ISO 12100:2011 **EN ISO 12100:2013**	Safety of machinery - General principles for design - Risk *asassessment and risk reduction*
EN ISO 13857:2020-04	Safety of machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs
DIN EN ISO 13854:2020-01 replaced **EN 349**	Safety of machinery - Minimum gaps to avoid crushing of parts of the human body
EN ISO 13849-1	Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design

For the mentioned product, a complete documentation with manual of instruction in original version is available.

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12. Troubleshooting

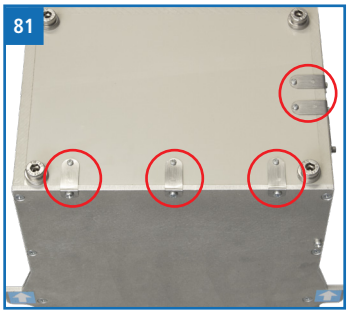
12.1 Cleaning the contacts of the measuring chamber

To do so: The calibration curvecalibration is not successful and the exclamation mark on the display does not go away. The contacts of the measuring chamber are polluted.

1. Lightly sand the contacts (figure 81) with a fine sandpaper (K400). The contacts are made of stainless steel.

2. Clean the contacts with a cloth and cleaning alcohol.

If this measure does not remedy the fault, please contact Schaller GmbH.



13. Transportation, storage and disposal

13.1 Transporting the device

ATTENTION

Damage due to improper transport

The device can be damaged or ruined by a dispatch with various parcel services or by post.

► Only ship the device in its original packaging.
► Only ship the device by a freight forwarder.

Before you transport the device, carry out the following activities:

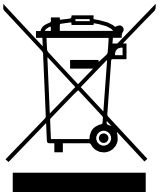
1. Remove the measuring chamber. It must not be inside the instrument during transport or shipment.
2. Disconnect the power cable from the device and the power socket.
3. Only pack the device in its original packaging.

13.2 Storing the device

The device must be stored as follows:

- Do not store outdoors.
- Store in a dry and dust-free place.
- Protect the device from sunlight.
- Avoid mechanical shocks/loads.
- Storage temperature: -20 °C to +60 °C

13.3 Disposing of the device



Devices marked with this symbol are subject to Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE).
If the device is being operated outside the European Union, the national regulations on the disposal of such devices that apply in the country of use must be observed.

Electronic devices must not be disposed of as domestic waste.

The device must be disposed of appropriately using appropriate collection systems.

14.2 Equipment packages

In addition to the standard version without any accessories, the device is available in three further, different equipment variants:

Data package

- LogMemorizer measuring data recording and analysing software and USB cable
- Integrated printer

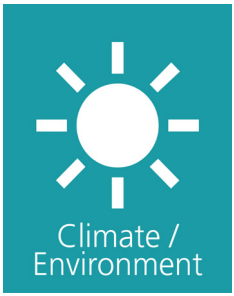
ATRO package

- LogMemorizer measuring data recording and analysing software and USB cable
- Integrated printer
- Determination of bulk density and dry weight (atro) in tons/m³ (only for wood chip products)
- Display of the calculated calorific value in MJ/m³ based on the stored literature value (only for wood chip characteristic curves)

14.3 Technical data

Display resolution	0.1% moisture content
Measuring range	5 to 70% moisture content (dependent on calibration curve)
Operating temperature	0 °C to +50 °C
Storage temperature	-20 °C to +60 °C
Temperature sensor	Infrared (non-contact)
Temperature compensation	Automatic
Probenmenge	12 liters
Power supply	100-240VAC 1.5A 50-60 Hz
Plug	Euro Schuko plug, CEE 7/4
Display	128 x 64 illuminated matrix display
Dimensions (WxDxH)	432 x 282 x 862 mm
Weight	29 kg (including measuring chamber)
IP rating	IP 40

15. Notes



Schaller Messtechnik develops, produces and sells professional moisture meters and turnkey solutions.

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