Schaller
Messtechnik / humimeter.com

Moisture meter

Operating Manual

humimeter FL2

Moisture meter with insertion probe

for measuring the moisture content of hay and straw

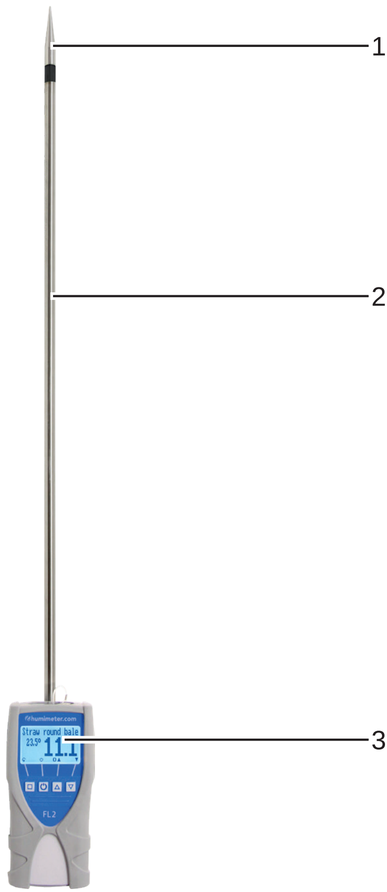
78,0 °F | 6,16% | 456 kg/m³ | -27,3 td | 0,64 aw | 51,9%r.H. | 14,8%abs | 100,4 g/m² | 09m/s | 4,90Ugl | 1

Version 2.3

Always read this operating manual before using the humimeter FL2

Your humimeter FL2 at a glance

The main unit

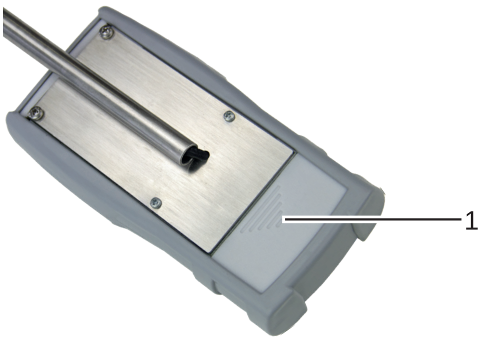


No	Name
1	Measuring head
2	Insertion probe
3	Electronics in plastic housing

The main unit in detail

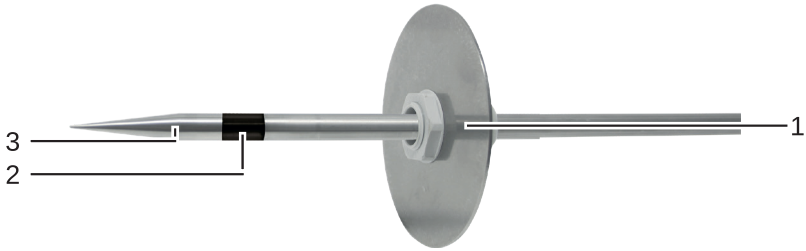
No	Name
1	USB port (optional)
2	Display
3	Keypad
4	Rubber protection cover

Rear of the main unit



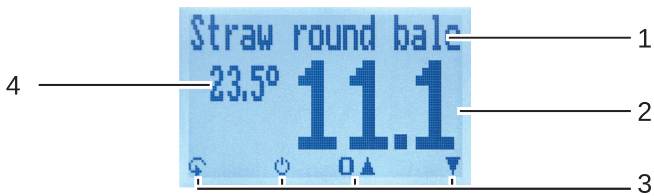
No	Name
1	Battery compartment

The measuring head



No	Name
1	Compression plate
2	Isolator
3	Measuring tip

The display



No	Name
1	Calibration curve
2	Moisture content % ("6.2 How moisture is de ned")
3	Display symbols
4	Temperature display

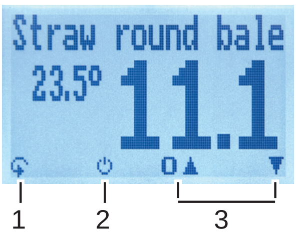
The display symbols

Symbol	Name	Symbol	Name
	Enter		No
	Up		Change input level
	Down		OK
	Back		Change menu
	Enter numbers		Enter data
	Enter letters		View measurements
	Continue / go right		Delete measurements
	Left		On/off button, display light
	Yes		Save measured value

The menus

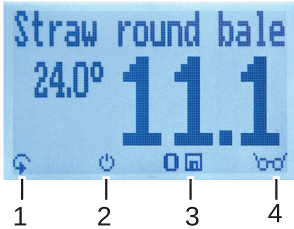
The device has three different menus: product selection, Data Log and main menu:

Product selection menu



No	Name
1	Change menu
2	Display illumination / device on/off
3	For changing the calibration curve

Data Log menu



No	Name
1	Change menu
2	Display illumination / device on/off
3	Save measured value
4	Show the last recorded values

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, Log Time, Language, Unlock, °C/°F, Userlevel, BL On Time, Auto Off Time, Materialcalib., Online Send, Password, Reset
- Status

Table of contents

Your humimeter FL2 at a glance 2

The main unit 2

The main unit in detail 3

Rear of the main unit 3

The measuring head 4

The display 4

The menus 5

1. Introduction 11

1.1 Information about this operating manual 11

1.2 Limitation of liability 11

1.3 Symbols used in this manual 12

1.4 Customer service 12

2. For your safety 13

2.1 Proper use 13

2.2 Improper use 13

2.3 User qualifications 13

2.4 General safety information 14

2.5 Warranty 14

3. On receipt of your device 15

3.1 Taking the device out of its packaging 15

3.2 Making sure that all of the components have been included 15

3.3 Inserting batteries 16

4. Using the device - Basics 16

4.1 Switching the device on 16

4.2 Selecting the calibration curve 17

4.3 Taking a measurement 17

4.4 Switching the device off 17

5. The measuring process 18

5.1 Preparing a measurement 18
5.1.1 Measuring loose hay/straw 18
5.2 Taking a measurement 19
5.2.1 Measuring hay and straw bales 19
5.2.2 Measuring loose hay/straw 19
5.3 Simplified user 21
5.3.1 Activating/deactivating the simplified user 21
5.3.2 Using the simplified user 21
5.4 Hold function - Freezing the displayed values 21
5.4.1 Activating the hold function in the options menu 21
5.4.2 Using the hold function 22
5.5 Saving individual readings 22
5.5.1 Activating the manual saving function in the options menu 22
5.5.2 Using the manual saving option 23
5.6 Saving several readings (a measurement series) at the same time 24
5.7 Viewing individual readings 26
5.8 Viewing individual readings from a series of measurements 26
5.9 Deleting all measured values (data log) 27
5.10 Deleting individual measurement series 27
5.11 Deleting single values from a series of measurements 28

6. Calibration curves 29

6.1 Digit calibration curve 29
6.2 How moisture is defined 30
6.3 Selecting the calibration curve 30
6.4 Notes for comparative measurement with oven-drying method 32

7. Using the LogMemorizer program 33

7.1 Installing / opening the program 33
7.2 Exporting measured values to a computer 34

8. Checking on the device's status 36

$POmHVSJOH UIF EFWJDF 37

9.1 Turning on Bluetooth 37

9.2 Adjust the date/time 37

9.3 Selecting a language 38

9.4 Activating options 38

9.5 Deactivating options 39

9.6 Selecting °C/°F 39

9.7 Changing the Userlevel 40

9.7.1 Changing from advanced to simplified user 40

9.7.2 Changing from simplified to advanced user 40

9.8 Reducing the device's power consumption 41

9.8.1 Configuring the display illumination time 41

9.8.2 Configuring automatic switch-off 41

9.9 Configuring the material calibration function 42

9.10 Changing the password 42

9.11 Resetting the device to its factory settings 43

10. Cleaning and maintenance 43

10.1 Changing batteries 43

10.2 Care instructions 44

10.3 Cleaning the device 44

11. Faults 45

12. Storage and disposal 47

12.1 Storing the device 47

12.2 Disposing of the device 47

13. Device information 48

13.1 CE declaration of conformity 48

13.2 Technical data 52

14. Notes 53

1. Introduction

1.1 Information about this operating manual

This operating manual is designed to enable you to use the humimeter FL2 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 FL2. 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 Messtechnik 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 quali ed users
- Unauthorised modi cations
- 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 the safety information provided in this manual is shown with a corresponding symbol.

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 ef ciently 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

Telefon: +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)
- Electromagnetic compatibility (EMC)

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 hay and straw
- The device must only be used for taking measurements on the products de ned in the following sections of this manual (see "6. Calibration curves"es").

2.2 Improper use

- The device is not suitable for measuring mouldy or rain wet hay/straw.
- The device is not waterproof and must be protected from water and ne dust (IP40).

2.3 User quali cations

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 General safety information

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

- Remove the batteries if the device isn´t used for a prolonged period of time.
- Keep the measuring head away from your body throughout all activities.
- Keep the measuring head away from other people throughout all activities.
- In case of damages or loose parts on the device, remove the batteries and contact Schaller Messtechnik GmbH or your dealer.

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.

2.5 Warranty

The warranty does not apply to:

- Damage resulting from non-observance of the operating manual
- Damage resulting from third-party interventions
- Products that have been used improperly or modi ed without authorisation
- Products with missing or damaged warranty seals
- Damage resulting from force majeure, natural disasters, etc.
- Damage from improper cleaning
- Batteries older than six months
- Damage resulting from improper strain (pressure, bending) of the insertion probe or the measuring head
- Damage by dropping the measuring head

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.

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:

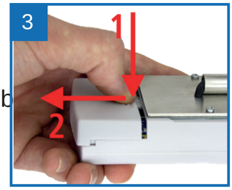
- humimeter FL2
- 4 pieces of AA Alkaline batteries
- Rubber protection cover
- Compacting plate
- Wooden case
- Operating manual

Optional accessories:

- humimeter USB data interface module - USB ash drive with software and USB-cable or download using humimeter.com/software
- Battery operated portable thermal printer (only possible together with humimeter USB data interface module) - Described in a separate operating manual
- Bluetooth module (only possible together with humimeter USB data interface module) - Described in a separate operating manual
- Test block

3.3 Inserting batteries

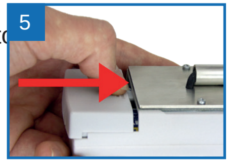
1. Remove the rubber protection cover. To do so, hold the rubber protection cover at the upper side and pull it over. If your device is provided with an optional USB port, remove the protection cap of the USB socket before (gure 1 and 2).



2. Take hold of the device with one hand, press your thumb onto the engraved area of the battery compartment (1) and drag downwards (2) (gure 3).

3. Insert the batteries with negative and positive terminals matching those indicated on the battery compartment. Press down the batteries so that they lay at on the bottom of the housing (gure 4).

» As soon as all batteries have been inserted, the device switches on automatically.



4. Push the battery cover onto the housing until it clicks into place. Then mount the rubber protection cover onto the housing, beginning at the end where the battery compartment is situated (gure 5).

4. Using the device - Basics

4.1 Switching the device on

- Press the button for 3 seconds.

» The display will then show the status indicator (gure 6).

» After inserting the batteries, the device switches on automatically.

4.2 Selecting the calibration curve

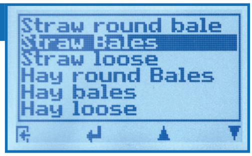
To do so: The device has to be in the product selection menu (gure 7).

For an overview of the different calibration curves and the criteria for selecting them, please refer to "6. Calibration curves"es".

1. Press the or button to move from one product to the next Or
2. Press the or button for 3 seconds to open the calibration curve overview (gure 8).

7

8



3. Use the arrow keys to move from one calibration curve to the next
4. and keep any of them pressed to scroll through the types.
5. Con rm your selection by pressing .

» The calibration curve you selected will now be shown at the top of the display.

4.3 Taking a measurement

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

4.4 Switching the device off

To do so: The device has to be in the product selection, the Data Log or the additional function menu. It is not possible to switch off the device when it is in the main menu.

- Press the button for 3 seconds.

5. The measuring process

5.1 Preparing a measurement

To do so: The device has to have nearly the same temperature than the product being measured. It is recommended to let your humimeter device adjust to the surrounding temperature before the measurement.

9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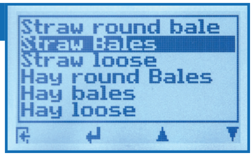
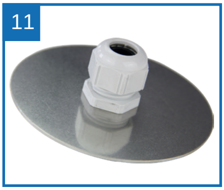


1. Switch on the device (see "4.1 Switching the device on").
2. Select the desired calibration curve (see "6. Calibration curves"es") by pressing the or (see "4.2 Selecting the calibration curve"rve") (gure 10).

5.1.1 Measuring loose hay/straw

Assembly of the compression plate

11


12


1. Loosen the xing nut.
2. Guide the compression plate over the measuring head onto the insertion probe (gure 11).

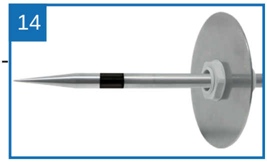
» The xing nut has to face towards the device.

13


3. Position the compression plate on the insertion probe and fasten the xing nut by hand (gure 13).

» The recommended distance between isolator and compression plate amounts to approx. the length of the measuring tip (gure 14).

» The compression plate must not be moved by moderate contact pressure.

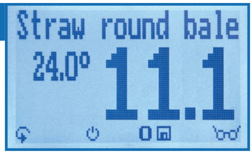
14


5.2 Taking a measurement

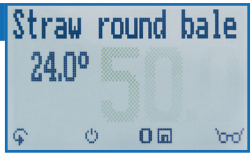
5.2.1 Measuring hay and straw bales

15

16



17



To do so: The device has to have nearly the same temperature than the product being measured.

- Insert the measuring head of the device straight into the hay or straw bale (gure 15).
- » Do not bend or drop the measuring head!
- » Both round bales and rectangle bales have to be measured on the face side of the bale!
- The device will now instantly display the moisture content on the display (gure 16).
- » The displayed value ashes when the moisture content exceeds the measuring range of the selected calibration curve (gure 17). A ashing value signals lowered accuracy of the measurement. The measuring range is dependent on the calibration curve (see "6. Calibration curves"es").
- » Once the reading has been taken, it can be saved on the device (see "5.5 Saving individual readings" or "5.6 Saving several readings (a measurement series) at the same time").

5.2.2 Measuring loose hay/straw

To do so: The device has to have nearly the same temperature than the product being measured. There has to be enough material to ensure adequate compaction.

18

1. Insert the measuring head of the device straight into the hay or straw (gure 18).

   » Do not bend or drop the measuring head!

2. Use the insertion probe to collect material and compress it (gure 19 and 20).

   » A contact pressure must be noticeable.

   » The measuring tip must not penetrate into the ground.

3. While compacting, have an eye on the display.

19

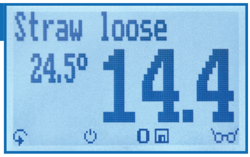
» Continue to compact as long as the display shows a constant measuring value (gure 21).

» The displayed value ashes when the moisture content exceeds the measuring range of the selected calibration curve (gure 17). A ashing value signals lowered accuracy of the measurement. The measuring range is dependent on the calibration curve (see "6. Calibration curves"es").

» Once the reading has been taken, it can be saved on the device (see "5.5 Saving individual readings" or "5.6 Saving several readings (a measurement series) at the same time").

20

21



CAUTION

Risk of injury

Risk of injury due to the measuring head

y Keep the measuring head away from your body throughout all activities.

y Keep the measuring head away from other people throughout all activities.

ATTENTION - HIGH MEASURING INTERVAL

The measuring head will heat up when taking a high amount of measurements on bales with high compressed density, in a rapid succession. This will decrease the accuracy of the measurement signi cantly.

i

Information - Measuring accuracy

This rapid and non-destructive measuring procedure allows you to take moisture readings at a number of different points. When saving the individual readings, the device will automatically calculate the readings' average (see "5.6 Saving several readings (a measurement series) at the same time").

i

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 Simpli ed user

The device can be con gured in such a way that the access of the user can be reduced to the product selection menu combined with the hold function.

5.3.1 Activating/deactivating the simpli ed user

- For information on how to activate/deactivate the simpli ed user, see section "9.7 Changing the Userlevel".

5.3.2 Using the simpli ed user

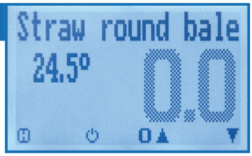
The simpli ed user offers the following limitations:

- The only useable menu is a slightly modi ed product selection menu (gure 22).

» No access to the Data Log or main menu.

- Hold function replaces the function to switch between the different menus (see "5.4 Hold function - Freezing the displayed values").

22



5.4 Hold function - Freezing the displayed values

The device can be con gured in such a way that the information being shown on the display will freeze at the touch of a button until a new button is pressed. This function can be very useful when e.g. taking readings in spaces where it is not possible to see the display (e.g. overhead).

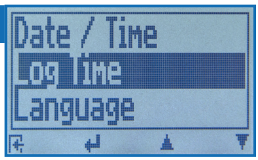
5.4.1 Activating the hold function in the options menu

To do so: The device has to be switched on and be in the product selection menu.

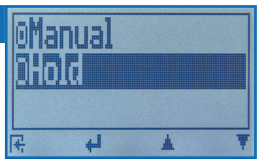
1. Press twice or hold for 2 seconds.
2. Select Options. To do so, press or and con rm by pressing .
3. Select Log Time (gure 23). To do so, press or and con rm by pressing .
4. Select Hold (gure 24). To do so, press or and con rm by pressing .

» The setting has been saved.

23



24



5. Press to leave the Options menu.

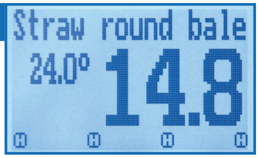
6. Press to leave the main menu.

5.4.2 Using the hold function

To do so: The device has to be switched on and be in the Data Log menu (see "The menus" page 5).

- Press .
» The current reading will be frozen. All of the four symbols will now be displayed as (gure 25).

25



- To reactivate the frozen display, simply press any button.

5.5 Saving individual readings

The device can be con gured in such a way that the device will save a reading every time a button is pressed. This option (manual saving function) is the device's default setting.

5.5.1 Activating the manual saving function in the options menu

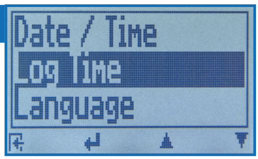
To do so: The device has to be switched on and be in the product selection menu.

1. Press twice or hold for 2 seconds.

2. Select Options. To do so, press or and con rm by pressing .

3. Select Log Time (gure 26). To do so, press or and con rm by pressing .

26



4. Select Manual (gure 27). To do so, press or and con rm by pressing .

» The setting has been saved.

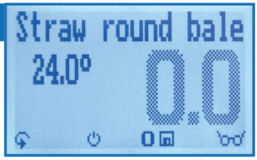
27

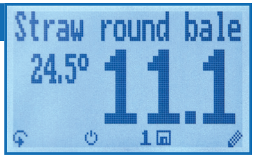
5. Press to leave the Options menu.

6. Press to leave the main menu.

5.5.2 Using the manual saving option

To do so: The device has to be in the Data Log menu (see "The menus" page 5). The device is set to Data Log time - Manual.

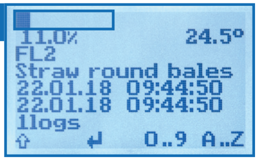
28


29


1. Press .

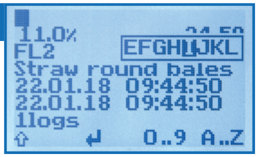
» The display will now appear as shown in gure 29 and the disc symbol will be preceded by the digit one.

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

30


» The display will now appear as shown in gure 30.

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

31


4. Inputting letters:
   Press and hold to quickly scroll to the required letter and either press it for 3 seconds or press to con rm the selected letter (gure 31).

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

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

7. Con rm your entry by pressing .

» The data you entered has been saved.

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

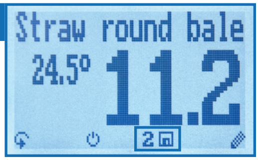
To do so: The device has to be in the Data Log menu (see "Data Log menu" page 6).

1. Take several measurements at different points of the same haystack (see "5. The measuring process").

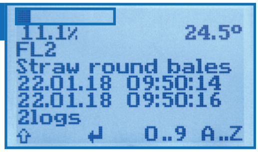
2. After each measurement, press to save the reading.

» The display will appear as shown in gure 32. The marked number shows the number of readings that have already been saved.

32



33



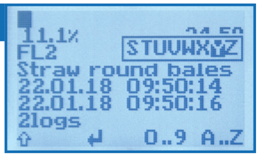
3. Press to enter a name for the saved measurement series and to nish the measuring process.

» The display will now appear as shown in gure 33.

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 con rm the selected letter (gure 34).

34



6. Inputting numbers:
   Press and hold to quickly scroll to the required number and either press it for 3 seconds or press to con rm the selected number.

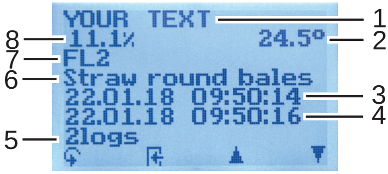
7. Moving forward/back:
   Press to switch to another input level. Press or to move forward or back.

8. Con rm your entry by pressing .

» The data you entered has been saved.

» The device automatically determines the average moisture content of the saved measuring values.

» The display will show the following information:



No	Name
1	Name of the measurement series (editable)
2	Temperature (average)
3	Date & start time of the measurement series
4	Date & end time of the measurement series
5	Number of saved readings
6	Calibration curve
7	Device name
8	Moisture content (average)

5.7 Viewing individual readings

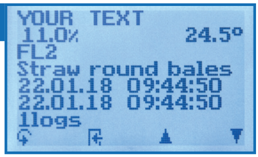
To do so: You must have saved a reading (e.g. 1 Log). The display will now appear as shown in gure 35.

35

1. Press .

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

36



» The display will now appear as shown in gure 36.

» Press to leave this screen.

5.8 Viewing individual readings from a series of measurements

To do so: You must have saved a series of measurements (e.g. 2 logs).
The display will now appear as shown in gure 37.

37

1. Press .

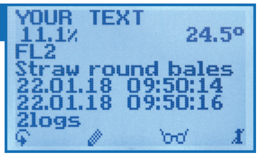
2. Navigate to the required measurement series. To do so, press or .

38

» The display will now appear as shown in gure 38.

3. Press to switch to another input level.

39

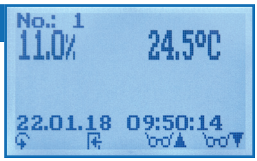


» The display will now appear as shown in gure 39.

4. Press again.

» The display will now appear as shown in gure 40.

40



5. Navigate to the required reading (No.: 1, No.: 2, No.: 3). To do so, press or .

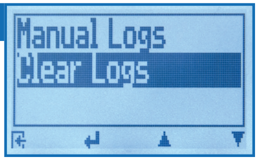
6. Press to leave this screen.

5.9 Deleting all measured values (data log)

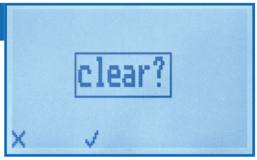
To do so: You must have taken and saved one or several readings.

41

42



43



1. Press twice or hold for 2 seconds.

2. Select Edit Logs (gure 41). To do so, press or and con rm by pressing .

3. Select Clear Logs (gure 42). To do so, press or and con rm by pressing .

   » The display will show the message clear? (gure 43).

4. Con rm by pressing .

   » The data log has been deleted.

5. Press to leave the Edit Logs menu.

6. Press to leave the main menu.

5.10 Deleting individual measurement series

To do so: You must have saved a measured value (e.g. log) or a series of measurements (e.g. 3 logs). The display will now appear as shown in gure 44.

44

45

46

1. Press .

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

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

3. Press to switch to another input level.

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

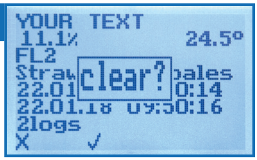
4. Press .

» The display will then show the message clear? (gure 47).

5. Con rm by pressing .

» The value has been deleted.

47



5.11 Deleting single values from a series of measurements

To do so: You must have saved a series of measurements comprising of at least 2 logs. The display will now appear as shown in gure 48.

48

1. Press .

» The display will now appear as shown in gure 49.

49

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

3. Press to switch to another input level.

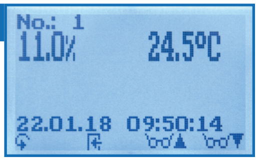
50

» The display will now appear as shown in gure 50.

4. Press .

» The display will now appear as shown in gure 51.

51

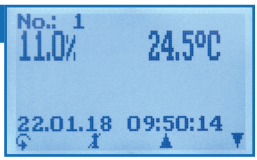


5. Select the required measured value. To do so, press or .

6. Press to switch to another input level.

» The display will now appear as shown in gure 52.

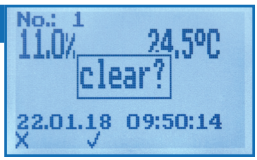
52



7. Press to delete the value shown.

» The display will then show the message clear? (gure 53).

53



8. Con rm by pressing .

» The value has been deleted.

6. Calibration curves

Product name	Calibration curve	Compressed density	Measuring range
Straw round bales	Straw round bales	> 130 kg/m³	8.5 % - 30 %
Straw bales	Straw rectangle bales	100 - 130 kg/m³	8.5 % - 30 %
Straw loose	loose straw		8.5 % - 30 %
Hay round bales	Hay round bales	> 130 kg/m³	8.5 % - 25 %
Hay bales	Hay rectangle bales	100 - 130 kg/m³	8.5 % - 25 %
Hay loose	loose hay		8.5 % - 25 %
Cellulose	Insulating material - special product	38 - 65 kg/m³	10 % - 35 %
Empty 1	free curve for special products		
Empty 2	free curve for special products		
Digit			0 - 100
Reference	! Only for testing the moisture meter !		

» A divergent compressed density may lead to deviations in the measuring result.

6.1 Digit calibration curve

The Digit calibration curve has a unitless measuring range from 0 to 100, which corresponds to the entire measuring range of the device. Special materials can be measured with this calibration curve.

The higher the displayed value, the wetter the material. With the aid of a comparative measurement taken with a reference procedure, a table of comparative values can be created.

very dry: 0% very wet: 100%

6.2 How moisture is de ned

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

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)

6.3 Selecting the calibration curve

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 (EN ISO 18134-2).

Schaller Messtechnik GmbH will be happy to advise you on the selection of the right calibration curve for special hay and straw types.

The insertion direction for both round and rectangle bales is from the face side of the bale as shown on the following gures. Measurements taken from any other direction may lead to incorrect readings.

Straw round bales

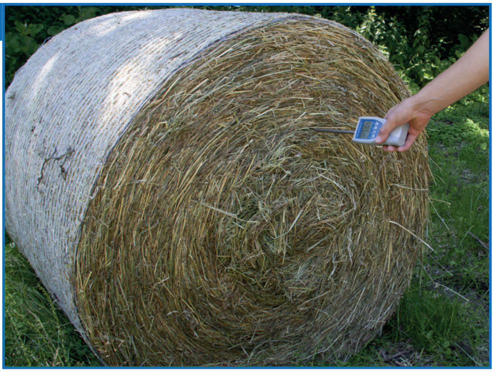
54

Straw rectangle bales

55

Hay round bales

56



Hay rectangle bales

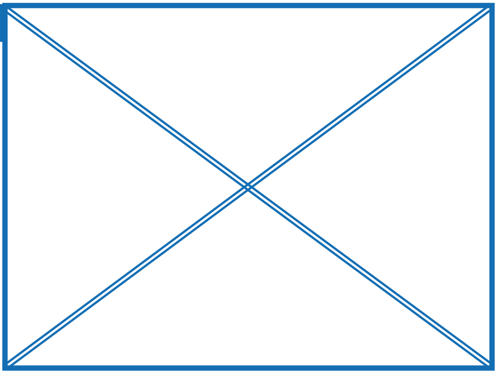
57

Hay loose

58

Incorrect measurement

59



6.4 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.