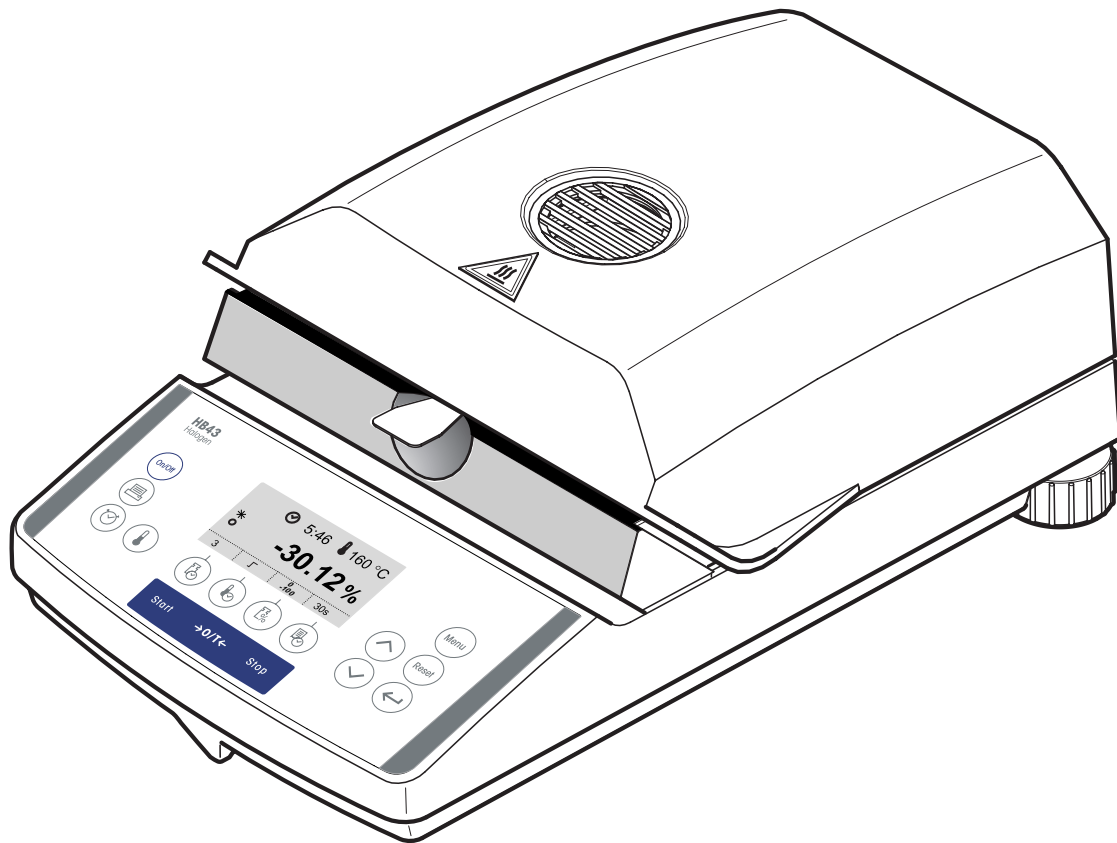
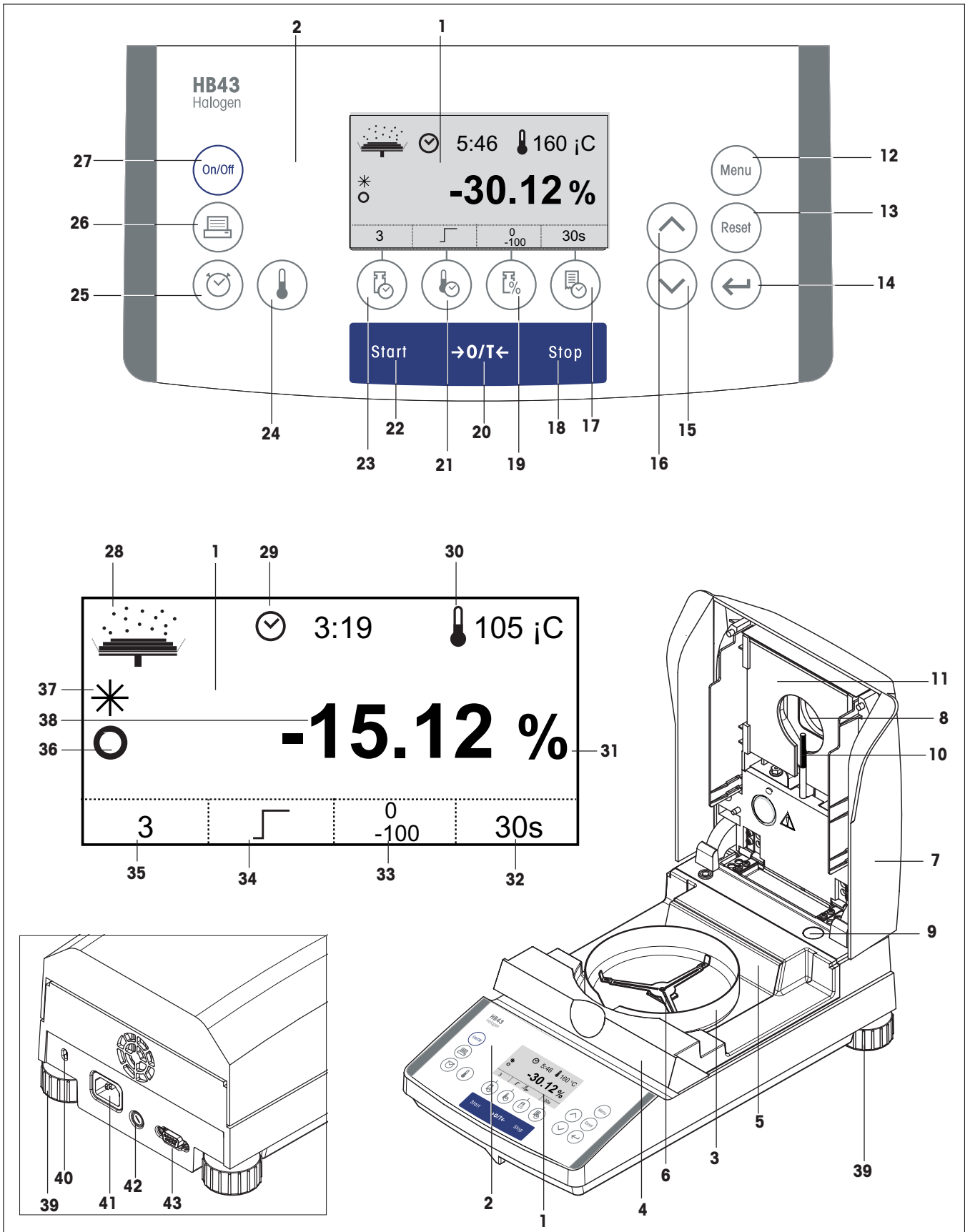


Operating instructions

Moisture Analyzer HB43



Overview of your HB43 Halogen Moisture Analyzer



Display, controls and connections of your HB43

No.	Designation	Info s. Section
1	Display	all
2	Keypad	all
3	Draft shield	2.3
4	Sample chamber	2.3/2.4
5	Heat shield	2.3
6	Sample pan holder	2.3/2.4
7	Heating module	2.3/2.4
8	Inspection window and vent	5.3
9	Level indicator (level)	2.3
10	Temperature sensor	6.1
11	Halogen lamp protective glass	6.1
12	Key «Menu»	5
13	Key «Reset»	2.4/4.1
14	Key «Accept entry»	all
15	Key «Scroll down»	5.1
16	Key «Scroll up»	5.1
17	Function key «Print interval»	4.6
18	Key «Stop» (stop drying)	4.7/4.8
19	Function key «Display mode»	4.5
20	Key «Tare» (zero)	2.4
21	Function key «Drying program»	4.2
22	Key «Start» (start of drying)	5.7
23	Function key «Switch-off criterion»	4.4
24	Key «Drying temperature»	4.3
25	Key «Drying time»	4.4
26	Key «Print»	4.7/5.1
27	Key «On/Off»	2.4

No.	Designation	Info s. Section
28	Status display ("User Guide")	2.4
29	Display of drying time resp. Free switch-off criterion	4.4
30	Display of drying temperature	4.3
31	Display of unit (percent or grams)	4.5
32	Function display «Print interval»	4.6
33	Function display «Display mode»	4.5
34	Function display «Drying program»	4.2
35	Function display «Switch-off criterion»	4.4
36	Stability detector	7.1/7.2
37	Symbol for calculated result	2.4
38	Dialog display (measured values, menu dialog, text entry, etc.)	all
39	Leveling screw	2.3
40	Antitheft device socket	2.3
41	Power supply receptacle	2.3
42	Power line fuses	6.2
43	RS232C interface connection	6.3/8.2

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1 Getting to know your Moisture Analyzer

Please read through this Section carefully, it contains important information for safe and economical operation of your Moisture Analyzer.

1.1 Introduction

Thank you for deciding to purchase a Halogen Moisture Analyzer from METTLER TOLEDO – you have made a wise choice. Your Moisture Analyzer is fast and reliable. It offers a high level of operating convenience and useful functions to facilitate determination of the moisture content of your samples.

Behind your instrument stands METTLER TOLEDO, a leading manufacturer of not only balances and scales for the lab and production, but also analytical measuring instruments. A customer service network covering the entire globe with well trained personnel is at your service at all times, whether you are choosing accessories or require guidance for a specific application to ensure optimum utilization of your instrument.

To ensure you make full use of the possibilities offered by your Moisture Analyzer, we advise you to read through these operating instructions very carefully.

1.2 What is the Halogen Moisture Analyzer used for?

Your Halogen Moisture Analyzer is used for determining the moisture content of almost any substance. The instrument works on the thermogravimetric principle: At the start of the measurement the Moisture Analyzer determines the weight of the sample, the sample is then quickly heated by the integral halogen heating module and the moisture vaporizes. During the drying process the instrument continually measures the weight of the sample and displays the reduction in moisture. Once drying has been completed, the moisture or solids content of your sample is displayed as the final result.

Of decisive importance in practice is the rate of heating. In comparison with conventional infrared heating or the drying oven method, for example, the halogen heating module of your instrument needs a shorter time to reach its maximum heating power. It also allows use of high temperatures, an additional factor in shortening the drying time. Uniform heating of the sample material ensures good repeatability of the drying results and makes it possible to use a smaller amount of sample.

All parameters of a measurement (drying temperature, drying time, etc.) can be preselected. But your Moisture Analyzer offers many other possibilities. To avoid exceeding the scope of this introduction, only a few of these are listed here:

- The drying process can be adjusted to suit the type of sample
- You can choose between various types of result display at any time
- Your settings and the measurement results can be recorded
- The instrument has a built-in storage battery, so your settings are protected even if there is a power failure
- The RS232C data interface fitted as standard allows your moisture analyzer to communicate with an external printer or with a computer.

This wealth of functions notwithstanding, your Moisture Analyzer is very simple to operate. The status display (User Guide) guides you step by step through the measurement cycle and you always know which particular stage in a measurement is currently being executed by the instrument and the next operating step. To exclude faulty handling in routine work, the keypad can be locked to prevent access to all but the elementary functions.

The Moisture Analyzer conforms with all common standards and directives. It supports stipulations, work techniques and result records as demanded by all international quality assurance systems, e.g. **GLP** (**G**ood **L**aboratory **P**ractice), **GMP** (**G**ood **M**anufacturing **P**ractice). The instrument has a CE declaration of conformity and METTLER TOLEDO as the manufacturer has been awarded ISO 9001 and ISO 14001 certification. This provides you with the assurance that your capital investment is protected in the long term by a high product quality and a comprehensive service package (repairs, maintenance, servicing, adjustment service).

As far as the features and possibilities of your Moisture Analyzer are concerned, we shall content ourselves at present with the above brief description. You will find further information in the following sections of these operating instructions. Please read through this information carefully to ensure you can use your instrument in an optimum and safe manner.

1.3 Safety has priority



Your Moisture Analyzer employs state of the art technology and meets the latest demands regarding instrument safety. This notwithstanding, improper operation can endanger personnel and cause damage to tangibles. For safe and dependable operation, please comply with the following instructions:

- The Moisture Analyzer is used for determining the moisture in samples. Please use the instrument exclusively for this purpose. Any other type of use can endanger personnel and damage the instrument or other tangibles.
- The Moisture Analyzer must not be operated in a hazardous environment and only under the ambient conditions specified in these instructions.
- The Moisture Analyzer may be operated only by trained personnel who are familiar with the properties of the samples used and with the handling of the instrument.
- Your Moisture Analyzer is supplied with a 3-pin power cable with an equipment grounding conductor. Only extension cables which meet the relevant standards and also have an equipment grounding conductor may be used. Intentional disconnection of the equipment grounding conductor is prohibited.
- **Note:** There are two versions of the power cable, 110 V and 230 V.



The Halogen Moisture Analyzer works with heat!

- Ensure sufficient free space around the instrument to avoid heat accumulation and overheating (approx. 1 m free space above the instrument).
- The vent over the sample must never be covered, plugged, taped over or tampered with in any other way.
- Do not place any combustible materials on, under or next to the instrument when it is connected to the power supply, since the area around the heating module becomes hot.
- Exercise caution when removing the sample. The sample itself, the sample chamber, the draft shield, and sample container (if used) may still be very hot.
- Be very careful if you open the heating module during operation, because the circular heating module or its protective glass can be as hot as 400 °C! For this reason, only ever touch the handles provided on the heating module.
- No modifications must be made within the heating module. It is particularly dangerous to bend any components or remove them, or to make any other changes.



Certain samples require special care!

With certain types of samples, there is a possibility of danger to personnel or damage to tangibles through:

**Fire or explosion:**

- Flammable or explosive substances
- Substances containing solvents
- Substances which evolve flammable or explosive gases or vapors when heated.

With such samples, work at a drying temperature that is low enough to prevent the formation of flames or an explosion and wear protective goggles. Should there be any uncertainty regarding the flammability of a sample, always work with a small amounts of sample (max. 1 gram). In such cases, **never leave** the instrument **unattended!** In cases of doubt, perform a careful risk analysis.

Poisoning, burning:

- Substances which contain toxic or caustic components. Such substances may be dried only in a fume cupboard.

Corrosion:

- Substances which evolve corrosive vapors when heated (e.g. acids). In the case of such substances, we advise you to work with small amounts of sample as the vapor can condense on cooler housing parts and cause corrosion.

Please note that the user always takes responsibility and assumes liability for damage caused by use of the types of samples mentioned above!

- Never make any modifications or constructional alterations to the instrument and use only original spare parts and optional equipment from METTLER TOLEDO.
- Your Moisture Analyzer is a rugged precision instrument – but you should still treat it carefully; it will then thank you with many years of trouble-free operation.
- Please comply with all notes and instructions in these operating instructions. Keep the instructions in a safe place where they are immediately to hand if any points are unclear. If you lose these instructions, please contact your METTLER TOLEDO dealer for an immediate replacement.



Moisture determination applications must be optimized and validated by the user according to local regulations. Application-specific data provided by METTLER TOLEDO is intended for guidance only.

1.4 Important information for these instructions

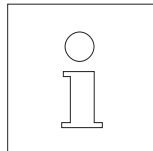
These instructions guide you step by step through the operation of your Moisture Analyzer. The first two Sections help you put the instrument into operation quickly, safely and properly and perform your first measurement within a short space of time. In Sections 3 through 5 you become intimately acquainted with the wide range of functions of your Moisture Analyzer. During this learning phase, you will find the table of contents and the detailed index in Section 9 a valuable orientation aid. Sections 6 through 8 contain additional information on the maintenance of your instrument, troubleshooting and the available options. As soon as you are familiar with your Moisture Analyzer, you will find the illustrations at the beginning of these instructions and the associated references (in the key) useful for quick access.

The following identifications and symbols are used in these instructions:

- Key designations are shown enclosed by twin angle brackets «». Keys with inscribed text are shown with the actual inscription (e.g. «On/Off» or «Start»). For all keys with symbols, designations are used in the text which describe the function of the particular key («Print», «Accept entry» or «Scroll down»).



- This symbol indicates safety and hazard instructions. If these are not complied with, injury to the user, damage to your instrument or other tangibles and malfunctions can result.



- This symbol indicates additional information and directions which facilitate your handling of the instrument and contribute to proper and economical use.

These instructions are also available in foreign languages. Should you require a set of instructions in a different language, please contact your METTLER TOLEDO dealer. You will find the address of your nearest dealer in the attached Declaration of Conformity 11780294.

2 Your first measurement in next to no time

In the Section you will learn how to put your new Moisture Analyzer into operation and obtain measurement results within a very short space of time.

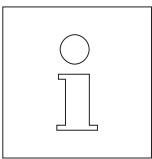
2.1 Unpacking and checking the standard equipment

Open the package and remove the instrument and the accessories. Check the completeness of the delivery. The following accessories are part of the standard equipment of your new Moisture Analyzer:

- 80 aluminum sample pans
- 1 sample holder
- 1 sample handler
- 1 specimen sample (circular, absorbent glass fiber filter)
- 1 draft shield
- 1 power cable
- 1 Operating instructions
- 1 Application brochure “Methods of moisture content determination”
- 1 CE declaration of conformity (in separate brochure 11780294)

Remove the wrapping from the instrument.

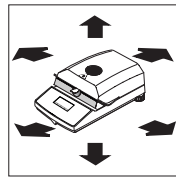
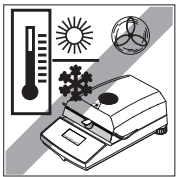
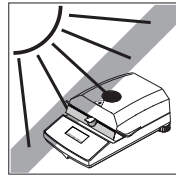
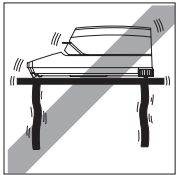
Check the instrument for transport damage. Immediately inform your METTLER TOLEDO dealer if you have any complaints or parts are missing.



Store all parts of the packaging. This packaging guarantees the best possible protection for the transport of your instrument.

2.2 Selecting the location

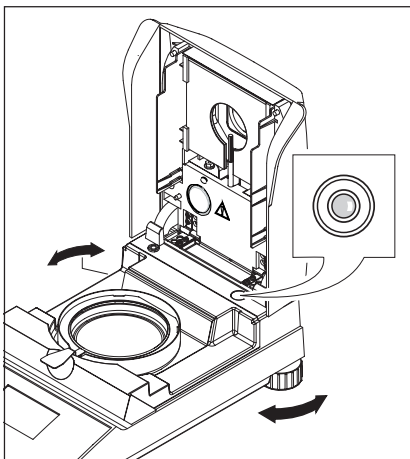
Your Moisture Analyzer is a precision instrument. An optimum location guarantees accuracy and dependability:



- Firm, horizontal location as free from vibrations as possible
- Avoid direct sunlight
- No excessive temperature fluctuations
- No powerful drafts
- Surroundings as free from dust as possible
- Enough space around the instrument to prevent build-up of heat
- Sufficient distance from heat-sensitive materials in the vicinity of the instrument.

2.3 Setting up, leveling and connecting to power supply

Exact horizontal positioning and stable installation are prerequisites for repeatable results. To compensate small irregularities or inclinations ($\pm 2\%$) at the location, the instrument can be leveled.

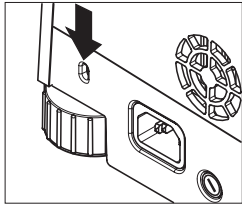


For exact horizontal positioning, the Moisture Analyzer has a level indicator (level) and 2 leveling screws. When the air bubble in the level indicator is exactly in the center, the instrument is standing perfectly horizontally. To level it, proceed as follows:

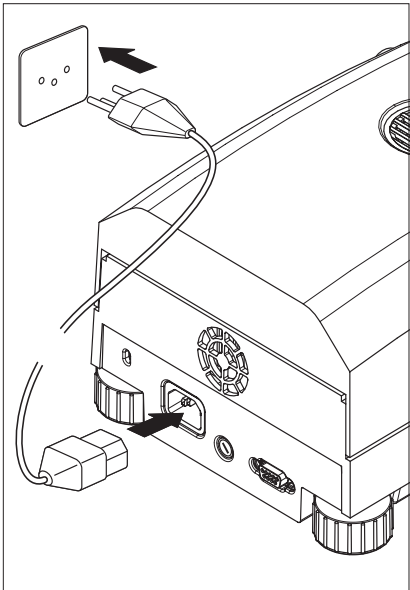
Position your Moisture Analyzer at the selected location.

Turn the two leveling screws until the air bubble is in the center of the level indicator.

Note: The instrument should be relevelled each time its location is changed.



For protection against theft, your Halogen Moisture Analyzer is fitted with a Buchse. Together with a lockable steel cable like those used to protect portable computers against theft, the Buchse can be used to fasten the instrument. You can obtain a suitable antitheft cable from your METTLER TOLEDO dealer.

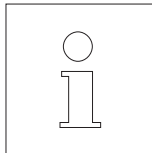


Connect the instrument to the power supply.

Warning:

If the power cable supplied is not long enough, use only a **3-pin extension cable with equipment grounding conductor!**

Allow your instrument to warm up for 60 minutes. The instrument adapts itself to the ambient conditions during this time.



For technical reasons, the halogen heating module is designed specifically for a particular line voltage (110 V AC or 230 V AC). A heating module is installed in the factory that is matched to the particular line voltage of the country of destination. If you are not sure whether the heating module built into your instrument is suitable for your local line voltage, check the voltage printed on the glass of the circular halogen lamp before you connect the Moisture Analyzer to the power supply!

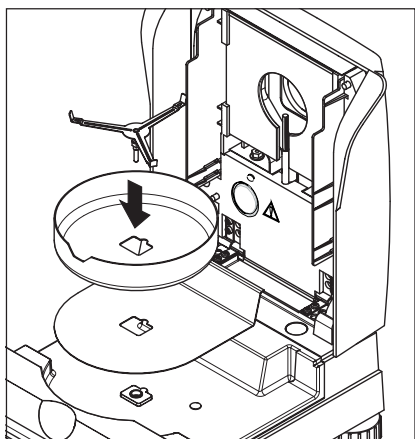


Connection to a line voltage that is too high can lead to blowing of the fuses, whereas a supply voltage that is too low will prolong the drying process.

Please note that some parts of your instrument are always live when the instrument is connected to the power supply.



Switch the instrument on with the «On/Off» key.



First lay the heat shield in the sample chamber. Then place the draft shield (can only be mounted in one position) and after that the sample pan support in position. Turn the sample pan support until it engages. In the engaged position the rear arm of the sample pan support lies exactly along the length of the instrument.

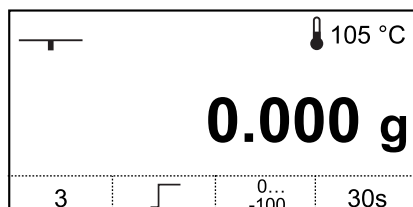
2.4 Your first measurement

After you have successfully put your new Moisture Analyzer into operation for the first time, you can immediately perform your first measurement. In doing so, you will become familiar with the instrument and the status display and at the same time perform a function check.

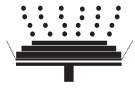
Please use the specimen sample supplied for your first measurement. This sample is an absorbent glass fiber filter. During your first measurement, the instrument operates with the factory settings. Therefore, it operates in the automatic operating mode "Auto", which allows you to perform a complete measurement without pressing a single key, thanks to the unique "SmartStart" function.



Press the «On/Off» key to switch the instrument on.



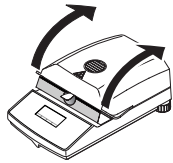
After it has been switched on, the instrument performs a self-test. Wait until the display shown opposite appears.



Your Moisture Analyzer has a graphical status display (User Guide) which you will become acquainted with in this Section. The status display informs you continuously about the current status of the instrument and prompts you to execute the next operating step (shown flashing).



Initial status with heating module closed.

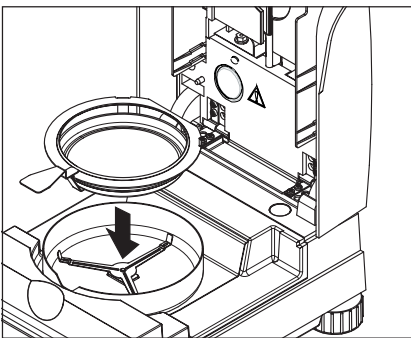


Open the heating module.



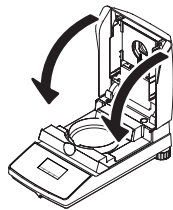
Status: Ready for taring

The status display flashes and prompts you to load the empty sample pan.



Place the empty sample pan in the sample pan handler (this is possible without tilting the sample pan if you insert this in the pan handler from the side directly below the round flange). Place the sample pan handler in the draft shield. Ensure that the tongue of the pan handler fits exactly in the slot of the draft shield. The sample pan must lie flat in the pan holder.

Note: We advise you to work with the sample pan handler at all times. The pan handler is ergonomic, safe and provides protection against possible burns due to the hot sample pan.



Close the heating module. This sets the balance installed in the Moisture Analyzer to zero.

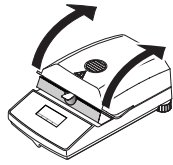


If you only operate the «Tare (zero)» key, you will be requested to close the heating module.

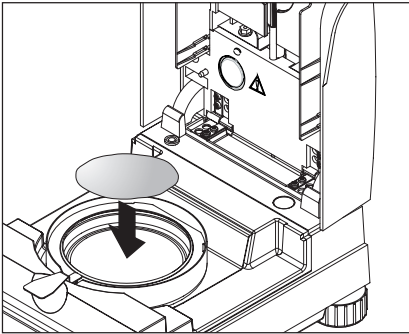


Status: Ready for weighing

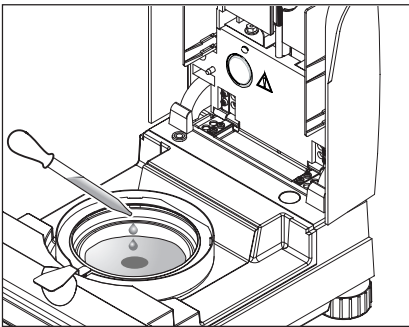
After taring, the status display flashes and prompts you to place the sample in the sample pan.



Open the heating module.



Place the specimen sample in the sample pan.

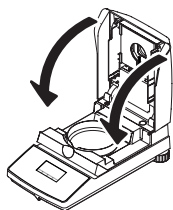


Wet the specimen sample with a few drops of water.

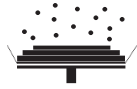


Status: Ready for start

The status display flashes and prompts you to start the drying process.



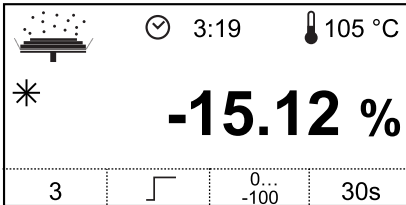
Close the heating module and the instrument then automatically begins the drying and measuring process.



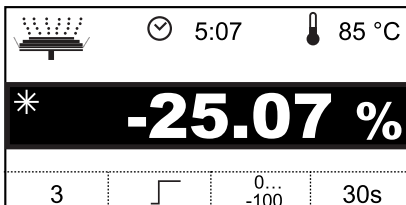
Status: Drying and measurement

You can follow the drying and measurement process in the display:

- The status display uses rising bubbles to symbolize the drying process.
- The current temperature in the heating module displayed as well as the elapsed drying time and the current drying value.
- Further, the display shows information on the selected settings. You will find additional information on the meaning of the displays and the various setting possibilities in Section 4. If there is an external printer connected to your instrument, the measurement results will be printed out continually (at intervals of 30 seconds).

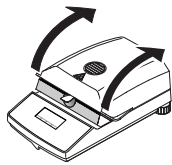


When drying is complete, an audio signal sounds.

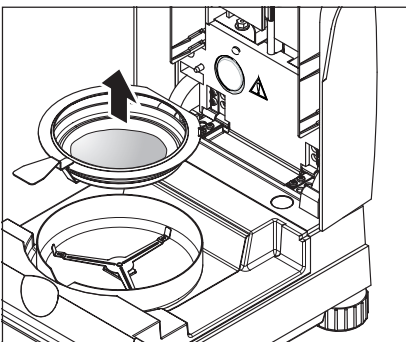


You can now read off the **moisture content** of your sample in the display.

The star symbol to the left of the measurement result indicates that the result is a calculated result.



Open the heating module. The measurement result is now deleted from the display. Likewise, you can reset the result by pressing the keys «Tare (zero)» or «Reset».



Carefully remove the sample pan handler from the sample chamber.



Warning: As the pan and sample may still be hot, you should let these cool down before removing the pan from the handler!

To remove the sample pan from the handler, lift the pan slightly from below and pull it sideways out of the handler (if you no longer need the sample and the pan, you can simply tilt the handler until the pan slides out).



Press the «Reset» key to delete the measurement result from the display. The instrument is now ready for the next measurement.

Congratulations!

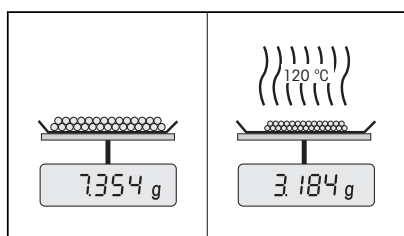
You have just performed your first measurement with your new Moisture Analyzer. In the following Section you will find important information on the operating principle of your instrument, its adjustment and optimum preparation of your samples.

3 How to obtain the best results

Following your first practical work with the Moisture Analyzer, in this Section you will find important information on how to obtain optimum results. You will discover what parameters influence the measurement process and how you can match the instrument optimally to your particular measurement task.

3.1 Measurement principle of the Halogen Moisture Analyzer

Your instrument performs measurements based on the **thermogravimetric principle**, i.e. the moisture is determined from the weight loss of a sample dried by heating.



In principle, your instrument thus comprises two instruments: a precision balance and a heating module. In contrast to other thermogravimetric methods (drying oven, infrared, microwave), the Halogen Moisture Analyzer operates with a halogen heating module. This ensures fast heating of the sample and thus guarantees rapid availability of the measurement results.

Irrespective of the measurement method, the quality of the measurement results stands or falls by the **preparation of the sample** and **a correct choice of the important measurement parameters**:

- Sample size
- Drying temperature
- Switchoff mode
- Drying time



Inappropriate setting of these parameters can cause the results to be incorrect or misleading. For this reason, check that the results for each type of sample are what might reasonably be expected.

You will find detailed information on the relationships between these parameters in the application brochure for moisture determination (see Section 8.3), enclosed to your instrument.

In practice, however, not only the quality of the measurement results, but also the **speed of the measurement process** is important. Thanks to its drying principle (with the heat generated by a halogen radiator), the Halogen Moisture Analyzer is very fast. You can increase the speed even further through optimum setting of the instrument.

The **optimum drying temperature and the drying time** are dependent on the nature and size of the sample and on the desired accuracy of the measurement results. These can be determined only by experiment.

3.2 Notes on adjustment of the balance and the heating module

To obtain optimal results, when you install the Moisture Analyzer at the place where it will be used, you should use the METTLER TOLEDO adjustment set to adjust the heating module under the prevailing operating conditions (e.g. in a fume cupboard). This ensures that any differences from the factory adjustment that may result from the specific local conditions are corrected.

If stipulated by your quality assurance system (e.g. GLP, GMP, ISO 9001), you should adjust your Moisture Analyzer regularly (e.g. every six months) at the place where it is used and under the prevailing operating conditions.

By adjusting the heating module you can ensure comparability with results from other instruments of the same design. This is done by using an appropriate thermometer, which is provided in the form of a temperature adjustment set with calibration certificate (see Section 8.7). This adjustment set comprises a black plate with a thermometer, which allows a reproducible adjustment of the heating module.

The balance and the integral heating module in your instrument can be adjusted using the appropriate accessories (Section 8.7).

A Moisture Analyzer is typically used in place of or in addition to the oven method. In an oven heat energy is transferred by the flow of air, which establishes an equilibrium between the sample temperature and the ambient temperature. This is not the case in a Moisture Analyzer. The actual sample temperature primarily depends on the specific absorption properties of the sample ("dark" samples absorb more heat), which can change during the measurement process. There can also be differences between the temperature at the surface of the sample and the temperature inside the sample. The heat output is therefore not dependent on the true sample temperature but instead is regulated by a temperature sensor underneath the halogen heating module.

For the reasons explained above, the temperature setting on the instrument will therefore deviate to the true sample temperature. By regularly adjusting the heating module, you will ensure a consistent and reproducible heat output for the entire lifetime of your instrument.

Note: METTLER TOLEDO offers an adjustment service – please contact your local dealer.

- If you also use your instrument as a high precision lab balance, you should adjust the balance at regular intervals.
- If you replace the heating module, you must adjust it using the temperature adjustment set, which is available as an accessory.

The procedure for adjusting the balance and heating module is described in Section 5.

3.3 Optimum sample preparation

Preparation of the sample is decisive for the speed of the measurement process and the quality of the measurement results.

Please note the following **basic rules** for the preparation of your sample:

The amount of sample you select should be as small as possible and only as large as necessary

Excessive amounts of sample require more time for drying and thus prolong the measurement process. If the amount of sample is too small, the measurement result may possibly not be representative. The following always holds: The greater the inhomogeneity of the sample, the larger the amount of sample needed to obtain a repeatable result (please see also the list in Section 8.1). Experience has shown a practical sample quantity go to be 3-5 g.

Distribute the sample evenly over the sample pan

You thus increase the surface area of the sample and facilitate heat absorption. The base of the pan should be evenly covered.

With liquid, fat-containing, melting and highly reflecting samples, you should cover the sample with the glass fiber filter available as optional equipment (HA-F1 214464, see Section 8.7). This also applies to samples which form a skin on their surface when heated. The glass fiber filter ensures even and rapid heat distribution and prevents the formation of a skin impervious to moisture on the sample surface.

3.4 Further information on moisture determination

You will find further information on the moisture determination, the importance of the parameters and the preparation of the samples in the **Application Brochure** "Methods of moisture content determination" dealing with moisture determination (see Section 8.3).

Useful tips and a variety of example methods (comparison between Halogen Moisture Analyzer results and the oven method) can be downloaded from www.mt.com/moisture.

If you require information on specific applications, your METTLER TOLEDO dealer will be pleased to help you.



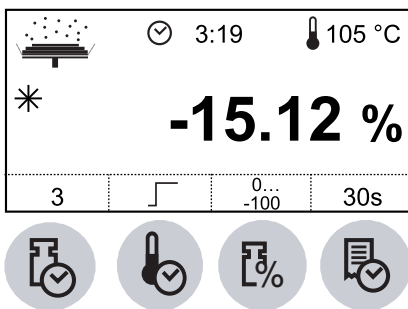
Moisture determination applications must be optimized and validated by the user according to local regulations. Application-specific data provided by METTLER TOLEDO is intended for guidance only.

4 Practical application of your Moisture Analyzer

In this Section we introduce you to the wide range of setting possibilities of your Moisture Analyzer and offer information and tips for optimum setting of the parameters.

4.1 The operating concept

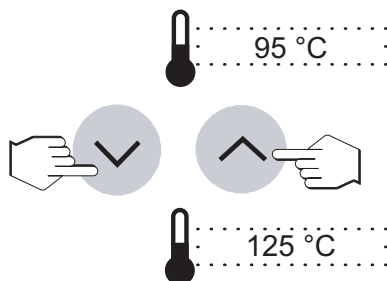
You already performed your first measurement in Section 2. This measurement was carried out using the factory settings. However, your instrument offers a number of setting possibilities to match the measurement process to your specific requirements. For instance, you can preselect the drying temperature, the type of result display and many other parameters.



Settings are made using the function keys. These keys are on the keyboard, directly below the display. The setting you select appears in the display directly above the associated key.

You will learn the available setting possibilities and the function keys in detail in the following Sections. You will also be given an explanation how to adjust the drying temperature and drying time. Finally, you will perform a complete measurement with the specific settings for your sample.

Numeric entries



With some settings (e.g. the drying temperature), **numeric entries** are required.

You can change the flashing displayed value with the «Scroll up» or «Scroll down» key.



As soon as you have entered the desired value, press the «Accept entry» key. The value will be stored.



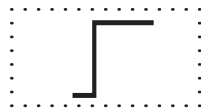
If you do not wish to save the change, you can escape from the change by pressing the «Reset» key. The old setting then becomes active again.

4.2 Selecting the drying program

This function key offers you two different drying programs for optimum matching of the drying characteristics to the sample used.

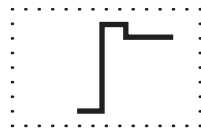


By pressing this key you can choose between the two programs. As soon as you have selected the desired program, the setting is active and you do not have to confirm or store it.



Standard drying

This **drying program** is set in the factory and is suitable for most samples. The sample is heated to the drying temperature (set temperature) and held constant at this temperature.

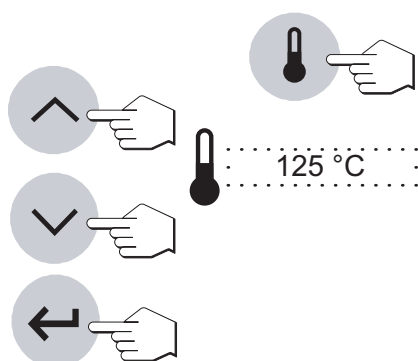


Rapid drying

This program is primarily suitable for **samples with a moisture content over 30%**. Following the start, the selected temperature is **exceeded** by 40% for 3 minutes to compensate the cooling due to vaporization and accelerate the drying process. The drying temperature is then lowered to the set value and maintained.

You will find details on how to enter the drying temperature in the next Section.

4.3 Setting the drying temperature



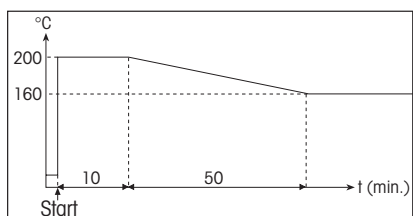
Press the «Drying temperature» key and enter the desired drying temperature, «Scroll up» or «Scroll down» key.

Press the «Accept entry» key.

Note: The admissible input range for temperatures is 50 °C – 200 °C, selectable in 5 °C steps.

Temperature limitation

Several mutually independent systems prevent the instrument overheating:



- At temperatures above 160 °C a time limit becomes active. The higher the temperature, the shorter the time until the instrument starts to lower the temperature (envelope curve, see illustration opposite).
- A temperature switch independent of the normal black temperature sensor over the sample is triggered when it detects exceptionally high temperatures. This situation could arise, for example, if the sample begins to burn or the heating module adjustment is defective. If this happens, the heating module is tripped out by a mechanical switch, and the instrument cannot be restarted. Reset the overload switch (see page 55).

When working with temperatures over 180 °C we recommend that you always wait 2 - 3 minutes with open instrument lid between individual measurements, in order to ensure good reproducibility of the readings and avoid overheating of the instrument.

4.4 Selecting the switch-off criterion

This function key offers you different switch-off criteria. A switch-off criterion defines when the instrument should end the drying. Switch-off criteria save you having to keep checking your watch and stopping the drying manually.



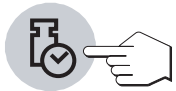
The following settings can be selected for the switch-off criterion:

- “Weight loss per unit of time ” (5 settings)
- “Free switch-off”
- “Manual switch-off”
- “Timed switch-off”

Weight loss per unit of time

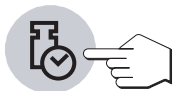
This switch-off criterion is based on a weight loss per unit of time. As soon as the mean weight loss is less than a preset value during a specified time, the instrument considers drying as complete and automatically discontinues the measurement process. During the drying, the time display shows you how long the measurement process has been in progress; the switch-off criterion is inactive during the first 30 sec. You will find additional information in Section 8.4.

The following 5 settings are available:



..... 1

This setting is suitable for samples which dry very quickly (surface moisture) or for (relatively inaccurate) fast measurements to determine a trend.



..... 2

This setting is suitable for quick drying samples.



..... 3

This is the **factory setting**. It is suitable for most types of samples.



..... 4

This setting is suitable for samples which dry moderately quickly.



..... 5

This setting is suitable for samples which dry very slowly (trapped moisture, skin formation).



..... F

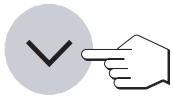
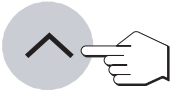
Free switch-off criterion

If none of the five available “Weight loss per unit of time” switch-off criteria is suitable for your application, the Moisture Analyzer allows you to define a free switch-off criterion (1 mg / 5 s to 1 mg / 180 s). The free switch-off criterion is also based on the principle of weight loss per unit of time. As soon as this drops below the preset value, the measurement is automatically ended.

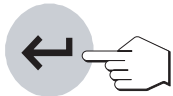


F 50 s

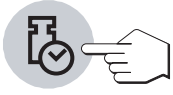
Select “F” and then press the «Drying time» key to change the switch-off criterion.



You can now change the time in 5 second increments using the «Scroll up» and «Scroll down» keys.



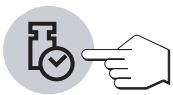
Press the «Accept entry» key.



..... M

Manual

With this switch-off criterion the measurement process continues until you stop it with the «Stop» key.



..... ⌚

Timed switch-off

With this switch-off criterion the measurement lasts until the preset drying time has elapsed (the time display provides you with continuous information on the drying time).



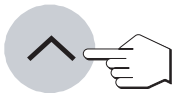
03:00

If you select this criterion, a clock and a time appear in the display. You must then enter the desired **drying time** as follows:

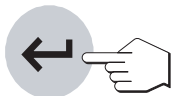


03:00

Press the «Drying time» key and the time display starts to flash. By using the «Scroll up» and «Scroll down» key you can select the drying time in one-minute steps.



Press the «Accept entry» key.



4.5 Selecting the display mode

With this function key you can select the desired type of result display. You also define what values are printed on the records.

The following display modes are available:

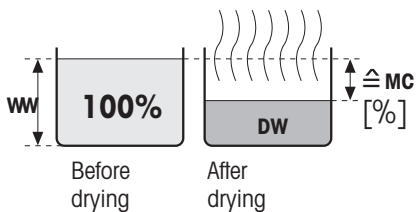
Moisture content



0...
-100

The moisture content of the sample is displayed (and printed out) as a percentage of the wet weight (= $ww = \text{initial weight} = 100\%$). This is the **factory setting**.

When the results are printed out, the moisture content is marked by "%MC" (**M**oisture **C**ontent) (e.g. -11.35 %MC) and shown as a negative value.



$$\text{MC [0...100\%]} = - \frac{\text{Wet weight } \mathbf{WW} - \text{Dry weight } \mathbf{DW}}{\text{Wet weight } \mathbf{WW}} * 100\%$$

During the drying the current measured value is continuously displayed in percent.

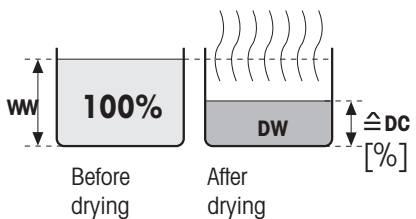
Dry content



100
...0

The dry content of the sample is displayed (and printed out) as a percentage of the wet weight (= $ww = \text{initial weight} = 100\%$).

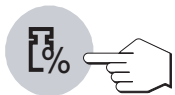
When the results are printed out, the dry content is marked by "%DC" (**D**ry **C**ontent) (e.g. 88.65 %DC).



$$\text{DC [100...0\%]} = \frac{\text{Dry weight } \mathbf{DW}}{\text{Wet weight } \mathbf{WW}} * 100\%$$

During the drying the current measured value is continuously displayed in percent.

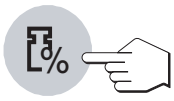
Weight in grams



g

The weight of the sample is displayed (and printed out) in grams. With this setting, the Moisture Analyzer is used as a precision balance.

During the drying the current weight is continuously displayed in grams.

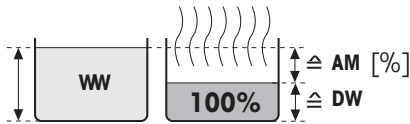


0...
-1000

ATRO moisture content

The moisture content of the sample is displayed (and printed out) as a percentage of the dry weight (= DW = final weight = 100%).

When the results are printed out, the ATRO moisture content is marked by “%AM” (ATRO Moisture Content) (e.g. -255.33 %AM) and shown as a negative value.



Before drying After drying

$$AM [0...-1000\%] = - \frac{\text{Wet weight } WW - \text{Dry weight } DW}{\text{Dry weight } WW} * 100\%$$

During the drying, the current measured value is continuously displayed in percent.

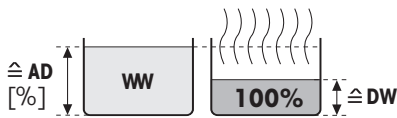


100...
1000

ATRO dry content (Wet weight)

The wet weight of the sample is displayed (and printed out) as a percentage of the dry weight (= DW = final weight = 100%).

When the results are printed out, the ATRO dry content is marked by “%AD” (ATRO Dry Content) (e.g. 312.56 %AD).

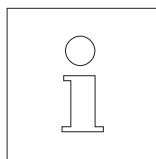


Before drying After drying

$$AD [100...1000\%] = \frac{\text{Wet weight } WW}{\text{Dry weight } DW} * 100\%$$

During the drying, the current measured value is continuously displayed in percent.

Comment on the ATRO display mode



If the current measured value in the ATRO display mode is greater or less than the predefined limit value (i.e. greater than 999.99 %AD or less than -999.99 %AM), a warning beep sounds and the instrument automatically switches the display mode (from %AM to %MC and from %AD to %DC). A display in the ATRO mode is no longer possible in this case, even if you have started your drying operation in the %MC, %DC or “g” (grams) display mode.

4.6 Defining the print interval

Note: This setting option is only available if an external printer is activated in the menu (see Section 5.9). If no printer is activated, the  symbol appears in the display.

The print interval determines the printout frequency of the intermediate results of an ongoing measurement.



The following settings are available under this function key:

Printout at intervals



.....30s.....

These 3 settings allow printout of the intermediate results at fixed, preset intervals. You can thus trace the drying process using the printed record. The following print intervals are available:

.....30s.....

– Printout **every 30 seconds**

.....1min.....

– Printout **every minute**

.....5min.....

– Printout **every 5 minutes**

Manual printout



.....M.....

With this setting there is no automatic printout. However, you can print out the intermediate results at any time with the «Print» key.

4.7 Performing a measurement

You are now familiar with all the parameters of your Moisture Analyzer and have defined all values for your sample. The instrument is now ready for the determination of your own samples. In this Section you will learn how to perform measurements, print out the measurement results and stop the measurement process.

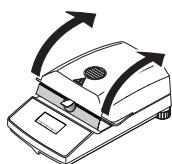


Switch the instrument on with «On/Off» key.



The status display (User Guide) symbolizes the initial status of the instrument when the heating module is closed.

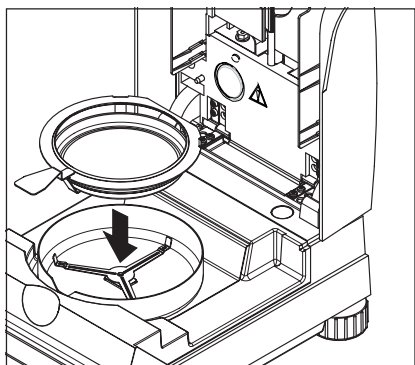
If you operate the instrument in "Auto" mode, you can perform the following process entirely without pressing a single key, thanks to the HB43's unique "SmartStart" function.



Open the heating module.

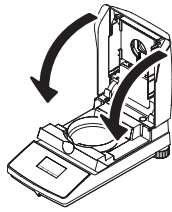


The status display (User Guide) now prompts you to load the empty sample pan.



Position the empty sample pan in the sample pan handler. Place the sample pan handler in the draft shield. Ensure that the tongue of the sample pan handler lies exactly in the slot of the draft shield. The pan must lie flat in the pan holder.

Note: We advise you to work with the sample pan handler at all times. The pan handler is ergonomic, safe and provides protection against burns due to the hot sample pan.



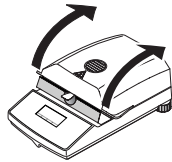
Close the heating module. The built-in balance is then automatically set to zero.



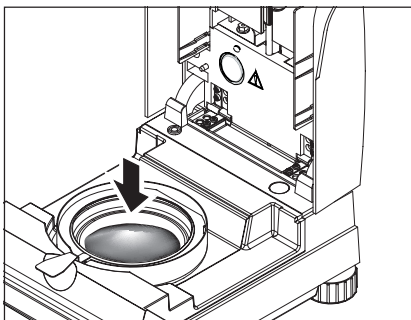
If you only operate the «Tare (zero)» key, you will be requested to close the heating module.



Following taring, the status display prompts you to add the sample to the sample pan.

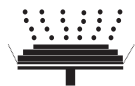


Open the heating module.

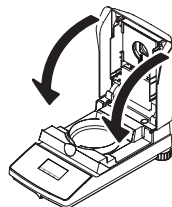


Add the sample to the sample pan. Please ensure that the sample is distributed evenly to obtain good analysis results.

The minimum allowable initial weight is 0.5 g. Experience has shown that good results are obtained with sample quantities between 3 and 5 g.



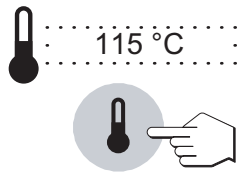
The status display now prompts you to start the drying process.



As soon as the sample has been put in, close the heating module and the instrument will automatically start the drying and measuring process.

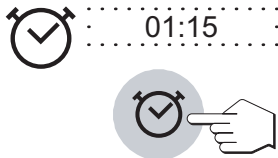


You can follow the measurement process in the display: The status display uses ascending bubbles to symbolize the drying process with the following values being continuously updated and displayed:



– **current temperature** in the heating module

Note: You can use the «Drying temperature» key to display the preselected drying temperature (current set temperature) for 2 seconds.



– **elapsed time** since the start of the measurement process

Note: If you have selected the switch-off criterion “Timed switch-off”, the elapsed drying time will be displayed. You can display the preselected drying time for 2 seconds with the «Drying time» key.

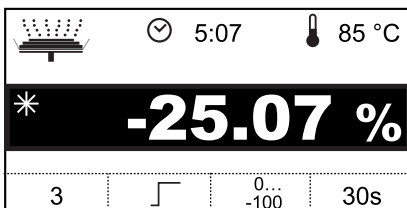
– **current result** in the preselected display mode.

You can select a different display mode with the function key at any time even during the measurement.



If you have connected an external printer to your instrument and activated it in the menu, the measurement value will be printed at the pre-selected intervals. You can use the «Print» key to output the intermediate result manually on the printer at any time. The units of the intermediate result are as defined in the preselected display mode and can therefore be changed during the drying process by pressing the «Display mode» function key. You will find an explanation of the measurement record in the next Section.

As soon as the preselected switch-off criterion is met (or the selected drying time has elapsed), an audio signal sounds.



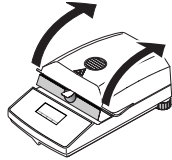
You can now read off the measurement result in the display. You will find information on the interpretation of the measurement results in Section 8.1. The result and time display remain at their final values, whereas the temperature continues to be updated.



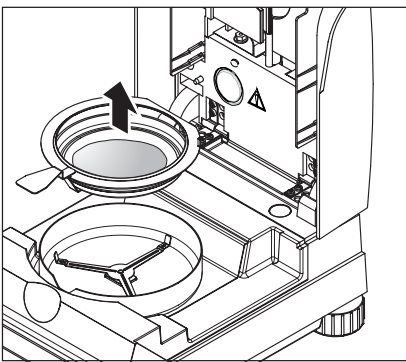
Warning: Pan and sample may still be hot! Allow them to cool before you remove the pan from the handler!



Note: You can also manually **stop** the measurement process **prematurely** at any time by pressing the «Stop» key. After a measuring time of at least 30 seconds, the result will be displayed from the time when the process is stopped. If you **stop** the measurement process sooner, or terminate it with the «Reset» key, the measurement result will not be displayed.



Open the heating module.



Carefully remove the sample pan handler from the sample chamber.



Press the «Reset» or «Tare (zero)» key to delete the final result and the time display.



If you do not wish to perform another measurement, switch the instrument off with the «On/Off» key and close the drying unit.

4.8 Information on the measurement record

If your instrument is connected to an external printer, and if the printer has been activated in the menu, the intermediate values will be printed out at the preselected intervals and the final result recorded on completion of the measurement.

The layout of the measurement record

The illustrations on the next page show a number of examples of measurement records. If you have not worked with the factory settings (e.g. for the print interval, display mode, etc.), your record may differ slightly from that shown.

```

A  -MOISTURE DETERMINATION-
B  METTLER TOLEDO
   Halogen MoistureAnalyzer
C  Type                      HB43
D  SNR                       1101234567
E  SW                         2.00
F  Switchoff mode            2
G  Standard drying
H  Drying temp.              185 °C
I  Disp.mode                 0...-100 %MC
J  Wet weight                1.276 g
K  0:30 min                  -9.17 %MC
   1:00 min                  -13.58 %MC
   1:30 min                  -20.45 %MC
   2:00 min                  -21.04 %MC
L  Total time                 2.18 min
M  Dry weight                 1.004 g
N  End result                 -21.32 %MC
O  Sample ID: .....
P  Comments: .....
Q  Signature: .....
S  ---31.07.2003---07:26---
```

The record contains the following data (from top to bottom):

- A** Record title
- B** Manufacturer and Designation of the instrument
- C** Type of the instrument
- D** Serial number of the instrument
- E** Version number of the software
- F** Selected switch-off criterion (or set drying time)
- G** Selected drying program
- H** Drying temperature (set temperature)
- I** Selected display mode
- J** Sample weight at start of drying
- K** Measured value at each print interval (the number of recorded measured values depends on the selected print interval and the measurement time)
- L** Total time of drying
- M** Indication dry weight
- N** Final result in the selected display mode
- O** Line for entry of the sample ID
- P** Line for entry for comments
- Q** Line for signature of the person who performed the Moisture determination
- R** Indication of manual operating mode
- S** Date and time at the end of the measurement

Note: You will find information on the dimensions of the results (%MC, %DC, %AM and %AD) in Section 4.5.

```

0:02 min          close
0:30 min          102.40 %AD
0:31 min          open
1:00 min          107.53 %AD
1:06 min          close

Total time        1.21 min
Dry weight        2.598 g
End result        109.55 %AD

Sample ID: .....
Comments: .....
Signature: .....
R  >>>>>>>  MANUAL  <<<<<<<<
   ---31.07.2003---07:29---
```

Special events are recorded in the measurement record as follows:

In **manual mode**, the **heating module** was opened while drying was in process. While the heating module is open the drying process is interrupted, and then continued after it has been closed again.

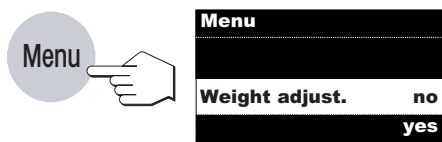
5 The menu (basic settings of the instrument)

In this Section you will learn how to use the menu to define the s your instrument uses for operation. You will also learn how to adjusting the built-in balance and the heating module.

5.1 Menu operation

The menu is a list of selection possibilities which you can use to preselect the **basic setting** of your instrument. The menu comprises various options (you will find an overview diagram of all menu options in Section 5.14). In addition to the **settings** (which are numbered for clarity), certain **functions** (e.g. balance adjustment and heating module adjustment) can also be performed. All menu settings are retained even in the event of a power failure.

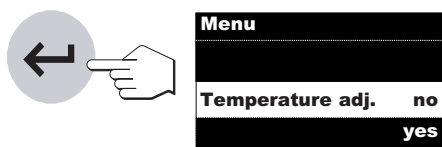
Using the menu is simple:



Press the «Menu» key to call up the menu. You are now directly in the first menu item (adjustment of the balance). As long as you are working in the menu, the word “Menu” is lit up in the display.



You can use the «Scroll up» and «Scroll down» keys to switch between the selection possibilities within the current menu items and hence select the desired setting or execute the particular function.



When you have set your desired option in a menu item, press the «Accept entry» key to store the setting and call up the next menu item.

Note: After a balance or heating module adjustment has been performed, the instrument automatically quits the menu and returns to the standby mode.



You can leave the menu by pressing the «Reset» key. If you do this, a menu item which is currently being changed will not be saved. However, all menu items which have been confirmed with «Accept entry» are saved.



```

--- LIST OF SETTINGS ---
METTLER TOLEDO
Halogen MoistureAnalyzer
Type           HB43
SNR            1101234567
SW             2.00
-----
System parameters
Startmode      Manual
Key protection  On
Printout       On
Baudrate       2400
Bit / Parity   7b-even
Handshake      Off
Contrast       50
Brightness     90
-----
---31.07.2002---11:13---

```

If you have connected an external printer to your instrument, you can record all menu settings. To do this simply press the «Menu» key followed by the «Print» key.

The following Sections will acquaint you with the individual menu items. The order corresponds exactly to that in the menu.

5.2 Adjusting the balance

In this menu item you can adjust the balance of your instrument. Consult Section 3.2 to learn when an adjustment is necessary. Before selecting the adjustment function, ensure that the sample pan is in position. Following a drying, you should wait at least 30 minutes before undertaking an adjustment.

Menu	
Weight adjust.	no
last #157	yes

The factory setting in this menu item is "no" (no balance adjustment).

Note: The number in the lower left corner of the display shows the number of adjustments carried out to date.



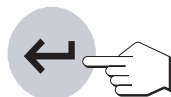
If you press the «Print» key in this status and an external printer is connected, the information from the last adjustment made will be printed out.



If you wish to adjust the integral balance, select "yes" (using the «Scroll down» key).



Press the «Accept entry» key to start the adjustment process.



Weight adjust.	#158
0.000 g	
Please remove weight	

Now follow the instructions on the display. If a weight has been placed on the weighing pan, you will be prompted to remove it. There should still be an empty sample pan on the pan carrier. The balance now takes the zero point and asks for the adjustment weight.

```

Weight adjust.      #158
                    20.000 g
Please put weight on pan

```

Place the requested adjustment weight in the middle of the sample pan. The weight is automatically recorded.

Note: An adjustment weight of 20 grams is used for adjustment. The adjustment weight is available as optional equipment (see Section 8.6).

```

Weight adjust.      #158
                    0.000 g
Please remove weight

```

The instrument stores the determined weight value and the display prompts you to lift off the adjustment weight.

```

Weight adjust.      #158
                    done
Weight adjustment done

```

Remove the adjustment weight.

This concludes the adjustment of the balance and the instrument automatically quits the menu and returns to the standby mode. The Moisture Analyzer is now ready for further measurements.

```

A  -- BALANCE ADJUSTMENT --
B  31.07.2003      09:54

C  METTLER TOLEDO
   Halogen MoistureAnalyzer
D  Type           HB43
E  SNR            1101234567
F  SW             2.00

G  Adjustment number  158

H  Weight ID: .....
I  Weight:         20.000 g

J  External adj. done

K  Signature
   .....
   ----- END -----

```

If you have connected a printer to your instrument and this is activated (see Section 5.9), on completion of the balance adjustment an adjustment record will be automatically printed out with the following data:

A Record title

B Date and Time of the balance adjustment

C Manufacturer and Designation of the instrument

D Type of the instrument

E Serial number of the instrument

F Version number of the software

G Sequence number of the balance adjustment

H Line for entry of the number of the adjustment weight used

I Adjustment weight used

J Confirmation that the balance adjustment has been performed correctly

K Field for signature of the person who performed the balance adjustment

Please enter the number of the adjustment weight used, sign the record and store it in a safe place. This assures traceability, one of the basic requirements of every quality assurance system.

5.3 Adjusting the heating module

In this menu item you can adjust the temperature control of the heating module. Consult Section 3.2 to learn when an adjustment of the heating module is necessary. We advise you to wait 30 minutes after a drying before performing the adjustment.

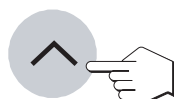


The factory setting in this menu item is “no” (no heating module adjustment).

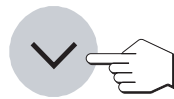
Note: The number in the lower left corner of the display shows the number of adjustments carried out to date.



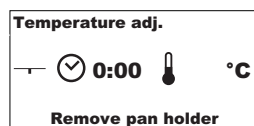
If you operate the «Print» key in this status and an external printer is connected, the information from the last adjustment carried out will be printed out.



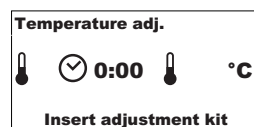
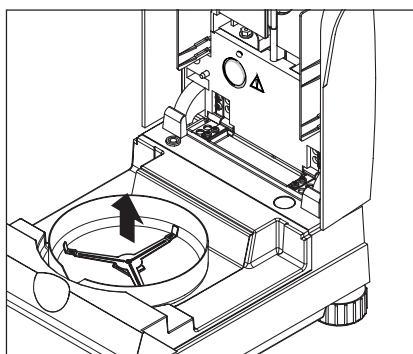
If you wish to adjust the heating module, select “yes” (using the «Scroll up» or «Scroll down» key).

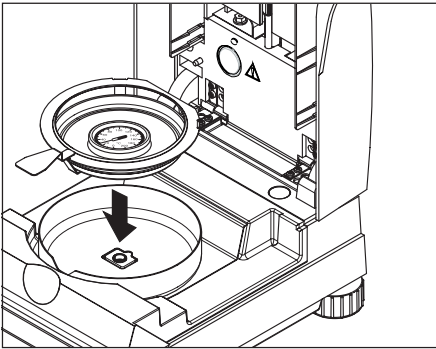


Press the «Accept entry» key to start the adjustment process.



You will be prompted to remove the pan holder from the sample chamber.

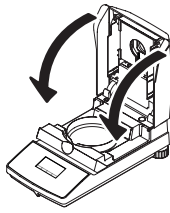




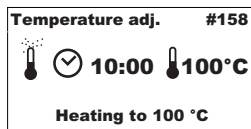
Insert the temperature adjustment set in the sample pan handler.

Place the sample pan handler in the sample chamber.

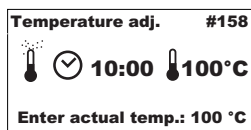
Note: The temperature adjustment set is available as optional equipment (see Section 8.6).



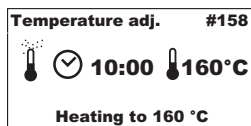
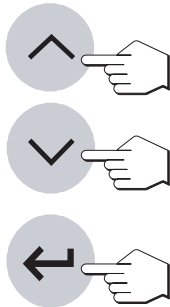
Close the heating module to start the adjustment process, and the heating module adjustment will begin.



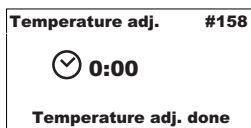
The heating module is heated to a temperature of 100 °C . You can follow this process in the temperature display. The instrument now waits 15 minutes until the temperature adjustment set shows the correct temperature, an audio signal then sounds.



Read the temperature adjustment set through the inspection window of the heating module and enter this temperature using the «Scroll up» and «Scroll down» keys (please note: 1 graduation mark = 2 °C) . After entering the value, press the «Accept entry» key. The temperature must be entered within 10 minutes of the audio signal sounding, otherwise the adjustment process will be terminated and an error message outputted.



As this adjustment is a two-point adjustment (adjustment of the temperature is defined by two points, namely 100 °C and 160 °C) , the heating module now heats to the second temperature (160 °C) . Proceed exactly as you did for the first temperature. After you have confirmed your entry with the «Accept entry» key, the adjustment is at an end.



When the adjustment is complete, you can open the heating module and remove the sample pan support and temperature adjustment set.

Warning: As the temperature adjustment set can still be hot, allow them to cool down before you remove them from the handler.

On completion of the heating module adjustment, the instrument automatically quits the menu and returns to the standby mode. It is now ready for further measurements.

If you have connected an external printer to your instrument and activated it, (see Section 5.9), on completion of the heating module adjustment an adjustment record will be automatically printed out with the following data:

```

A - DRYER UNIT ADJUSTM. -
B 31.07.2003          09:59

C METTLER TOLEDO
  Halogen MoistureAnalyzer
D Type                HB43
E SNR                 1101234567
F SW                  2.00

G Adjustment number  158

H Temp Reference ID:.....
I Temperature 100°C:102°C
J Temperature 160°C:159°C

K Heating module adj. done

L Signature

.....
----- END -----
    
```

- A** Record title
- B** Date and Time of the heating module adjustment
- C** Manufacturer and Designation of the instrument
- D** Type of the instrument
- E** Serial number of the instrument
- F** Version number of the software
- G** Sequence number of the heating module adjustment
- H** Line for entry of the number of the temperature adjustment set used (Serial-Number of temperature adjustment set is printed on dial)
- I** Target and actual temperature for the first adjustment point
- J** Target and actual temperature for the second adjustment point
- K** Confirmation of the adjustment
- L** Field for signature of the person who performed the heating module adjustment

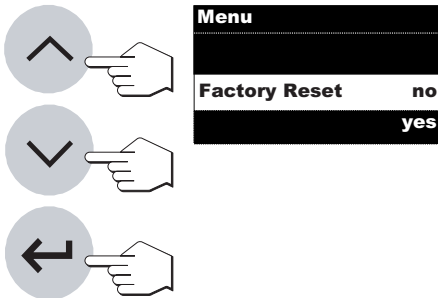
Enter the number of the adjustment disk, sign the record and store it in a safe place. This assures traceability, one of the basic requirements of every quality assurance system.

5.4 Resetting to the factory settings

In this menu item you have the possibility to reset the basic settings of the instrument to the factory setting.



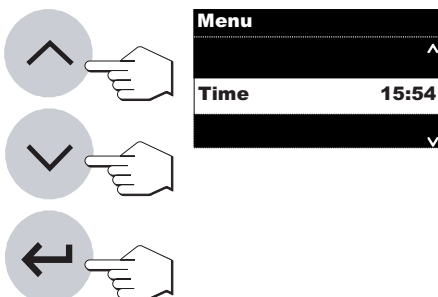
Warning! With the exception of the time, date and dialog language, all individual settings you have made in the menu will be lost and replaced by the factory settings!



The factory setting in this menu item is "no". If you really wish to delete your individual menu settings, select "yes" and confirm this with the «Accept entry» key.

5.5 Setting the time

Your Moisture Analyzer is fitted with a built-in clock. If you have connected a printer to the RS232C interface, the time and date you have set are printed out on each report. When you put your new instrument into operation for the first time, you should enter the current date and the time, these settings are retained even if you disconnect your instrument from the power supply. In this menu item you enter the current time. This is necessary when putting your instrument into operation for the first time and for possible corrections (e.g. changeover from summer to winter time).

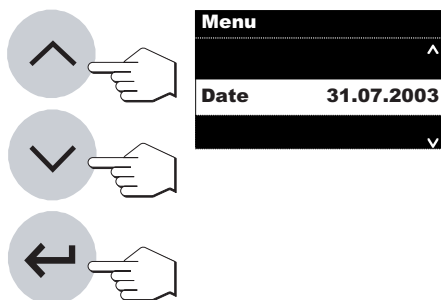


Set the time with the «Scroll up» and «Scroll down» keys (Range 00:00–23:59).

Confirm your setting with the «Accept entry» key and the instrument stores the time.

5.6 Entering the date

In this menu item you enter the current date. This is only necessary the first time you put your instrument into operation or if it needs to be corrected.



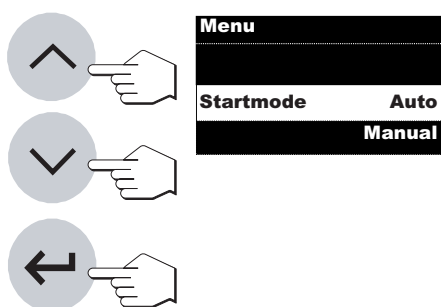
Set the date with the «Scroll up» and «Scroll down» keys in the format “Day – Month – Year” (DD.MM.YYYY). Confirm your entry with the «Accept entry» key and your instrument stores the date.

Note: If US English is used as the dialog language, the entry has the format “Month – Day – Year” (MM/DD/YYYY).

5.7 Selecting the start mode for drying

With this menu item you select whether **drying** should be started **automatically or manually**. At the factory your instrument is already set to automatic drying. In automatic start mode the instrument determines the initial (wet) weight and begins drying when the heating module is closed. This “SmartStart” function enables you to perform the entire drying process without pressing a single key.

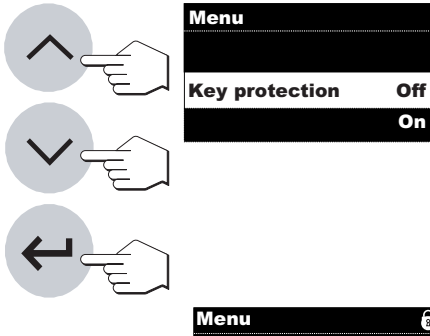
In manual start mode drying does not start automatically when the heating module is closed. When the «Start» key is pressed the initial (wet) weight, which is important for determining the moisture content, is recorded. This can be done with the heating module open or closed. Drying only begins when the heating module is subsequently closed. We recommend manual start mode for samples which contain highly volatile substances. In manual start mode you have time for further preparation of the sample (e.g. mixing the sample with silica sand, or distributing it evenly) because weight lost by evaporation during the preparation time is already recorded. In manual start mode you can even open the heating module while drying is taking place. If this is done, the drying process is not terminated (as it is in automatic mode) but only interrupted until the heating module is closed again.



The factory setting in this menu item is “Auto” (automatic operating mode). If you wish to switch to the manual operating mode, select “Manual” and confirm this with the «Accept entry» key.

5.8 How to activate the key protection

In this menu item you can protect the working parameters (e.g. switch-off criterion, drying temperature, etc.) and all menu items (except key protection) against being changed unintentionally.



The instrument is set in the factory to allow the parameters to be changed ("Key protection Off").

If you wish to protect the settings against change, selection "Key protection On" and confirm this with the «Accept entry» key.

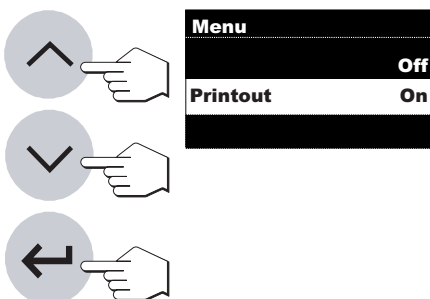
The display shows the padlock symbol and the following settings can then no longer be changed:

- Switch-off criterion
- Drying program
- Display mode
- Print interval
- Drying temperature
- Drying time
- Menu (except key protection)

If you press one of the locked keys, an audio signal and an error message (see Section 7.1) draw your attention to the nonavailability of the corresponding function.

5.9 Switching the printer on or off

With this menu item you can switch the external printer on or off.



In the factory this item is switched on ("On").

If you wish to switch the printer off, select "Off" and confirm this with the «Accept entry» key.

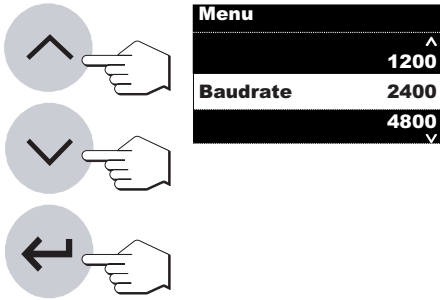
This activates the «Printout off» symbol (🔒) in the lower right corner of the display.

This setting must be selected if you want to connect the HB43 to a computer via a serial interface.

This prevents the HB43 from sending characters to the computer in an uncontrolled manner. It permits data exchange to take place without interference using the MT-SICS interface commands.

5.10 Setting the baud rate (data transmission speed)

The data transmission speed (baud rate) determines speed of transmission across the serial interface. The unit is the baud (1 baud (bd) = 1 bit/second).



The following settings are available:

600 bd, 1200 bd, 2400 bd, 4800 bd, 9600 bd, 19200 bd

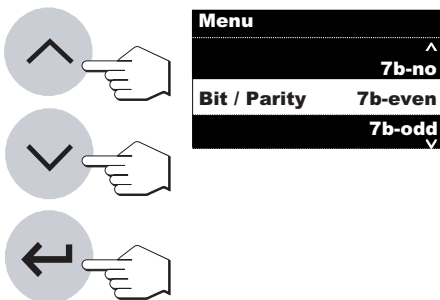
You can use the «Scroll up» and «Scroll down» keys to change the settings.

Confirm your setting with the «Accept entry» key and the instrument will store the baud rate.

The baud rate is set to 2400 bd at the factory.

5.11 Setting bit / parity

With this menu item you can set the character format for transmission across the serial interface.



The following settings are available:

7b-no, 7b-even, 7b-odd, 8b-no

You can use the «Scroll up» and «Scroll down» keys to change the setting.

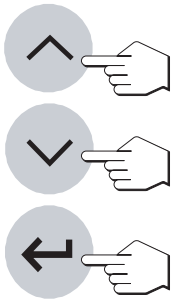
Confirm your setting with the «Accept entry» key and the instrument will store the bit / parity setting.

Bit / Parity is set to 7b-even at the factory.

If in the menu you have selected a language other than English, some symbols may not be displayed correctly if the instrument is set to the factory settings. In this case, change the bit / parity setting of your printer and HB43 to 8b-no.

5.12 Setting the handshake

With this menu item you can set the character format for transmission across the serial interface.



The following settings are available:
Off, Software (Xon/Xoff), Hardware (RTS/CTS)

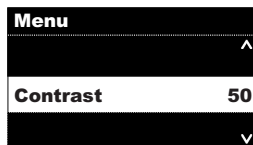
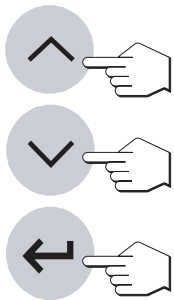
You can use the «Scroll up» and «Scroll down» keys to change the setting.

Confirm your setting with the «Accept entry» key and the instrument will store the handshake setting.

The factory setting is Off (no handshake).

5.13 Setting the contrast and brightness

You can use these 2 menu items to adjust the contrast and brightness of the display.

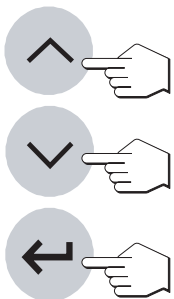


The **contrast** can be set in the range 0 - 100.

You can adjust the setting with the «Scroll up» and «Scroll down» keys.

Confirm your setting with the «Accept entry» key and the instrument will store the setting.

The factory setting is 50.



The **brightness** can be set in the range 0 - 100.

You can adjust the setting with the «Scroll up» and «Scroll down» keys.

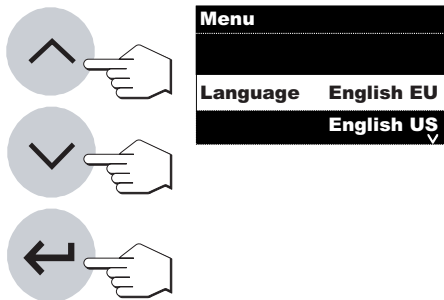
Confirm your setting with the «Accept entry» key and the instrument will store the setting.

The factory setting is 90.

5.14 Selecting the dialog language

In this menu item you specify the dialog language.

Select the desired dialog language and then confirm your entry with the «Accept entry» key.



The following languages are available:

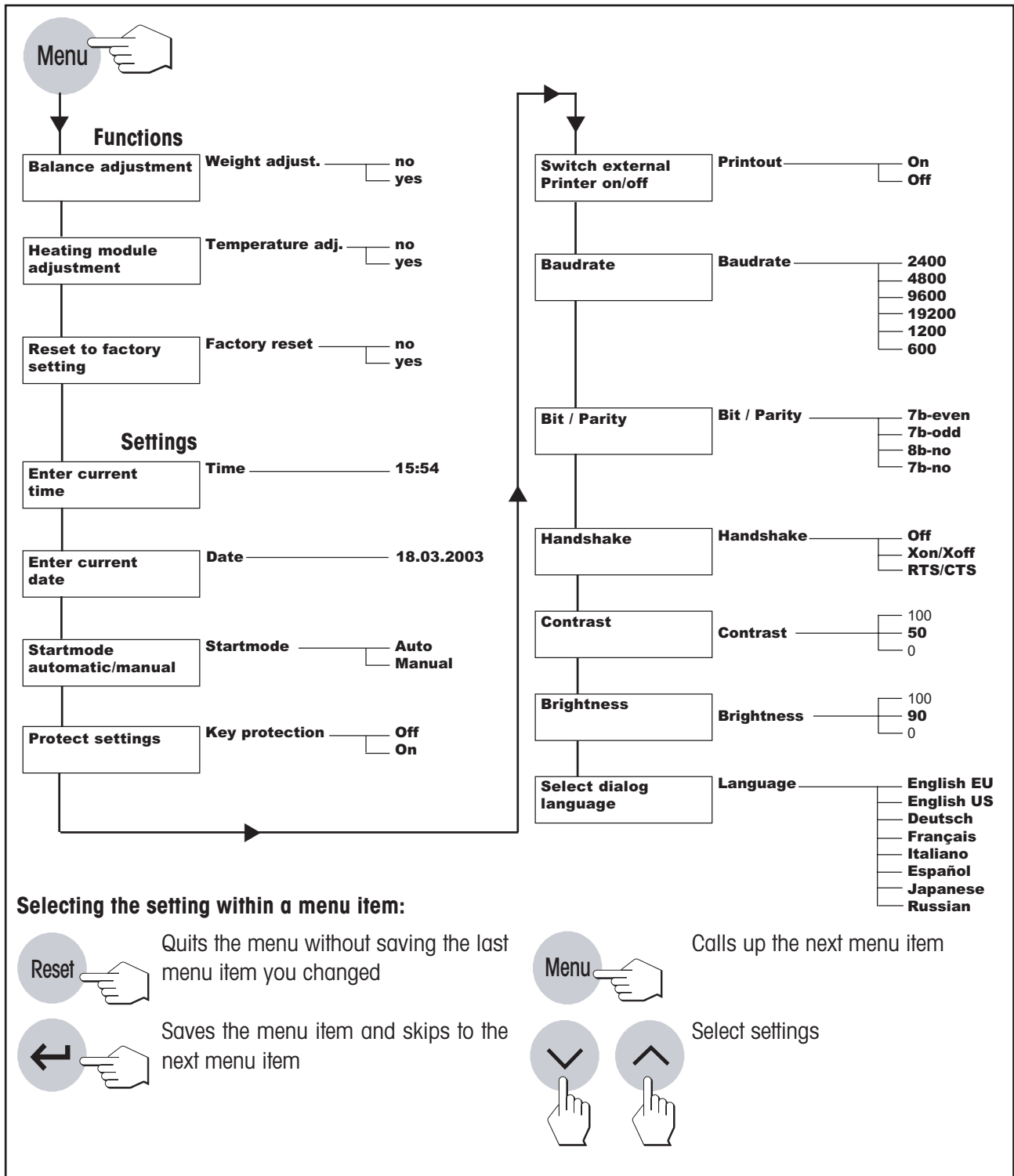
- English (“English EU”)
- English (“English US”)
- German (“Deutsch”)
- French (“Français”)
- Italian (“Italiano”)
- Spanish (“Español”)
- Japanese (“Japanese”)
- Russian (“Russian”)

You can use the «Scroll up» and «Scroll down» keys to change the setting.

Confirm your setting with the «Accept entry» key and the instrument will store the language setting.

Note: If you select American English (“English US”) as the dialog language, the date format is changed and appears on all records in the American notation (month/day/year).

5.15 Menu overview HB43

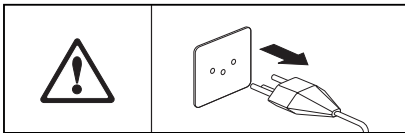


6 Servicing and replacing individual parts

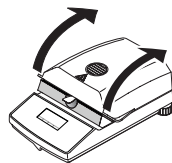
In this Section you will learn how to keep your Moisture Analyzer in good condition and how to replace expendable parts.

6.1 Cleaning the heating module and the sample chamber

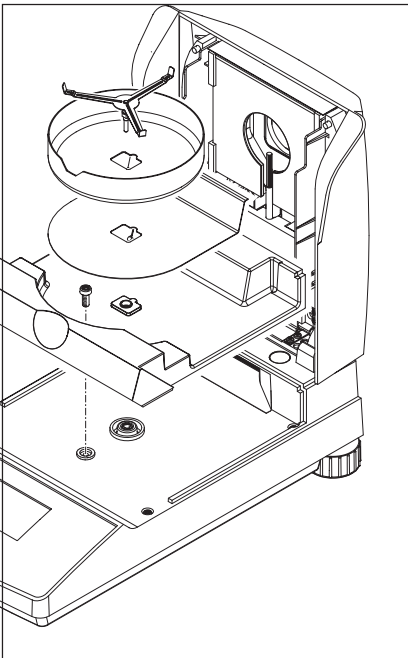
To obtain precise measurement results, we recommend you to clean the temperature sensor and the protective glass of the halogen lamp regularly. Please note the following directions for cleaning your instrument:



Disconnect the instrument from the power supply before cleaning.



Open the heating module.



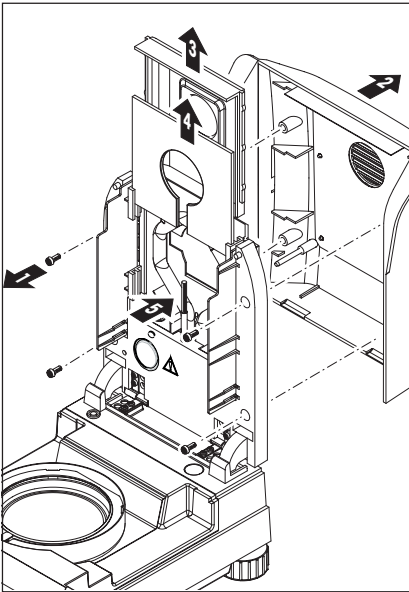
The draft shield, sample pan carrier and heat shield can be removed for cleaning without tools.

To dismantle the sample chamber you need a normal, commercially available screwdriver.

Use a lint-free cloth for cleaning.

Clean the exterior of the instrument with a mild cleaning agent. Although the housing is extremely rugged and resistant to solvents, never use abrasive cleaning agents or solvents!

Ensure that no liquid enters the interior of the instrument.



To dismantle the heating module the four screws (1) must be unscrewed. A normal, commercially-available screwdriver is needed for this purpose.

Following this, the cover (2) of the heating module can be pulled off toward the back.

The gold-plated reflector (3) and the protective glass of the halogen lamp (4) can be pulled upward and out of the guide rails of the heating module.

Clean the reflector and the protective glass of the halogen lamp with a mild cleaning agent.

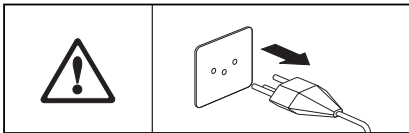
Remove any deposits from the black temperature sensor (5).

Avoid touching the round halogen lamp. If you have to remove any splashes, deposits, or spots of grease from the halogen lamp, it is advisable to use a weak organic solvent such as ethanol, for example. ethanol.

After the temperature sensor has been cleaned, we recommend you to adjust the heating module (see Section 5.3).

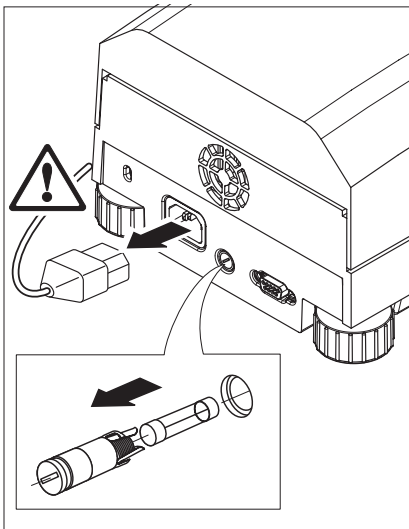
6.2 Replacing the power line fuse

If the display of your instrument remains "dark" after switching on, this is most probably because the instrument's power line fuse is defective.



To change the fuse, proceed as follows:

Disconnect the instrument from the power supply.



The power line fuse is located inside the back of the instrument. Using a screwdriver, turn the fuse holder to the left and pull it out of the instrument.

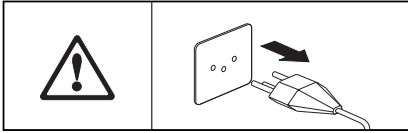
Check the condition of the fuse. Replace a faulty fuse with a fuse of the same type and with the same rated value (5 x 20 mm, T6. 3 H 250 V).



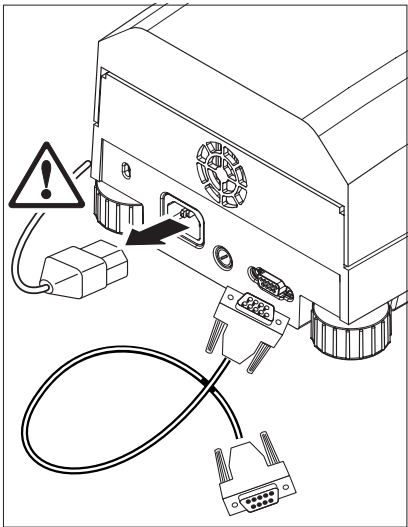
It is not allowed to use a fuse of a different type or rated value, or to short out (bridge) the fuse, because this can put your safety at risk and damage the instrument!

6.3 Connecting to an external printer

To prepare the printer for use, proceed as follows:



Disconnect the instrument from the power supply.



Connect the printer. The HB43 is fitted with a 9-pin (f) socket for this purpose. The RS-P42 and LC-P45 plain paper printers are provided with suitable connection cables.

Connect the instrument and the printer to the power supply.

If necessary, set the baud rates and bit / parity of the printer and the HB43 to the same value (see Sections 5.10 and 5.11).

If in the menu you have selected a language other than English, some symbols may not be displayed correctly if the instrument is set to the factory settings. In this case, change the bit / parity setting of your printer and HB43 to 8b-no.

7 If problems arise on occasion

In this Section you will learn how errors can appear during operation of your Moisture Analyzer and how you can rectify these errors.

7.1 Meaning of the error messages

Your instrument distinguishes between the three different types of errors explained below.



Input errors (key not active or can not be pressed in current operating status) are reported by your instrument with a short audio signal. In addition, a short explanation will be displayed, which automatically disappears after 2 seconds.



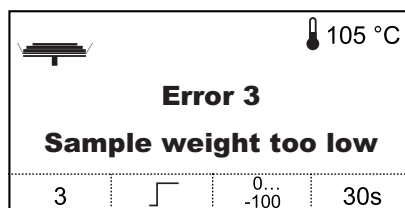
Display: Printer deactivated
Cause: Printer deactivated in menu
Remedy: Activate printer in menu



Display: Timer not activated
Cause: The selected switch-off criterion does not allow entry of a time
Remedy: Select "Timed switch-off" as switch-off criterion



Display: Key protected activ
Cause: Key protection turned on in menu
Remedy: Turn off key protection in menu

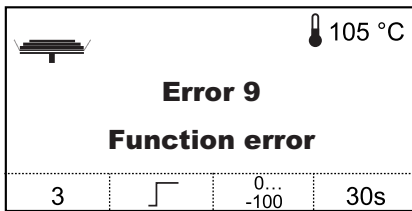


An **application error** occurs when the instrument can not perform a procedure or a corrective action is necessary as the limits of a value range have been violated or because a general operating error exists. Application errors are reported by your instrument with an audio signal. Further, the message "Error" appears in the display followed by the error number and error message text. You will find a list of all application errors in the next Section.

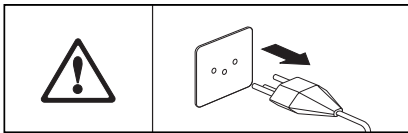


Before you can continue working, you must delete the error message with the «Reset» key. You can only delete error messages 1-8 and 10 with the «Reset» key.

Error 1 Weight unstable	Display: Error 1 Weight unstable Cause: No stability during taring or adjustment Remedy: Ensure stable ambient conditions and an optimum location. Also take care that no part of the sample or the sample pan touch the draft shield or the sample pan holder. Highly volatile substances in the sample also prevent a stable weighing result being detected
Error 2 Wrong adjustment weight	Display: Error 2 Wrong adjustment weight Cause: Either no weight, or the wrong weight, has been placed on the sample pan during adjustment Remedy: Load required adjustment weight
Error 3 Sample weight too low	Display: Error 3 Sample weight too low Cause: Sample weight below 0.5 g Remedy: Weigh in a sample of at least 0.5 g
Error 4 Missing tare weight	Display: Error 4 Missing tare weight Cause: Sample vessel has not been tared Remedy: Tare sample vessel
Error 8 Temp. entry missing	Display: Error 8 Temp. entry missing Cause: In the heating module adjustment, the wait time of 10 minutes for entry of the temperature value has been exceeded Remedy: Repeat heating module adjustment and enter temperature values before elapse of the wait time



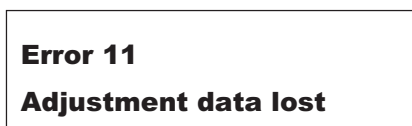
Function error indicate that a program or hardware error exists. The message "Function error" appears in the display together with the respective error number and a clear text explanation of the error in the second line. In such a case, disconnect the instrument from the power supply. Should the error reappear after reconnection to the power supply, contact your METTLER TOLEDO dealer to arrange an appointment for diagnosis and repair, Note the error number in order to facilitate the work of the service engineer.



Display: Error 9
Function error + number

Cause: Undefined condition

Remedy: Pull out the power supply plug and allow the instrument to cool for at least 5 minutes. If this error occurs repeatedly, please contact your METTLER TOLEDO dealer and inform him of the displayed number



Display: Error 11
Adjustment data lost

Cause: The heating module and balance adjustment data, and the method and menu settings, have been lost. Cause: Power interruption while being stored

Remedy: Do heating module and balance adjustment. Make settings

7.2 What if...?

... the display remains "dark" after switching on?

- no line voltage
- power cable not connected
- blown power line fuse
- instrument faulty

Ensure that the instrument is connected to the power supply and that power is actually supplied. Check the power line fuse of the instrument and replace if necessary (see Section 6.2). If the instrument still refuses to function, contact your METTLER TOLEDO dealer.

... after switching on "0.000" flashes in the display?

The sample pan holder is not installed. Install the sample pan holder.

... the symbol of the stability detector is continuously lit up immediately after the start?

As soon as the symbol of the stability detector fades, the weighing result is stable and is accepted as a "wet weight". If the symbol does not fade, your instrument is probably at an unsuitable location (vibrations, shocks, powerful drafts, etc.). Seek a more suitable location.

Samples containing readily volatile substances may never reach stability owing to continuous evaporation. In this case you must select manual operating mode for the drying unit (see Section 5.7).

... the printer that is connected does not print?

Ensure that the printer is activated in the menu (see Section 5.9) and that the ribbon and paper are correctly installed. Check the transmission rate, bit / parity and handshake.

... incorrect characters are printed?

Change the bit / parity setting of your printer and HB43 to 8b-no. Check to see if both instruments have the same baud rates.

... no drying time can be entered?

Entry of the drying time is possible only if you have selected the switch-off criterion "Timed switch-off", with all other switch-off criteria this input possibility is not available (see Section 4.4). If you attempt to enter a drying time, the instrument reports "Error 7" (see Section 7.1).

... certain keys are inactive?

You have protected the parameters (switch-off criterion, print interval, etc.) in the menu against change (see Section 5.8). If you attempt to change a parameter, the instrument reports "Error 10" (see Section 7.1).

... the measurement takes too long?

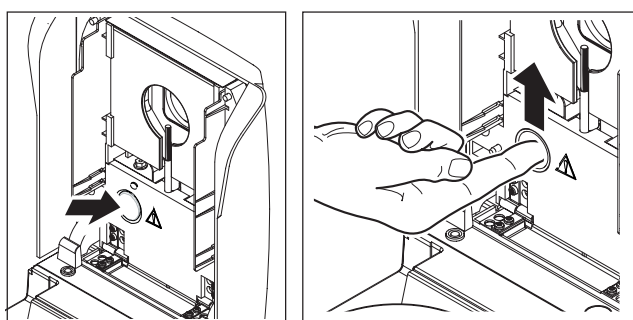
You have selected an unsuitable switch-off criterion.

An excessive amount of sample can also be the cause of slow drying, likewise samples which tend to form a skin which hinders vaporization.

Perform experiment at higher temperature.

... the instrument does not heat following the start?

The heating module is overheated and the thermal overload protection has responded. The instrument is equipped with thermal overload protection (bimetallic sensor) which switches off the heating tube if overheating occurs. This can be caused, for example, by a burning sensor.

**Reset the overload protector:**

1. Disconnect the instrument from the power supply.
2. Use a screwdriver to remove the cover.
3. Use a finger to reset the overload switch.
4. Replace the cover and reconnect the instrument to the power supply.

Note: If this is not possible, there may be a fault (e.g. a faulty halogen heating module). In such a case, contact your METTLER TOLEDO dealer.

After the temperature switch is reset or a heating module replaced (Section 6.1) we recommend that you readjust the heating module of your Halogen Moisture Analyzer (Section 5.3).

... the measurement results are not repeatable?

- The samples are not homogeneous, i.e. they have different compositions. The more inhomogeneous a sample, the larger the amount of sample needed to obtain a repeatable result.
- You have selected a drying time that is too short. Extend the drying time or select a suitable switch-off criterion "Weight loss per unit of time".
- The sample does not become completely dry (e.g. owing to skin formation). Dry the sample with the aid of glass fiber discs (see Section 3.3).
- You have selected a temperature that is too high and the sample has oxidized. Lower the drying temperature.
- The sample boils and the splashed drops continuously change the weight. Lower the drying temperature.
- Insufficient heating power because the protective glass of the halogen lamp is dirty. Clean the protective glass of the halogen lamp (see Section 6.1).
- The temperature sensor is contaminated or faulty. Clean the temperature sensor (see Section 6.1) or have it replaced by a service engineer.
- The support on which the instrument is standing is not sufficiently stable. Use a stable support.
- The surroundings are very unstable (vibrations etc.).

8 Further useful information

8.1 Notes on interpretation of the measurement results and the ideal sample weight

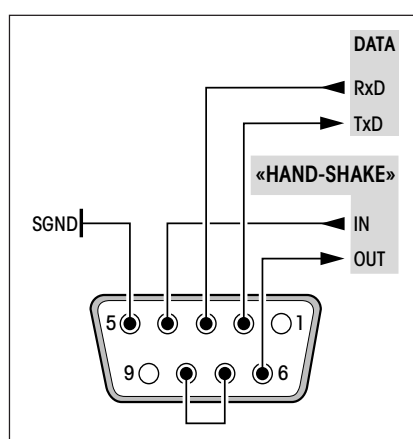
The accuracy of the measurement results depends on the wet weight and the original moisture of the sample. The relative accuracy of the measurement result improves with increasing wet weight. While the moisture of the sample is fixed, the weight of the sample can frequently be determined by the user. However, with increasing weight the drying process is lengthened. **We thus advise you to select the weight of your sample to obtain the repeatability you require.** You can use the following table to determine the ideal weight for your sample. The table does not include the scatter due to the sample and its preparation.

An example will suffice: A result with a repeatability of $\pm 0.1\%$ is expected. As the following table shows, your sample should have a minimum weight of 3 grams.

Repeatability of the result	Minimum sample weight
$\pm 0.03\%$	10 g
$\pm 0.1\%$	3 g
$\pm 0.3\%$	1 g

8.2 RS232C interface

So that your Moisture Analyzer can be connected to a peripheral device (e.g. printer or computer) it is fitted with an RS232C interface as standard.



9-pin socket

To adapt it to the other device the transmission parameters can be set in the menu (see Section 5.10).

The many ways in which the HB43 Moisture Analyzer can document results can only be fully utilized if a printer is connected, for example the METTLER TOLEDO LC-P45 or RS-P42. The printed results are a decisive contribution to simplifying working procedures in accordance with GLP/GMP.

For interface commands please refer to the "Reference Manual METTLER TOLEDO Standard Interface Command Set" 11780409, available from your METTLER TOLEDO dealer or download from the Internet (www.mt.com/moisture). More Information please find in the Section 8.6.

8.3 Application Brochure

The application brochure for moisture determination from METTLER TOLEDO (order number: 11795011) contains a great deal of useful information for optimum utilization of your Moisture Analyzer. To order your personal copy, please contact your METTLER TOLEDO dealer.

Example methods and applications can be found at www.mt.com/moisture.



Moisture determination applications must be optimized and validated by the user according to local regulations. Application-specific data provided by METTLER TOLEDO is intended for guidance only.

8.4 Switch-off criterion “Weight loss per unit of time”

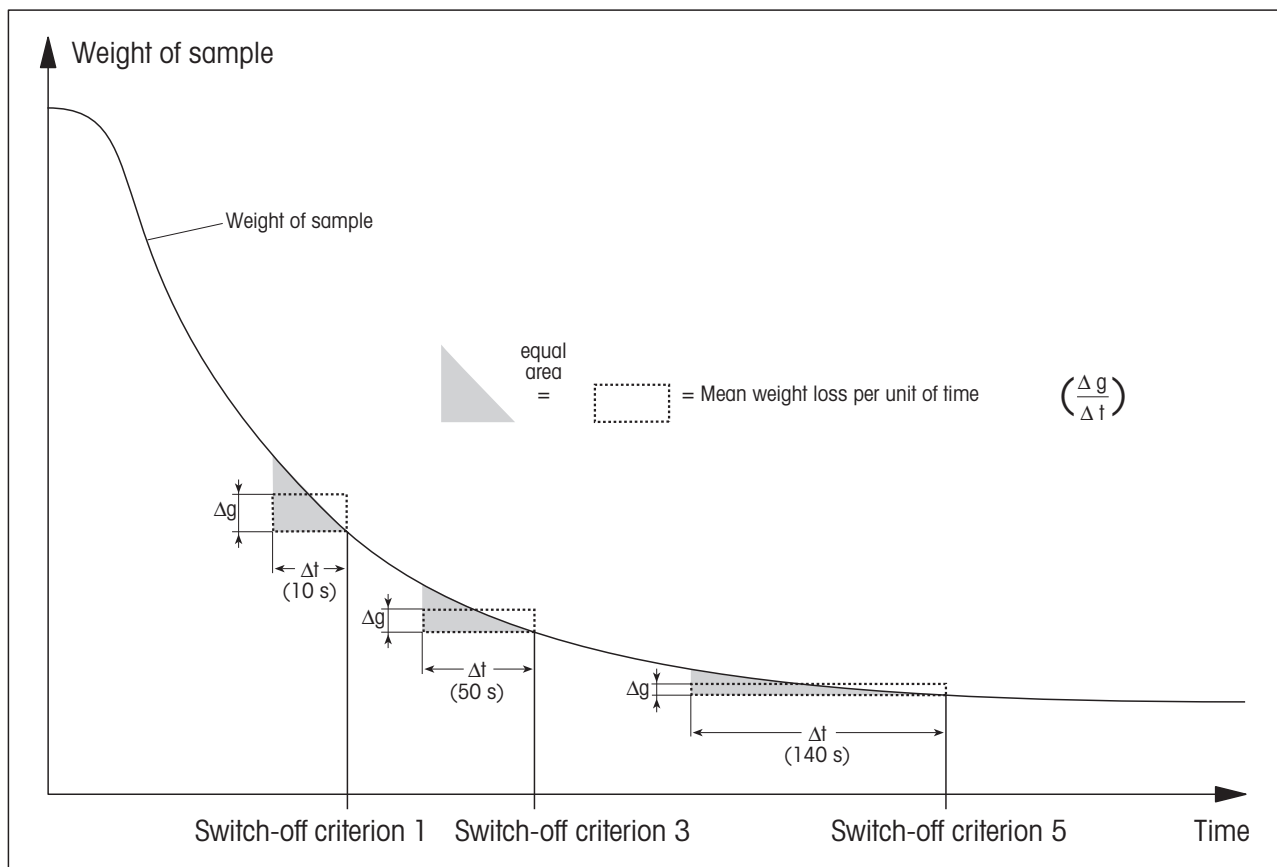
With the switch-off criterion “Weight loss per unit of time”, drying is automatically ended as soon as the **mean** weight loss (Δg in mg) per unit of time (Δt in seconds) drops below a preset value. 5 levels are preprogrammed in the factory each with a fixed weight loss per unit of time.

Further, a “Free switch-off criterion” allows you to define the weight loss per unit of time yourself.

The following applies to the individually selectable levels:

	Δg in mg	Δt in seconds
Switch-off criterion 1	1 mg	10 seconds
Switch-off criterion 2	1 mg	20 seconds
Switch-off criterion 3	1 mg	50 seconds
Switch-off criterion 4	1 mg	90 seconds
Switch-off criterion 5	1 mg	140 seconds
Switch-off criterion “F” (free)	1 mg	5 seconds to 180 seconds

The graph below exemplifies the mode of operation of the switch-off operation (not to scale).



Key:

Switch-off criterion 1 (rapid availability of the result, suitable for determination of a trend)

Switch-off criterion 3

Switch-off criterion 5 (suitable for precision measurement)

8.5 Technical data

Please note that the Moisture Analyzer will undergo continuous further development in the interest of the users. METTLER TOLEDO thus reserves the right to change all technical data at any time and without prior notification.

Dryer

Heating module:	Halogen ring-shaped radiator
Temperature range:	50–200 °C
Temperature step:	5 °C
Heating module adjustment:	with temperature adjustment set HA-TC or HA-TCC

Balance

Minimum sample weight:	0.5 g
Maximum sample weight:	41 g
Balance adjustment :	with external weight, 20 g ± 0.1 mg
Units:	g, % moisture content, % dry content, ATRO moisture content, ATRO dry content
Stability detector:	with symbol in display
Readability of the balance:	1 mg
Readability of the result:	0.01%
Repeatability (sd) with 1 g sample ¹⁾ :	0.3%
Repeatability (sd) with 10 g sample ¹⁾ :	0.03%

Data

Time, date	system clock, fail safe
Drying time:	manual, 30 seconds to 480 minutes
Operational settings:	read-only memory, fail safe
Switch-off criteria:	5 levels, manual, timed, free
Drying programs:	Standard- and Fast drying
Reset protection:	by locking the keypad

Evaluation

Display modes:	5 modes (moisture, dry content, weight, ATRO moisture content, ATRO dry content = MC, DC, g, AM, AD)
Records:	Using external printer (optional)

¹⁾ Instrument acclimatized in room and connected to power supply for 60 minutes, drying temperature 160 °C.

Hardware

Audio signal:	Provided
Data interface:	Built-in RS232C interface
Inspection window:	in heating module
Leveling:	2 leveling screws and level indicator
Display:	64x128 dot backlit matrix display
Status display (User Guide):	integrated in display
Sample pan, \varnothing :	90 mm
Thermal overload protection:	bimetallic-element switch in heating module
Dimensions (w x h x d):	23 x 15 x 36 cm
Weight, ready to measure:	4.3 kg

Admissible ambient conditions

	Use only in closed rooms
Temperature range:	5 °C to 40 °C
Atmospheric humidity:	80% rh @ to 30 °C
Warm-up time:	At least 60 minutes after connecting the instrument to the power supply; when switched on from standby-mode, the instrument is ready for operation immediately.
Voltage fluctuations:	-15%+10%
Installation category:	II
Pollution degree:	2
Power load:	Max. 450 W during drying process
Current consumption:	4 A or 2 A, according to the heating module
Power supply voltage:	100 V – 120 V or 200 V – 240 V, 50/60 Hz (the voltage is given by the heating module)
Power line fuse:	1 piece, 5 x 20 mm, T6.3 H 250 V



Defective instrument must be disposed of in accordance with applicable customer and national regulations.

8.6 MT-SICS Interface commands and functions

Many of the instruments and scales used have to be capable of integration in a complex computer or data acquisition system.

To enable you to integrate instruments in your system in a simple manner and utilize their capabilities to the full, most instrument functions are also available as appropriate commands via the data interface.

All new METTLER TOLEDO instruments launched on the market support the standardized command set "METTLER TOLEDO Standard Interface Command Set" (MT-SICS). The commands available depend on the functionality of the instrument.

Basic information on data interchange with the instrument

The instrument receives commands from the system and acknowledges the command with an appropriate response.

Command formats

Commands sent to the instrument comprise one or more characters of the ASCII character set. Here, the following must be noted:

- Enter commands only in uppercase.
- The possible parameters of the command must be separated from one another and from the command name by a space (ASCII 32 dec., in this description represented as `␣`).
- The possible input for "text" is a sequence of characters of the 8-bit ASCII character set from 32 dec to 255 dec.
- Each command must be closed by `CrLf` (ASCII 13 dec., 10 dec.).

The characters `CrLf`, which can be inputted using the Enter or Return key of most entry keypads, are not listed in this description, but it is essential they be included for communication with the instrument.

Example

S – Send stable weight value

Command	<code>S</code>	Send the current stable net weight value.
Response	<code>S␣S␣WeightValue␣Unit</code>	Current stable weight value in unit actually set under unit 1.
	<code>S␣I</code>	Command not executable (balance is currently executing another command, e.g. taring, or timeout as stability was not reached).
	<code>S␣+</code>	Balance in overload range.
	<code>S␣-</code>	Balance in underload range.

Example

Command	<code>S</code>	Send a stable weight value.
Response	<code>S␣S␣␣␣␣␣␣␣50.000␣g</code>	The current, stable weight value is 50.000 g.

The MT-SICS commands listed below is a selected list of available commands. Commands and further information please refer to the Reference Manual “MT-SICS for Halogen Moisture Analyzers HB43 11780409” downloadable from the Internet under www.mt.com/moisture.

Commands and responses MT-SICS level 0

I0	Inquiry of all implemented MT-SICS commands
I1	Inquiry of MT-SICS level and MT-SICS versions
I2	Inquiry of instrument data
I3	Inquiry of SW version and type definition number
I4	Inquiry of serial number
I5	SW-Identifications number
S	Send stable weight value
SI	Send weight value immediately
SIR	Send weight value immediately and repeat
Z	Zero
ZI	Zero immediately
@	Reset

Commands and responses MT-SICS level 1

D	Display
DW	Weight display (Display show Weight)

Commands and responses MT-SICS level 2

DAT	Date
PWR	Power on/off
TIM	Time

Commands and responses MT-SICS level 3

Control commands

HA01	Reset application / escape
HA02	Set factory settings
HA03	Switch keypad on/off
HA05	Start / end drying
HA06	Trigger audio signal
HA07	Report instrument status change
HA08	Request printer record

Status inquiries

HA20	Inquiry of instrument status
HA21	Inquiry of automatic sample chamber position
HA22	Inquiry of last balance adjustment
HA23	Inquiry of last heating module adjustment
HA24	Inquiry of temperature
HA25	Inquiry of drying weights
HA26	Inquiry of drying data
HA27	Inquiry of drying result

Instrument settings

HA40	Inquiry / setting of language
HA40X	Inquiry / setting of menu parameter
HA61	Inquiry / setting of method parameters (part 1)
HA62	Inquiry / setting of method parameters (part 2)

8.7 Optional equipment, expendable material and spare parts

Designation	Order No.	Notes
Optional equipment		
Adjustment weight 20 g (Class F1)	158640	Adjustment of balance
Temperature adjustment set, HA-TC	214455	Adjustment of heating module
Calibrated temperature adjustment set, HA-TCC (including test certificate at 50 °C, 100 °C and 160 °C)	214528	Adjustment of heating module
Recalibration from HA-TCC, HA-TCCRe (including test certificate at 50 °C, 100 °C and 160 °C)	214534	Recalibration with certificate
Reusable sample pan (steel, height: 6 mm), HA-DR1	214462	Set of 3 piece
Reusable sample pan (steel, height: 15 mm)	13954	1 piece
Transport case	11113855	
Sample pan handler, HA-PH	214526	3 piece
Chemically resistant protective cover, HA-COVER	11113363	2 piece
Printer RS-P42	229265	
Connection cable	11101051	
Printer LC-P45 (including connection cable)	229119	
Antitheft device	11600361	
Expendable material		
Printer paper	72456	Set of 5 rolls
Paper roll (self-adhesive) for printer	11600388	1 piece
Ribbon (cassette, black) for printer	65975	Set of 2 piece
Aluminum sample pan Ø 90 mm, HA-D90	13865	Set of 80 piece
Reinforced aluminum sample pan Ø 90 mm	11113863	Set of 80 piece
Glass fiber filter (for liquids), HA-F1	214464	Set of 100 piece

If you require other spare parts for your Moisture Analyzer, please contact your METTLER TOLEDO dealer.

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METTLER TOLEDO service assures you of quality, measuring accuracy
and preservation of value of the METTLER TOLEDO products for
years to come.**

Please send for details of our attractive terms of service.

Thank you.



P11780531

Subject to technical changes and to the availability
of the accessories supplied with the instruments.

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