

User Manual

User manual no.:
LMI-49-05/04/13/A

MOISTURE ANALYZER MAX SERIES



BALANCES AND SCALES

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APRIL 2013

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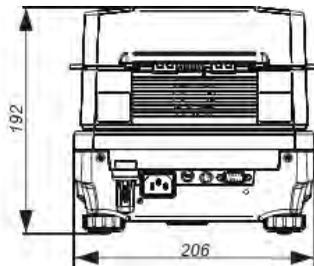
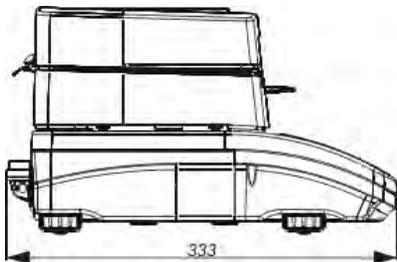
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1. TECHNICAL DATA

Type	MAX 50/1	MAX 50	MAX 60
Reading interval	0,1 mg	1 mg	
Max. capacity	50 g		60 g
Reading interval of moisture content	0,0001%	0,001%	
Tare range	- 50 g		- 60 g
Max. sample mass	50 g		60 g
Repeatability of moisture content reading	+/-0,24% (sample mass up to 2g), +/-0,06% (sample mass between 2-10g), +/-0,04% (sample mass over 10g)		
Drying temperature range	max. 160 °C max. 250 °C (model WH)		
Heating module	infrared emitter halogen (WH)		
Drying modes	4 modes: standard, quick, step, mild		
Finish modes	4 modes: time defined, moisture content stabilization, time optimized, manual		
Working temperature	+10 °C ÷ +40 °C		
Power supply	230V 50Hz AC / 420W		
Display	graphic (backlit)		
Drying chamber dimensions	120 x 120 x 20 mm		
Net weight / Gross weight	5,1 / 6,6 kg		
Packaging dimensions	470 x 380 x 336 mm		



2. BASIC INFORMATION

CAUTION!

Use of moisture analyzer MAX series conversely to safety provisions and other than following guidelines of this user manual may be hazardous to human health and life. Never use the moisture analyzer is explosive area. Moisture analyzer is not intended to use in areas with danger of explosion. The inner shields of a moisture analyzer may heat up to 400 °C. Moisture analyzer's nominal voltage is 230 VAC, thus it is necessary to use the device in accordance with safety principles of low-voltage instruments.

A symbol visible on instrument's top cover (see below) is a warning against its hot surface.



2.1. Intended use

A moisture analyzer MAX series is designed to determine relative moisture content in small samples of various substances, determine dry mass content in small samples and determine mass of weighed objects.

MAX series ensures fast and precise determination process of water content in a tested sample, and application of a graphic display considerably simplifies functioning, operation and carrying out measurement processes. Moisture analyzer MAX series can be used to determine humidity content of different materials.

At the initial stage of measurement, the device precisely determines the mass of an object placed on instrument's weighing pan. As mass reading is stabilized, the sample is quickly heated by halogen lamps or IR emitters, causing humidity evaporation from the tested sample. While sampling, the moisture analyzer is continuously checking the decline of mass, and on calculation, it displays current moisture content in a tested sample.

Compared to conventional methods of humidity content determination of various substances, application of moisture analyzer MAX series considerably shortens measurement time and simplifies testing procedure. The moisture analyzer allows for setting multiple parameters which influence the procedure of moisture content determination in a sample, such as: temperature, time, drying modes, etc.).

2.2. Inappropriate use

CAUTION!

Do not open the drying chamber during drying process. Moisture analyzer features a halogen lamp which is a very powerful heat source. Thus, user should pay special attention not to touch those elements of a moisture analyzer that get hot while drying procedure (i.e.: disposable pan, pan handle, and inner shields of the drying chamber).

Remember that some of tested samples may become dangerous if heated (appearance of poisoning vapours, danger of ignition or explosion).

A moisture analyzer MAX series is not intended for dynamic weighing. Even if small amounts of a sample are added to taken off the weighing pan, the mass readout should be taken only on stabilization of measurement result (appearance of stability pictogram  on the display).

Do not place any magnetic materials on the weighing pan, as this can cause damage of the measuring system of the instrument. Be sure to avoid impact shock and overloading the moisture analyzer in excess of the prescribed maximum measuring range (max capacity), minus any possible tare weight that has been applied).

Never use the moisture analyzer in an environment endangered by an explosion. This moisture analyzer has not been adjusted for operation in explosive areas. There must not be any modification made to the moisture analyzer.

2.3. Principles of safety use

Use of moisture analyzer MAX series conversely to safety principles and user manual guidelines may be hazardous to operator's health and life. It is obligatory to acknowledge with safety principles listed in the user manual:

- use a moisture analyzer only to determine humidity content in samples and determine mass of a tested sample. Any other use of the moisture analyzer may be dangerous either to the device or the user,
- before switching on the moisture analyzer, make sure that the nominal power of the device specified on its data plate, is compatible with the supply in the mains to which the moisture analyzer will be plugged in,
- **change of heating element can only be carried out by authorized service,**
- protect moisture analyzer against contacts with liquids,
- as the area around moisture analyzer gets heated, do not put any inflammable objects or substances in close distance to the device,
- substance containing toxic or caustic vapour should be tested in a chamber which absorbs the vapours,
- samples of substances that produce inflammable vapours if heated should be relatively small (small sample mass), and drying process should be carried out in low temperatures,
- remember that aggressive substances may cause corrosion to the device.

2.4. Warranty

Warranty does not cover the following cases:

- Not observing the regulation listed in user manual,
- Using the moisture analyzer conversely to its intended use,
- Any modifications of moisture analyzer or cases when its housing is opened (damaged protective stickers),
- Mechanical defects and defects caused by media, liquids, water and natural wearing off,
- Improper placing of defects of electrical network / mains,
- Overloading of measuring mechanism of the moisture analyzer.

2.5. Monitoring metrological parameters of the instrument

Metrological characteristics of the moisture analyzer requires periodical inspection carried out by its operator. Inspection frequency is conditioned by ambient conditions in which the moisture analyzer is used, types of performed processes and accepted quality management system in an organization.

2.6. Data included in this user manual

Please read the user manual carefully before instrument's plugging to mains and startup, even if the user is experienced with this type of moisture analyzers.

2.7. Staff competence

Moisture analyzer MAX series should only be operated and maintained by personnel who is trained and experienced in using this type of instruments.

3. TRANSPORT AND STORAGE

3.1. Delivery check

Please check the packaging immediately upon delivery and the device during unpacking for any visible signs of external damage.

3.2. Packaging

Please retain all parts of the original packaging should the moisture analyzer be transported in the future. Only the original packaging should be used for dispatching the moisture analyzer. Before packing, disconnect all attached cables and remove any loose/movable parts (weighing pan, shields, inserts). Place moisture analyzer and its components in their original packaging, and protect them against damage during transport.

4. UNPACKING, ASSEMBLING AND STARTUP

4.1. Assembling and place of use

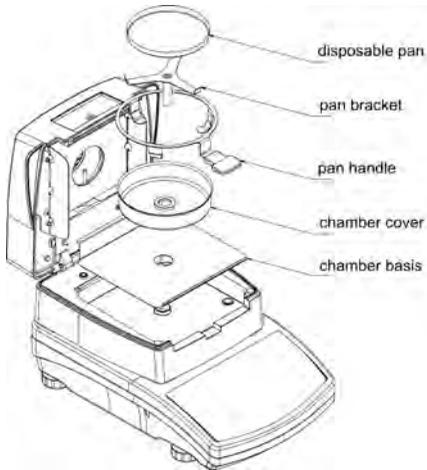
- * A moisture analyzer should be stored and used in locations free of vibrations and shakes, free of air movement and dust, located at the max altitude of 2000 above sea level,
- * Moisture analyzer's place of use should ensure good air circulation around the instrument (approximately 20 cm free space around the moisture analyzer and 1 m free space over it),
- * Ambient air temperature in the weighing room should not exceed the range of: $+10^{\circ}\text{C} \div +40^{\circ}\text{C}$,
- * Ambient relative humidity should not exceed 80% in the temperature up to 31°C , and decrease linearly to 50 % of relative humidity in temperature 40°C ,
- * A moisture analyzer should be located on a stable wall console desk or a stable working table which is not affected by vibrations and distant from heat sources,
- * Take special safety measures when weighing magnetic objects, as part of the moisture analyzer is a strong magnet,

4.2. Unpacking

Carefully remove the moisture analyzer from its packaging, remove the plastic and foil transport protective elements. Gently place the moisture analyzer in its intended place of use.

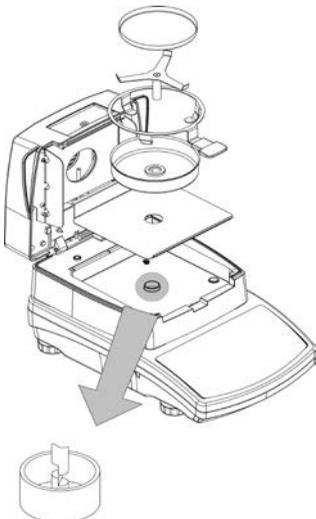
Assemble the components of drying chamber, following guidelines from below figure:

Assembling moisture analyzer components:



- Assembly insert of the drying chamber's basis
- Assembly drying chamber cover,
- Assembly drying pan handle,
- Assembly drying pan bracket,
- Assembly the disposable drying pan..

Setting drying pan's supporter (bracket).



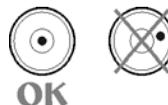
When assembling the pan supporter (bracket) pay special attention to the correct positioning of its mandrel. The mandrel features a cut for its unique positioning against the pan handle, thus preventing their contact and friction.

Setting pan's bracket:

- On assembling the pan bracket onto the mandrel, turn the bracket slightly, so that the cut on the mandrels are located in their unique and correct position,
- When turning the mandrel use most gentle movements not to damage moisture analyzer's measuring system.

4.3. Level setting

Before plugging to mains, level the moisture analyzer using adjustable feet. Turn the feet in a way that the air bubble of the level is located centrally.



4.4. Standard delivery components

- A moisture analyzer MAX series
- Insert of drying chamber basis.
- Drying chamber shield.
- Drying pan handle.
- Drying pan bracket.
- Disposable pan.
- Power cord.
- User manual.

4.5. Cleaning

Remember to unplug the moisture analyzer from mains before any cleaning activities.

Clean the moisture analyzer using a damp cloth by gentle rubbing contaminated places.

Remember to remove the drying pan from the drying chamber before its cleaning. If the drying pan assembly is installed while cleaning it may damage instrument's measuring system, thus remove it from the bracket.

4.6. Plugging to mains

A moisture analyzer can be plugged to mains only by means of original power cord, which comes standard with the moisture analyzer. Rated voltage (specified on device's data plate) must be compatible with mains rated voltage.

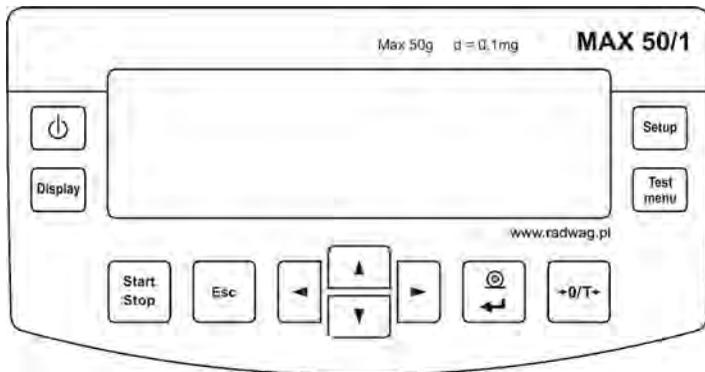
The power cord can be connected only to socket with ground contact. Plug the power cord to the moisture analyzer. The moisture analyzer's power plug is located at the back of instrument's housing.

On plugging to mains moisture analyzer's displays software's name and number, after which the indication changes to 0.000 g (in case of a moisture analyzer with measuring accuracy 1 mg) or 0.0000 g (in case of a moisture analyzer with measuring accuracy 0,1 mg). In mass indication is other than zero press **TARE** key located on the overlay.

4.7. Connecting peripheral equipment

The moisture analyzer must be unplugged from the mains before connecting or disconnecting any peripheral equipment (printer, PC computer). Use only peripheral equipment recommended by the manufacturer with your moisture analyzer. These have been ideally coordinated to your moisture analyzer. On connecting a peripheral device, plug the moisture analyzer to mains.

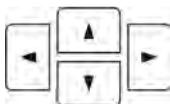
5. KEYBOARD



Start/Stop key – starting / ending drying process according to selected drying mode.



Esc key, abandoning introduced changes / exit one level higher in menu structure.



Group of navigation keys – change of parameters value; moving in moisture analyzer's menu.



Print/Enter key – sending display status to peripheral device (Print) or confirmation of selected value or function (Enter).

	Zero / Tare key – zeroing moisture analyzer's indication.
	On/Off key – switch on/off display of moisture analyzer. On switching off the display of the device, other subassemblies are continuously supplied, and the moisture analyzer is in standby mode.
	Display key – changes type of data displayed during and after drying process.
	Setup key – enter to main menu.
	Test menu key – function key for selecting drying modes.

6. MOISTURE ANALYZER'S MENU

User menu of the moisture analyzer MAX series is divided into two sections. The first one is made available on pressing **SETUP** key. This menu enables setting the following parameters: moisture analyzer and temperature sensor adjustment, setting date and time format, programming printouts and communication parameters with peripheral equipment, and setting user profile parameters.

The second menu is accessible on pressing **TEST MENU** key, and it is dedicated to setting parameters of basic drying mode, including: drying temperature, drying mode, time and other parameters. The menu additionally provides access to the library of drying programs. The library stores up to 99 different drying procedures containing detailed settings on drying modes of various substances.

P1 Adjustment

- P1 01 External adjustment
- P1 02 User adjustment
- P1 03 Adjustment test
- P1 04 Temperature adjust.
- P1 04 Adjustment report printout
- P1 05 Drying test

P2 GLP

- P2 01 User
- P2 02 Project
- P2 03 Print time
- P2 04 Print date
- P2 05 Print user name

P5 RS-232

- P5 01 Baud rate
- P5 02 Parity
- P5 03 Data bits
- P5 04 Stop bits
- P5 05 Handshake
- P5 06 Print stable
- P5 07 Printout type
- P5 08 Paper cut off

P6 Printouts

- P6 01 Printout no.
- P6 02 Header no.
- P6 03 Line no.
- P6 04 Footer no.
- P6 05 Printout 1 start
- P6 06 Printout 1 stop

P2 06 Print project name
P2 07 Print ID
P2 08 Print adjustment data

P6 13 Text 1
P6 14 Text 2

P3 Date/Time
P3 01 Date format
P3 02 Time format
P3 03 Time
P3 04 Date
P3 05 Display time
P3 06 Display date

P4 Readout
P4 01 Filter
P4 02 Autozero
P4 03 Temperature
P4 04 Negative

P7 Other

P7 01 Password
P7 02 Database of drying programs
P7 03 Beep sound
P7 04 Language
P7 05 Display backlight
P7 06 Display brightness
P7 07 Display contrast
P7 08 Factory no.
P7 09 Software version
P7 10 Parameters printout
P7 11 Upload parameters
P7 12 Set ID
P7 13 ID automatic printout
P7 14 Previous version

7. MOVING THROUGH USER MENU

A user can move through moisture analyzer's menu by means of three options:

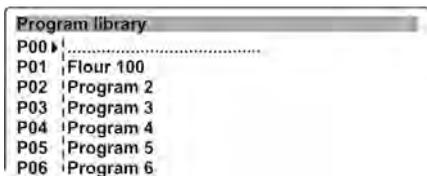
1. moisture analyzer's keyboard,
2. external computer keyboard type PS connected to moisture analyzer's port
3. using commands sent from a computer connected to moisture analyzer's RS232 interface.

7.1. Menu operation using moisture analyzer keyboard



Entering option of selecting a drying mode:

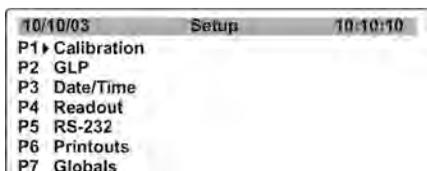
Press **Test Menu** key to open a list with drying programs saved in moisture analyzer's memory. The library can contain up to 100 drying programs. Each of drying programs is optionally configurable, and available for multiple times during operation of the moisture analyzer.



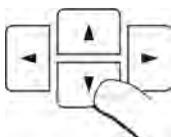
Exit menu without saving changes:
Press **Esc** key.



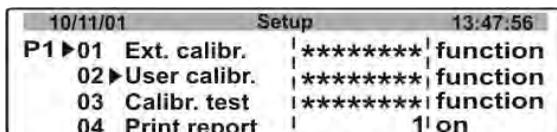
Entering moisture analyzer's main menu:
Press **Setup** key to get access to user menu and its parameters.



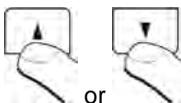
Exit menu without saving changes:
Press **Esc** key for two times.



Selecting a desired option in the menu:
Press one of navigating keys (marked with black coloured arrows) on moisture analyzer's overlay to move the cursor (black triangle) up or down in menu structure and set it against a desired menu option.

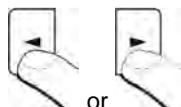


Entering selected menu option / function:
Set the cursor (black triangle) against a desired function, and press **SETUP** key.



Changing parameter and function settings:

Use **UP / DOWN** navigating arrows to select accessible value of a parameter or change setting of an active parameter (e.g. name) when its value is flashing.



Use **RIGHT / LEFT** navigating arrows to select a character while entering a parameter value (while its flashing).



Accepting changes in function / parameter settings:
Press **PRINT/ENTER** key to save settings of a modified parameter/function.



Changing displayed data during drying process:
A moisture analyzer MAX series enables previewing five types

of measurement result while the drying process is in progress or on its completion.

The measuring units are previewed by pressing **DISPLAY** key. Each pressing of the key changes in turns the measuring unit and automatic recalculation of measurement result. Available measuring units:

%M (percent loss of mass in tested sample);

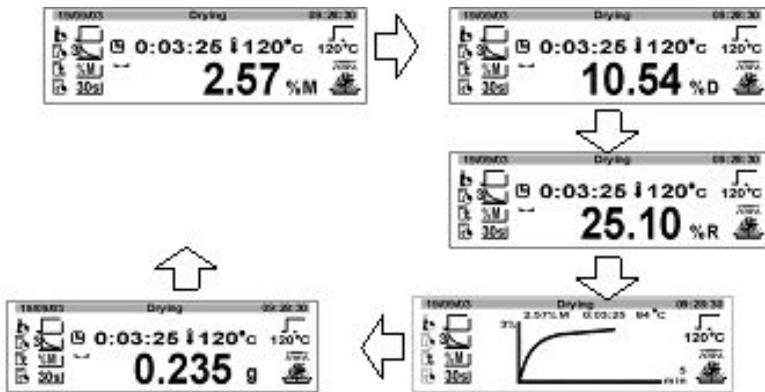
%D (dry mass in tested sample);

%R (humid / dry ratio expressed in %);

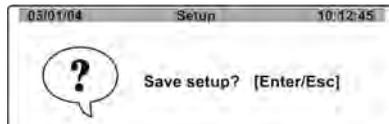
A chart from drying process

Mass loss in tested sample in [g].

Additionally, the display of MAX series contains the following: drying time, current temperature in drying chamber, drying mode, target (set) temperature, drying process result in a form of: %M; %D; %R; chart, mass loss in [g].



Changes made to software settings are effective only on exiting to main menu with procedure of saving changes.



On making all changes in the parameter settings, exit to main menu by pressing the ESC key for a few times, until the software displays a message box with below two option:

- ENTER** – save changes and exit
- ESC** – abandon changes and exit

7.2. Menu operation using external computer keyboard

All keys present on moisture analyzer's overlay have their equivalents on a computer keyboard PS type, described in below table:

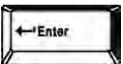
- function keys

	Description	Overlay
	Start / End drying process in an active drying mode.	
	Entering main menu.	
	Entering selection menu and settings of the drying mode.	
	Changing the type of displayed data on drying process.	
	Sending current display status to a connected peripheral device (PRINT).	
	Zeroing/Tarring moisture analyzer's indication.	

- navigating arrows

	Moving the cursor up	
	Exiting one level back in menu structure	
	Entering the settings of a selected parameter	
	Moving the cursor down	

- keys: ENTER / PRINT and ESC

	Accepting entered value (of a parameter)	
	Abandoning and exiting a function / parameter without changes	

8. USER MENU

User menu is accessible on pressing **SETUP** key on moisture analyzer's overlay. The user enables: moisture analyzer adjustment, setting transmission parameters, setting time and date and their format, and also other user parameters. This section of the user manual presents software possibilities of the moisture analyzer and means of changing the parameter settings.

8.1. Moisture analyzer adjustment

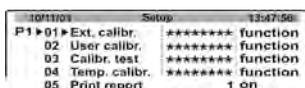
8.1.1. Adjustment

Should a moisture analyzer MAX series be used as a laboratory balance, then before carrying out the measurements it has to be adjusted using an external mass standard / weight).

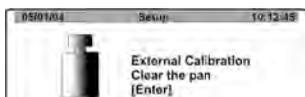
Adjustment is a set of processes **determining relation** between the value indicated by a moisture analyzer / balance, and mass of a weighed standard (adjustment weight). The process enables **correcting the indication** if necessary.

Adjustment process on a moisture analyzer MAX series should be carried out with use of a mass standard / adjustment weight class F₂. The weight is an additional equipment of the moisture analyzer.

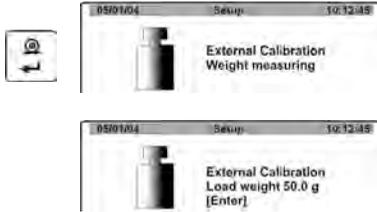
Moisture analyzer type	Adjustment weight mass
MAX	50g



Enter group of parameters **P1 Adjustment**. Set the marker next to a parameter **01 External adjustment**.

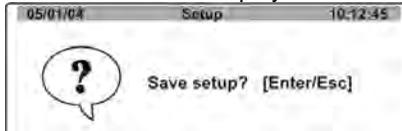


Press **RIGHT ARROW KEY**, which displays a command to unload the moisture analyzer's pan (the pan has to be empty). After emptying the pan press **ENTER** key.



The moisture analyzer gives a command on determining mass of an empty pan, followed by a command to place a 50 g weight (standard) on the pan.

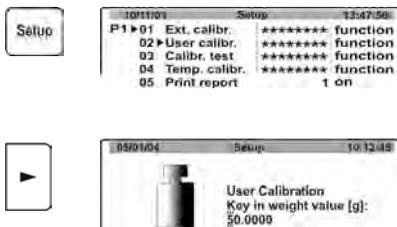
- a) After completing adjustment process the moisture analyzer returns to submenu **P1 - Adjustment**
- b) Press **ESC** for a few times until the display indicates below message



- c) Depending on needs press **ENTER** or **ESC** key.
- d) The moisture analyzer returns to the main window (weighing mode).

8.1.2. User adjustment

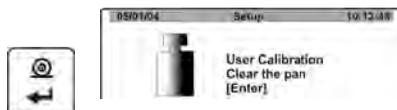
User adjustment should be carried out with a mass standard (weight) in accuracy class **F₂**.



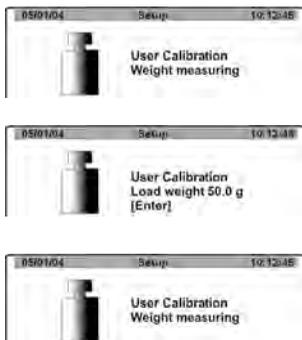
Enter group of parameters **P1 Adjustment**. Set the marker next to a parameter **02 User adjustment**.

Press **RIGHT ARROW KEY**. The moisture analyzer displays a command to enter mass of an adjustment weight to its memory. in the displayed mass value the first digit is flashing, i.e. it can be modified.

Use navigating arrow keys to enter the new mass value of the external adjustment weight.



Accept entered mass of the adjustment weight. Then the moisture analyzer proceeds to the adjustment process and displays corresponding messages on its display.



The moisture analyzer gives a command on determining mass of an empty pan, followed by a command to place a weight with pre-determined mass.

On placing the weight on the pan accept the process by pressing **Enter** key. After completing the user adjustment process the moisture analyzer returns to submenu **P1 - Adjustment**.

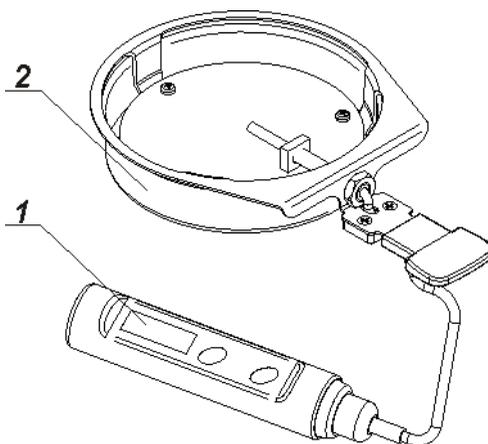
As specified in the previous point return to the weighing mode.



It is recommended that the mass of an external adjustment weight is approximately $\frac{3}{4}$ of the maximum capacity of a balance / moisture analyzer.

8.1.3. Drying chamber (Temperature) adjustment

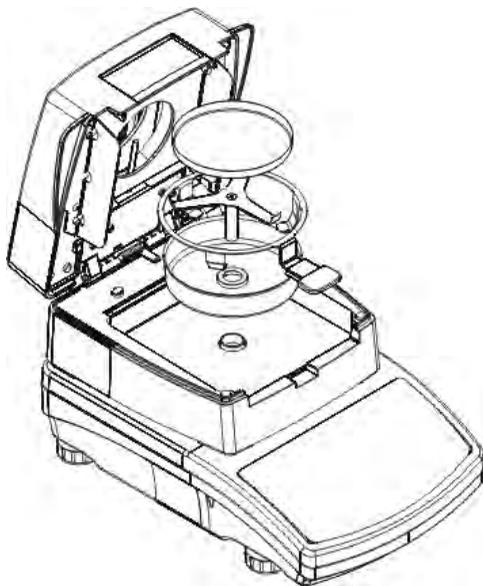
Temperature adjustment of the drying chamber is carried out using a dedicated set available as additional equipment of the moisture analyzer.



1. Thermometer
2. Thermometer holder with a shield

Adjustment is a simple process aimed at adjusting the temperature sensor assembled in moisture analyzer's drying chamber. Before carrying out the

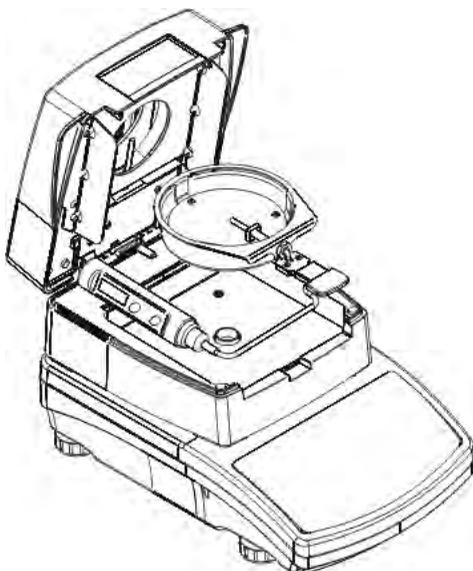
temperature adjustment process, install the adjustment set inside the drying chamber following below figures.



Step 1.

Remove from the drying chamber the following:

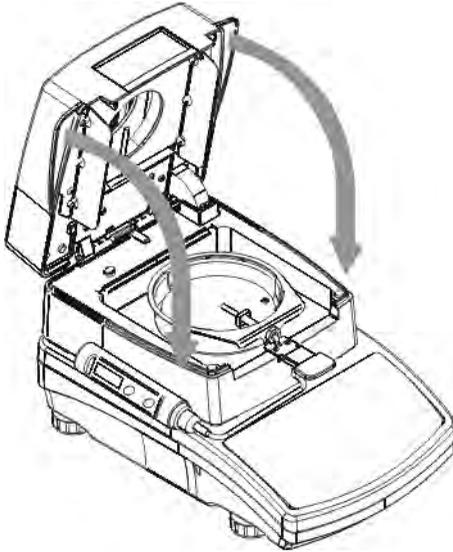
- Disposable pan
- Pan holder
- Pan bracket
- Chamber cover



Step 2.

Place in the drying chamber the components of the temperature adjustment set:

- Drying chamber shield with assembled control thermometer



Step 3.

After assembling the adjustment set close drying chamber's lid and start the temperature adjustment process.

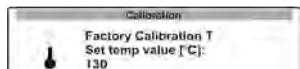
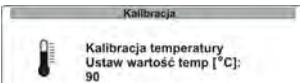
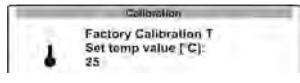
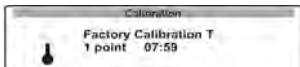
CAUTION: remember to carry out all the processes with great care not to damage the mass measuring mechanism of a moisture analyzer.



Setup		12:47:56	
P1 ▶ 01	Ext. calibr.	*****	function
02	User calibr.	*****	function
03	Calibr. test	*****	function
04 ▶	Temp. calibr.	*****	function
05	Print report	*****	1 on



Enter menu group **P1 Adjustment**.
Set the marker next to a parameter **04 Temperature adjustment**.



Press **RIGHT ARROW** navigating key. The moisture analyzer previews current temperature value. After 8 minutes, the display indicates flashing temperature value. Enter the temperature value as indicated on the external (control) thermometer.

Press **Print/Enter** key to proceed to the following step of drying chamber adjustment process. The moisture analyzer switches on the halogen heating element and for the following 8 minutes it heats the drying chamber, and simultaneously indicates on its display the current temperature value. After the 8 minute time interval the moisture analyzer's display indicates the flashing temperature value. Enter the temperature value as indicated on the external (control) thermometer.

Press **Print/Enter** key to proceed to the

following step of drying chamber adjustment process. The moisture analyzer continues heating the drying chamber for another 8 minutes and simultaneously indicates on its display the current temperature value. After the 8 minute time interval the moisture analyzer's display indicates the flashing temperature value. Enter the temperature value as indicated on the external (control) thermometer. After entering the temperature value finish the adjustment process by pressing **Print/Enter** key.

After completing the process return to the main menu with procedure of saving changes.

8.1.4. Adjustment test

Adjustment test is a comparison of mass of an adjustment weight **value** with the value of current measurement result. The process is aimed at checking the comparison results, and it does not affect coefficients saved in software settings. On previewing the test results press **ESC** key.

Carrying out adjustment test

- a) Go to submenu **P1 – Adjustment**.
- b) Set the marker next to the **Adjustment test** function
- c) Press **RIGHT ARROW** navigating key
- d) The moisture analyzer automatically carries out the test process
Factory adjustment – name of last carried out adjustment process
Adj (Cal) – value of a load currently placed on moisture analyzer's pan
Curr. – mass value of an adjustment weight saved in moisture analyzer's memory
Dev. – calculated difference between the above two values
- e) Return to the weighing mode =, as specified in point 6 of this user manual.

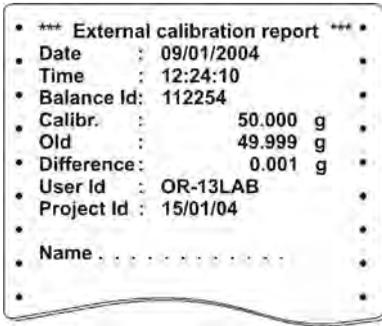
8.1.5. Adjustment report printout

On completing each of adjustment processes the moisture analyzer enables generating a report from adjustment process. The report can be printed on a connected printer and sent to a computer and saved in a form of file for future records.

P1 05 Report printout : **1 : YES** – report is printed
P1 05 Report printout: **0 : NO** – report is not printed

Remember that on enabling report printout (set to 1), the report is generated and sent automatically.

An example of a printout of a report from adjustment process:



The printout content depends on parameters set in group **P2 GLP** (see point 8.2 of this user manual). Variables that are printed have an attribute set to **1: yes**.

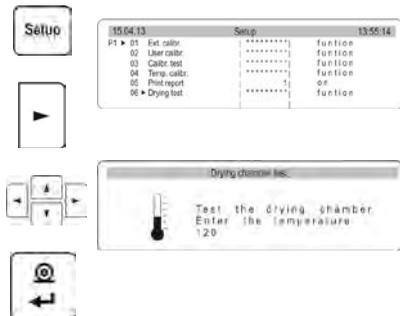
Apart from the content set in this menu group, a report contains the following data: mass of an adjustment weight stored in moisture analyzer memory from last completed adjustment process (described as **Curr:**), mass of an adjustment weight determined in current adjustment process (described as **Adj:** (or **Cal**) and a deviation from adjustment process (described as **Dev:**), i.e. the difference between the two mass values.

8.1.6. Drying test

Parameter <Drying test> enables monitoring correctness of temperature indications as recorded by the moisture analyzer’s internal thermometer. The testing procedure is carried out using a dedicated set (a thermometer with a holder) that is available as additional equipment of a moisture analyzer MAX series. (It is the same set that is used for carrying out temperature adjustment process). Means of assembling the set is described in the chapter on temperature adjustment of this user manual.

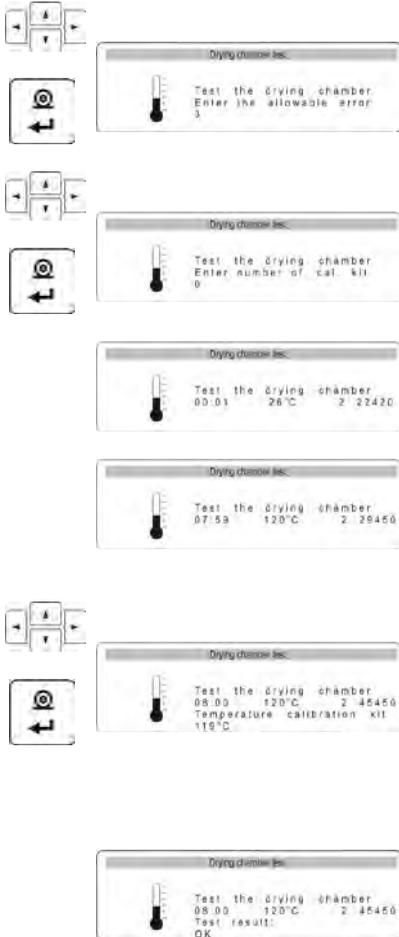
Enabling the testing procedure requires assembling the control set inside the moisture analyzer’s drying chamber, and entering a menu group <Adjustment> in instrument’s parameters. Start the process by following below specified instructions.

Remember to assembly the control thermometer set before starting the testing procedure and then close the drying chamber lid.



Enter menu group **P1 Adjustment**.
Set the marker next to a parameter **06 Drying test**

Press **RIGHT ARROW** navigating key. The moisture analyzer opens a window for entering the temperature value for carrying out the drying test. Use the navigating keys to enter the desired temperature value and press **ENTER** button to accept.



The moisture analyzer displays another message for entering the permissible temperature error that is acceptable by an operator. Use the navigating keys to enter the desired error size and press ENTER button to accept.

The moisture analyzer displays another message for entering the factory number of the adjustment set used for carrying out the test. Use the navigating keys to enter the factory number data and press ENTER button to accept.

After accepting the factory number of the adjustment set, the software automatically starts heating the drying chamber until reaching a pre-defined temperature value. The moisture analyzer's display indicates data on time and temperature of the drying chamber sensor.

The temperature is maintained for 8 minutes (as in case of temperature adjustment). After this time interval, a message box is opened on moisture analyzer's display for entering the temperature value as recorded by the control thermometer set assembled inside the drying chamber. Use the navigating keys to enter the temperature value from the control thermometer and press ENTER button to accept it.

Then the display opens a message box with the temperature error of the drying chamber as recorded by the control thermometer set.

```

-----
Test the drying chamber
-----

17/04/2013          15:03:42
Balance Id: 01
Number of calibration kit:      0
Temperature setpoint:          120
The final temperature:         120
The temperature measured:      119
Permissible error:             3
Status:                         OK
-----

```



The test result can be printed on a printer connected to a moisture analyzer by pressing PRINT button. An example of a report from drying chamber test is presented in the table on the left.

Return to the main menu by pressing Esc button for a number of times.

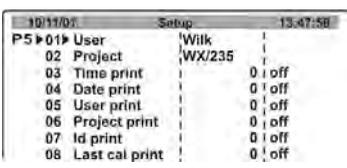
8.2. Determining content of a printout for GLP procedures

This group of parameters enables determining name of a user and project, and declaring other data to be printed in reports and standard printouts. All data can be easily inserted using either moisture analyzer's keyboard or an external computer keyboard PS/2 type connected to balance's port.

It is recommended to use an external computer keyboard PS/2 type, as it is a much faster and easier means of entering text.

8.2.1. User

Enter menu group **P2 GLP**



Enter user name:

Using moisture analyzer's keyboard

Press navigating arrow to enter the settings of parameter **01 User**, where a name or a number of a user operating the moisture analyzer is entered. The name/number can include letters and/or numbers , maximum 8 characters. Use navigating arrow keys. All letters and numbers are displayed in sequence and in a

closed circuit. Select a needed character. Next move the cursor to the right and enter the following character. On entering all of the characters press **ENTER** key.

Using external computer keyboard PS/2 type

Press **F2** key to enter the main menu, press **F3** key or use navigating arrows to set the marker next to a parameter **01 User** and press **F2** key to enter parameter settings (flashing first character of an existing number or flashing cursor if not number is specified). Use computer keyboard to enter a new **User** name and accept it by pressing **Enter** key. Use **Esc** and **Enter** keys to return to weighing mode.

8.2.2. Project

Name of a project can contain maximum 8 alphanumeric characters. The project name is set as in the case of user names specified above (see point 8.2.1 above).

8.2.3. Parameters determining content of the GLP procedures

A standard printout template can comprise the following parameters to be printed:

P2 03 print time – measurement time or report time acquired from moisture analyzer's real time clock

P2 04 print date – measurement date or report date acquired from moisture analyzer's real time clock

P2 05 print user – user name as specified in parameter **P2 01 User**

P2 06 print project – project name as specified in parameter **P2 02 Project**

P2 07 print ID – moisture analyzer factory number given by the manufacturer

P2 08 print adjustment – data on last completed adjustment process including: adjustment date and time, adjustment type and deviation.

Data to be printed must have an attribute set to "1 yes".

EXAMPLES OF PRINTOUTS FOR DIFFERENT GLP SETTINGS:

P2 03 print time: 1:yes
P2 04 print date: 1: yes
P2 05 print user: 1: yes
P2 06 print project: 1: yes
P2 07 print ID: 1: yes
P2 08 print adjustment: 1: yes

```
Date : 16/01/2002
Time : 13:12:30
User : R. Wilk
Project : Check
Balance : 11111111
Last adjustment:
-----
16/01/2002 13:02
External adjustment
Dev.: 0.0001 g
-----
130.0500 g
```

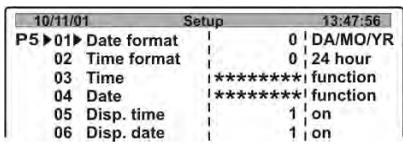
P2 03 print time: 0:no
P2 04 print date: 1:yes
P2 05 print user: 1:yes
P2 06 print project: 0:no
P2 07 print ID: 1:yes
P2 08 print adjustment: 0:no

```
Date : 16/01/2002
User : R. Wilk
Balance : 11111111
? 12.0085 g
```

8.3. Date and time settings

Group of parameters enabling setting date and time of the real time clock in moisture analyzer memory, and setting their displaying and printing format.

Enter menu group P3 Date/Time



8.3.1. Setting date format

Press navigating arrow key to enter submenu **01 Date format**.
 Select one of available values:

- 1 Date format - **Month/Day/Year**
- 2 Date format - **Day/Month/Year**

On selecting the appropriate value accept it by pressing **ENTER** key.

8.3.2. Setting time format

Press navigating arrow key to enter submenu **02 Time format**.

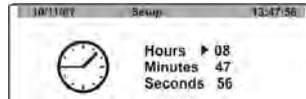
Select one of available values:

- 1 Time format – **12 hours**
- 2 Time format – **24 hours**

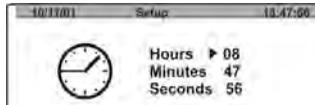
On selecting the appropriate value accept it by pressing **ENTER** key. **12 hour** time format is differentiated by letters **PM** or **AM** visible on a printout.

8.3.3. Setting time

Press navigating arrow key to enter settings of parameter **03 Time**



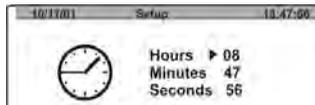
Set current time:



Place the cursor next to a value to be changed (i.e. Hour, Minute, Second) .



Enter the value settings mode (the first digit starts flashing)



Use navigating arrow keys to set time

Select a digit to be changed



Select digit value



Accept set value of time (the last changed digit stops flashing)

Repeat the process for the following values (minute, second). On setting the new values press **ENTER** key. The moisture analyzer returns to submenu **P3 Date/Time**. The time value visible in the upper bar of the display is changed. After setting the time to a needed value return to the weighing mode following procedure described in point 7.1 of this user manual.

8.3.4. Setting date

Press navigating arrow key to enter settings of parameter **04 Date**



Following procedure described in point **8.3.3** set current date value. After setting the date return to the weighing mode following procedure specified in point 7.1 of this user manual.

8.3.5. Setting displaying criteria for date and time

Moisture analyzer MAX series enables declaring whether date and time should be visible in the upper bar of the display during instrument operation. The displaying criteria are modifiable by setting an appropriate value of the parameter.

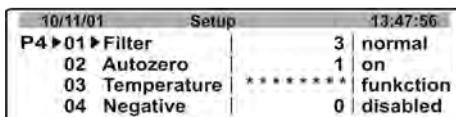
The value is changed in accordance with specification given in point 7.1 of this user manual. If the parameter value is set to **1** then date and time re visible in the upper bargraph of the display.

8.4. Setting moisture analyzer operating parameters

Moisture analyzer MAX series enables adjusting its operation to current ambient conditions (filter) or user needs (display refreshment, autozero, last digit). The parameters are grouped in menu **<P4 Readout>**.

8.4.1. Entering menu group P4 Readout

Enter menu group **P4 Readout**



8.4.2. Filter settings

Depending on current ambient conditions at a workstation it is necessary to set filtering value. In case of perfect operating conditions set the filter value to very fast (set value of parameter **01 Filter** to **1**). If the conditions are bad (i.e. vibrations, air

movement) it is recommended to set the filter value to slow or very slow (set value of parameter **01 Filter** to **4** or **5**). The efficiency of filter operation differs in relation to the measuring range. The filter operates with lower accuracy while the mass indication is quickly increasing after placing a load on the pan, Filter accuracy is increased when weighed mass is within **filter's set operation range** (parameter: filter operation range is available only in balance's service menu, and it is inaccessible for the user).

8.4.3. Autozero function

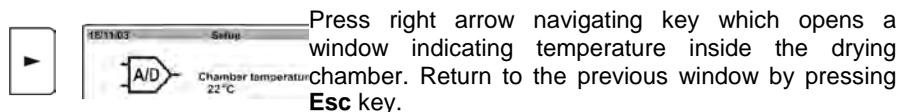
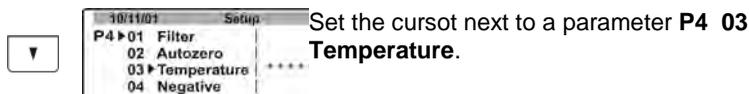
In order to ensure moisture analyzers's precise mass indication, "**AUTOZERO**" software parameter has been introduced. The application of this function is automatic control and correction of zero indication.



The parameters determining the range and time of autozero operation are set by the manufacturer and they are not accessible for the user.

If **AUTOZERO** function is enabled, then each weighing process starts from precise zero point. Disabling **AUTOZERO** operation may result in result instability while the pan is not loaded with a mass to be weighed. There are, however, some cases when this function can be a disturbing factor of measuring process; for instance very slow placing of a load on the weighing pan (e.g. load pouring). Enabling and disabling **AUTOZERO** operation is carried out in parameter **P4 02**.

8.4.4. Previewing temperature value inside the drying chamber



8.5. RS 232 Functions

Moisture analyzer MAX series enables determining communication parameters with a computer or a printer.

Enter menu group **P5 RS-232**

10/11/01		Setup	13:47:56	
P5 ▶ 01 ▶	Baud rate	3		9600
02	Parity	0		none
03	Data bits	1		8 bits
04	Stop bits	0		1 bit
05	Handshake	0		none
06	Print on stab	1		enabled

8.5.1. RS 232 parameter settings

Use function keys to set required parameters values (see point 7 of this user manual – moving through user menu) which determine correct cooperation between a moisture analyzer and a computer or a moisture analyzer and a printer:

Parameter number and name	Parameter value	Parameter number and name	Parameter value
01 Baud rate:	0 : 2400; 1 : 4800; 2 : 9600; 3 : 19200	05 Handshake	0 : no; 1 : RTS/CTS; 2 : XON/XOFF
02 Parity	0 : no; 1 : even; 2 : odd	06 Print stable	0 : no; 1 : yes
03 Data bits	1 : 7 bits; 2 : 8 bits	07 Printer type	0 : Standard 1 : Kafka 2 : Epson 3 : PC 4 : PC-RADWAG
04 Stop bits	1 : 1 bit; 2 : 2 bits	08 Paper cut	0 : no 1 : yes

Caution:

*In case of parameter set to **P5 07 – 3 : PC** – the data sent to a printer is only a line. The data from the header and the footer is not printed.*

*For parameter set to **P5 07 – 4 : PC-RADWAG** – each printout is proceeded by a special controlling signs, which enable moisture analyzer cooperation with the computer software **E2R MOISTURE ANALYZER**.*

8.6. Printouts

18/11/02 Setup 13:46:42	
P6 ▶ 01 ▶ Printout No.	0 standard
02 Header No.	1 printout 2
03 Line No.	1 printout 3
04 Footer No.	1 printout 4
05 Pr. 1 start	1
06 Pr. 1 stop	1
07 Pr. 2 start	1
08 Pr. 2 stop	1
09 Pr. 3 start	1
10 Pr. 3 stop	1
11 Pr. 4 start	1
12 Pr. 4 stop	1
13 String 1	
⋮	
45 String 79	

User of a moisture analyzer MAX series can set up to 5 different printout templates which are sent from the instrument to a connected peripheral device (a printer or a computer) through the RS 232 slot.

- A single **STANDARD** printout containing data enabled in the GLP procedures
- Four **NON-STANDARD** customized printout templates

8.6.1. Standard printout template

On pressing **ENTER / PRINT** key the moisture analyzer sends through the **RS 232** interface current display status (mass of weighed load) and variables declared in submenu **P2 GLP**.

Examples of standard printout templates in weighing mode:

62.690 g	Date: 22/10/2001 Hour: 13.04.23 User: Wilk Project: XW/456 62.690 g	Date: 22/10/2001 Hour: 13.16.49 User: Wilk Project: XW/456 Balance: 10 ? 62.685 g
----------	---	--

A question mark preceding the mass value means that the mass readout was unstable at the moment of printout release.

A printout can be divided into three sections:

- Header (containing data on selected drying mode and start mass of a sample to be dried)
- Line (containing partial drying time and humidity content result)
- Footer (containing end mass, total drying time and final drying result).

8.6.2. Non-standard printout templates

Principles of creating non-standard printout templates:

1. Moisture analyzer MAX series enables creating up to 4 custom printout templates;
2. each template must have the string of text start and end specified, e.g. **Printout no. 1 Start – 1** and **Printout no. 1 Stop – 40**. In this case the **Printout no. 1** contains text strings from **1 to 40**.
3. Next insert the texts into the specified text strings, i.e. 1 ÷ 40. It is recommended to use an external computer keyboard connected to moisture analyzer's port. This means of text input is much simpler and quicker.
4. Non-standard printout templates may overlap each other, i.e.:
 Printout 1 Start – 1
 Printout 1 Stop – 40
 Printout 2 Start – 20
 Printout 2 Stop – 40

A non-standard printout can contain:

- ✓ Variables dependent on user needs (mass, date, project no., temperature of the drying chamber, etc.)
- ✓ Texts inserted in moisture analyzer's user menu

A custom non-standard printout template can contain up to **640** characters inserted in **80** text strings, **8** character each. (starting with parameter **String 1 to String 80**). A balance user can create up to **4** non-standard printout templates.

8.6.3. Inserting text into strings

Variables in printouts

%%	Printout of a single character “%”	%K	Type of last completed adjustment process
%N	Current net mass in basic measuring unit	%I	Deviation in last completed adjustment process
%d	Current date	%1	Code 1
%t	Current time	%2	Code 2
%i	Balance factory no.	%3	Code 3
%r	Software no.	%4	Code 4
%P	Project no.	%5	Code 5
%U	User no.	%6	Code 6
%k	Date and time of last completed adjustment process		

Variables available in drying mode only

%C	Drying chamber temperature	%c	Drying time
%M	Drying result – humidity content	%S	Start mass of a sample
%D	Drying result – dry mass	%E	End mass of a sample
%R	Drying result – humid/dry ratio	%p	Parameters of an enabled drying mode
%N	Drying result – current net mass in basic measuring unit		

Special signs for designing a non-standard printout template

\	Single “\” sign
\c	CRLF
\r	CR
\n	LF
\t	Tabulator
\s	Skip to the following text “string”
\0	End of a printout template

Each text string (**Text 1 + 89 Text 80**) can contain up to **8 characters** (letters, digits, special signs, space). Inputting a sentence comprising multiple words and signs requires using a set of neighbouring 8-character text strings. A user can add special signs to include needed variables in a non-standard printout template.

Example no 1:

Maximum mass cannot exceed 11.250 g!

Inputting this sentence requires using 36 characters grouped in the neighbouring text strings. Enter text strings settings and input 8 characters from the above text into each of the text strings until completing the sentence.

Text string no.	Text							
	1	2	3	4	5	6	7	8
19 Text 10	M	a	x	i	m	u	m	
20 Text 11	m	a	s	s		c	a	n
21 Text 12	n	o	t		e	x	c	e
22 Text 13	e	d		1	1	.	2	5
23 Text 14	0		g	!				

Example no. 2:

“RADWAG” Balances & Scales

Date:

Hour:

Load mass

*****Signature:.....

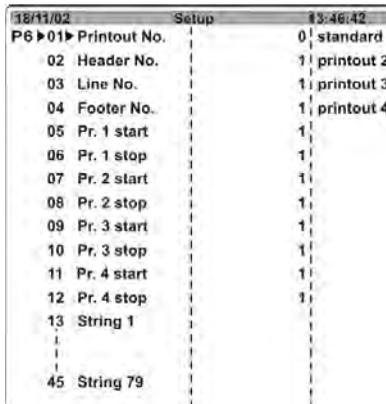
<active working mode >

Enter text strings settings and input 8 characters from the above text into each of the text strings until completing the printout.

Text string no.	Text							
	1	2	3	4	5	6	7	8
25 Text 16	“	R	A	D	W	A	G	“
26 Text 17		B	a	l	a	n	c	e
27 Text 18	s		&		S	c	a	l
28 Text 19	e	s		\	c	D	a	t
29 Text 20	e	:	d	\	c	H	o	U
30 Text 21	r	:	%	t	\	r	\	n
31 Text 22	L	o	a	d		m	a	s
32 Text 23	s	:	%	N	\	c	\	c
33 Text 24	*	*	*	*	*	S	i	g
34 Text 25	n	a	t	u	r	e	:	.
35 Text 26
36 Text 27	.	\	c	*	*	*	%	F
37 Text 28	*	*	*					

Text string selection

Enter group of parameters **P6 Printouts**



Place the cursor next to a selected text string (from string 1 to string 80). od tekst 1 do tekst 80). Press navigating arrow key to enter parameter settings (if the selected field was empty, then the first available space for a character starts flashing. If a text is inserted to a string, then the first character of a line starts flashing).

Principles of inserting texts:

a) Using keys on balance's overlay

	Toggling upwards through all available characters: digits, letters, and signs by one value.
	Toggling downwards through all available characters: digits, letters, and signs by one value.
	Selecting a character for modification by moving the cursor to the RIGHT (the following pressing of the the right arrow key causes activating a character for modification (character is flickering; if no character is inserted, then repeated pressing of this key causes adding a space in the text)
	Selecting a character for modification by moving the cursor to the LEFT (another pressing of the left arrow key causes a erasing a flickering character, and causes flieckering of a character located on the left from the erased one.)
	Accept an inserted character

b) Using computer keyboard PS/2 type

Press **F2** key to enter main menu of a balance. Press **F3** or use navigating arrows to place the cursor next to a group of parameters **P6 Printouts** and by pressing **F2** key enter the submenu group. Then, using the navigating arrows place the cursor next to a desired parameter and press **F2** key to activate text inserting procedure. Use keyboard text keys to insert a **text** into the strings (max 8 characters per one text string) and accept it by pressing **Enter** key. Repeat the process for the other text strings

8.6.4. Printout selection

Enter menu group **P6 Printouts**. Select one of available values for the parameter **P6 01 Printout no.:**

- 0 : standard**
- 1 : printout 1**
- 2 : printout 2**

3 : printout 3

4 : printout 4

On selecting an appropriate value accept it by pressing **ENTER** key.

8.6.5. Enabling non-standard printout templates

Enabling a non standard printout template, e.g. **printout no. 1**:

Enter group of parameters **P6 Printouts**. In a parameter determining printout type **01 Printout no.** enter **1: printout 1** and in parameter **02 printout 1 start** enter the text string of printout start. Available values for start of a non-standard printout: from 1 to 80!

After entering the number of a text string starting a printout, set number of a text string finishing the non-standard printout template:

Enter parameter settings **03 printout 1 stop** and enter the text string of printout stop (end). Available values for start of a non-standard printout: from 1 to 80!

After accepting the selected parameters and returning to a weighing mode with procedure of saving changes each pressing of **PRINT** key causes printing of a declared non-standard printout template.

8.6.6. Non-standard printout templates in drying mode

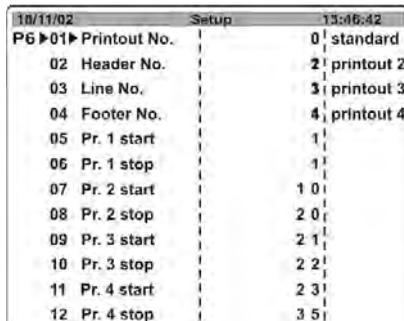
The process of designing non-standard printout templates for drying mode is the same as in case of weighing mode. The only feature of the printout template in drying mode differentiating it from the printout in weighing mode is the need to determine three sections of a printout template (see standard printout in drying mode): **Header, Line** and **Footer**.

An example of determining a printout template for a drying mode:

Header – Printout 2

Line – Printout 3

Footer – Printout 4



The screenshot shows a printer setup menu with the following parameters and values:

Parameter	Value
18/11/02 Setup 13:06:42	
P6 ▶ 01 Printout No.	0 standard
02 Header No.	2 printout 2
03 Line No.	3 printout 3
04 Footer No.	4 printout 4
05 Pr. 1 start	1
06 Pr. 1 stop	1
07 Pr. 2 start	1 0
08 Pr. 2 stop	2 0
09 Pr. 3 start	2 1
10 Pr. 3 stop	2 2
11 Pr. 4 start	2 3
12 Pr. 4 stop	3 5

Printout 2		Printout 3	
22 String 10	D r y i n g _ s	33 String 21	%C%M \ c% N
23 String 11	t a r t \ c D a	34 String 22	\ c \ 0 _ _ _ _
24 String 12	t e : % d \ c T		
25 String 13	i m e : % t \ c		
26 String 14	D r y i n g _ p		
27 String 15	a r a m e t e r		
28 String 16	s . \ c \ c % p		
29 String 17	\ c \ c \ S t a		
30 String 18	r t _ w e i g h		
31 String 19	t : % N \ c \ c		
32 String 20	\ 0 _ _ _ _ _		

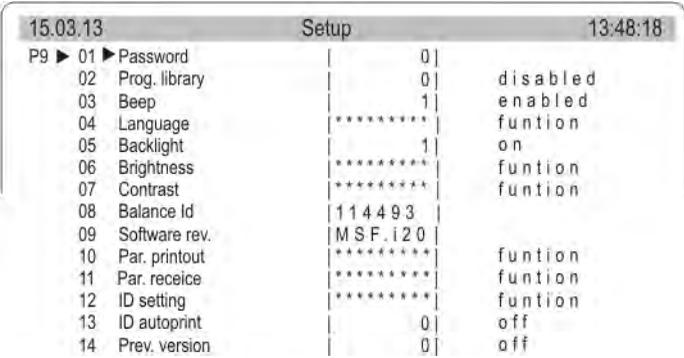
Printout 4	
35 String 23	S t o p _ w e i
36 String 24	g h t : % N \ c
37 String 25	T i m e _ d r y
38 String 26	i n g : % C \ c
39 String 27	\ c F i n a l _
40 String 28	r e s u l t : %
41 String 29	M \ c \ c D r y
42 String 30	i n g _ s t o p
43 String 31	\ c \ c S i g n
44 String 32	a t u r e : . . .
45 String 33
46 String 34	- - - - -
47 String 35	\ c \ 0 _ _ _ _

8.7. Moisture analyzer parameter settings.

Depending on user needs the moisture analyzer enables setting parameters influencing its operation. These parameters are grouped in menu **P7 Other**, for instance: beep sound on pressing a key/button, screen contrast, etc.

8.7.1. Entering menu group P7 Other

Enter submenu group **P7 Other**.



The screenshot shows a menu titled "Setup" with a timestamp of "15.03.13" and "13:48:18". The menu items are as follows:

Item	Value	Status
P9 ▶ 01 ▶ Password	0	
02 Prog. library	0	disabled
03 Beep	1	enabled
04 Language	*****	function
05 Backlight	1	on
06 Brightness	*****	function
07 Contrast	*****	function
08 Balance Id	114493	
09 Software rev.	M.S.F.i20	
10 Par. printout	*****	function
11 Par. receice	*****	function
12 ID setting	*****	function
13 ID autoprint	0	off
14 Prev. version	0	off

8.7.2. Parameter settings

The parameters are set as specified in case of previous menu groups.

01 Password

The password protects the moisture analyzer against making changes in its settings

02 Database of drying programs

Enabling / disabling accessibility of the database of drying programs.

03 Beep sound

Determines whether each pressing of a key/button on balance overlay is confirmed by a beep sound, available settings: YES/NO

04 Language

Selecting language version of software menu, available settings Polish or English

05 Display backlight

Determines whether the backlight of the balance's graphic display should be enabled or disabled (enabling the backlight option improves data visibility on the display)

06 Screen brightness

Enables changing the brightness of the balance's graphic display – entering the function opens a window for setting brightness level using buttons on the balance's overlay

07 Screen contrast

Enables changing the contrast of the balance's graphic display – entering the function opens a window for setting contrast level using buttons on the balance's overlay

08 Balance no.

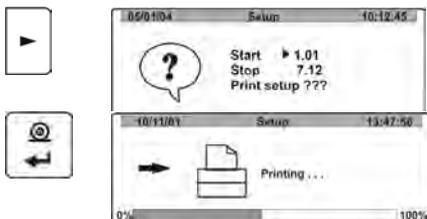
This function serves for information purpose only, and it enables previewing factory number of a balance

09 Software no.

Enables previewing number of software revision operating in a balance

10 Parameter printout

Enabling this function causes printing balance parameters set in the user menu. The user specifies numbers of parameters that should be printed.



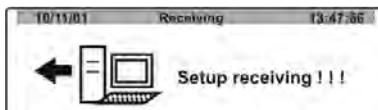
After entering the parameter printout option a window with the following question is displayed

If accepted, the moisture analyzer starts sending current user parameter settings to a connected printer/computer via RS 232 slot.

11 Acquire (upload) parameters

Enabling this function causes uploading all parameters sent via RS 232 interface from a connected computer.

On entering the function the following window is opened:



On completing uploading process the balance informs a user on number of accepted and changed parameters, and number of incorrectly declared parameters which are rejected by the balance.

Printing and uploading balance parameters is a very simple and intuitive means of setting new values of balance parameters. On printing to a file current parameter values on a connected computer, the user can simply and

quickly change parameter values. After saving made changes, the updated file is sent from the computer level to balance's software. On completing of uploading process and saving changes the balance accepts new parameter settings. The procedure requires that a user is familiar with balance parameters and has good knowledge of computers.

12 ID setting

Enables entering codes to moisture analyzer memory

13 Automatic ID Printout

Determines whether a code entered to moisture analyzer's memory should be automatically sent via RS 232 interface.

14. Previous version

The parameter enables functioning of a moisture analyzer as it would be if previous software version was running, i.e. after setting the parameter value to <YES> the moisture analyzer operates the drying process and the drying temperature range similarly to the one specific for the previous software version (in comparable temperature conditions).

The parameter enables using the drying process settings specific for the previous version of this type of moisture analyzers if such are in use of an organization. The parameter of a new moisture analyzer allows an operator to use already determined and verified drying procedures for materials to be tested, as implemented in older devices of the same type.

9. DRYING PROCESS WITH USE OF SHORTENED MENU

This section of the user manual presents the means of carrying a moisture content determining process using the shortened procedures.

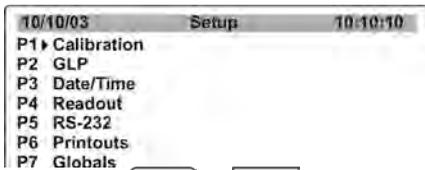
Menu of drying mode enables setting the following parameters:

- Drying mode with its profile (temperature, time)
- Means of drying process finish mode
- Type of displayed measurement result
- Frequency of printing data from a drying process

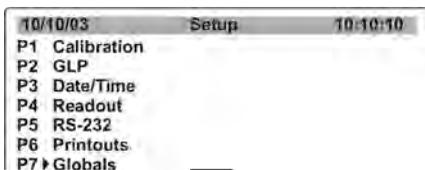
9.1. Enabling shortened menu

In order to start drying process with use of shortened menu, disable access to libraries of drying programs – go to menu group P7 Other, parameter P7 02 Database of drying programs and set it to “0” - disabled).

Database of drying programs disabling procedure:



Press **Setup** key which opens a window with groups of parameters.



Press navigating arrow keys to set the cursor next to a menu group P7 Other.

10/11/01		Setup	13:47:56
P7▶01▶	Password	0!	
02	Prog. library	1 enabled	
03	Beep	1 enabled	
04	Language	1 English	
05	Backlight	1 on	
06	Contrast	***** function	
07	Balance Id	12564	



10/11/01		Setup	13:47:56
P7▶01▶	Password	0!	
02	Prog. library	1 enabled	
03	Beep	1 enabled	
04	Language	1 English	
05	Backlight	1 on	
06	Contrast	***** function	
07	Balance Id	12564	

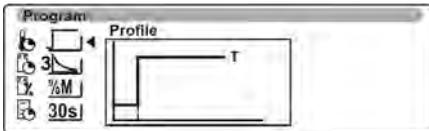
10/11/01		Setup	13:47:56
P7▶01	Password	0!	
02▶	Prog. library	1 disabled	
03	Beep	1 enabled	
04	Language	1 English	
05	Backlight	1 on	
06	Contrast	***** function	
07	Balance Id	12564	

On returning to the main window (with procedure of saving changes) the user can carry out a drying process after setting the basic parameters for drying a sample to be tested. There is no need to select a specific drying program from the database. When setting the parameter Database of drying programs to value 0 – disabled. The user does not have access to the database records saved in the moisture analyzer memory.



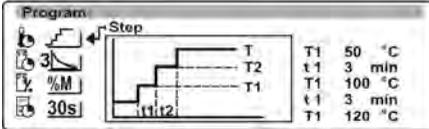
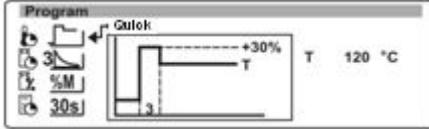
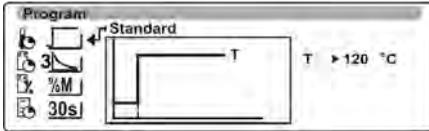
Press **Test menu** key. The software automatically goes to setting the basic drying parameters.

9.2. Means of setting drying parameters:

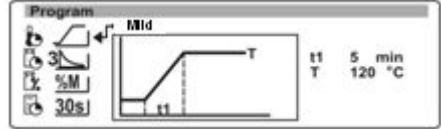


Press **Test Menu** key which opens a window with the first step of the drying parameters of the shortened menu.

Press right arrow navigating key to enable selection of a drying profile (name of a drying mode is previewed above the mode's graphic presentation. The pictogram denoting drying mode selection menu is flashing in the upper left corner of the display)



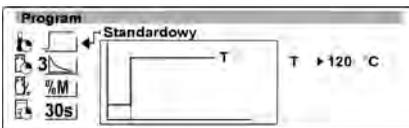
Press UP or DOWN navigating arrow keys to select one of available drying modes: Standard, Quick, Mild or Step.



If selected drying mode is **QUICK**, then set the drying temperature and heating time in temperature exceeded by 30 % than the actual drying temperature. The heating time is calculated from the moment of reaching the set temperature by the moisture analyzer.

If selected drying mode is **STEP**, then set the drying temperatures for thresholds 1 and 2 and the drying temperature and their corresponding time intervals for each of the thresholds. The heating time in each of the thresholds is calculated from the moment of reaching a set temperature in each of the steps.

On selecting appropriate drying mode press the right arrow navigating key to go to the following step of drying mode parameters. Pressing the arrow key causes appearing of a cursor (black triangle) next to the first parameter of selected drying mode (visible on the right hand side of the drying mode graphic presentation).

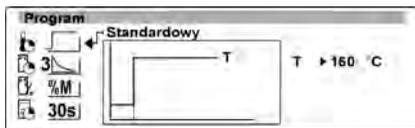




Press right arrow navigating key to change parameter value (the displayed value starts flashing)



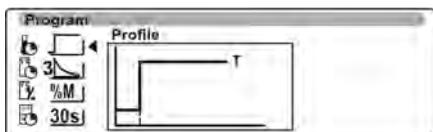
Press UP or DOWN navigating arrow keys to select needed parameter value.



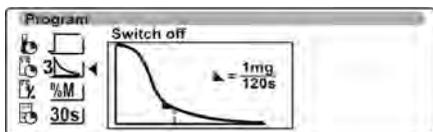
After setting the parameter value accept it by pressing ENTER key (the value stops flashing).



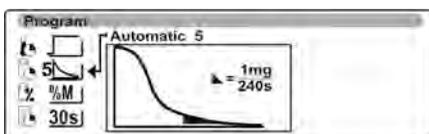
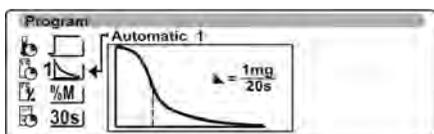
If a Mild or Step drying mode is selected then go to other mode settings. If selected mode is Standard or Quick set the following criteria of a drying process. In order to set other parameters of the drying process press ENTER key. The software returns to displaying the initial window.

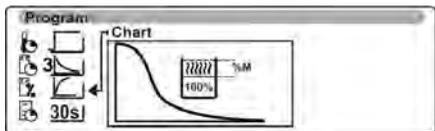
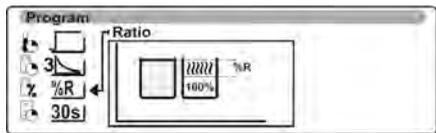
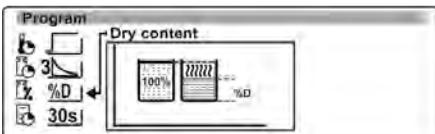
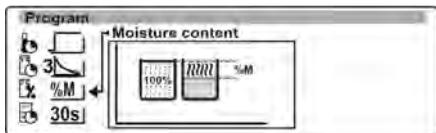
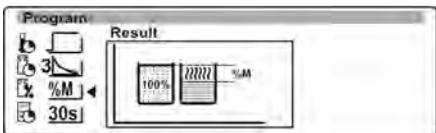
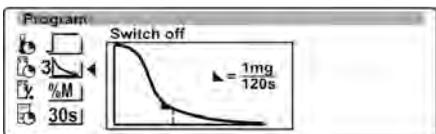
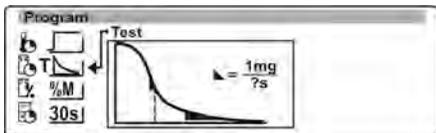
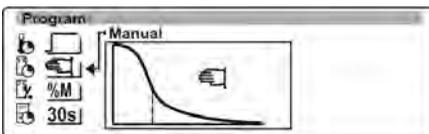
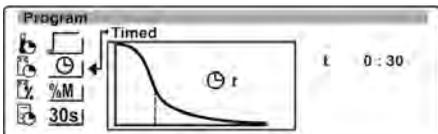
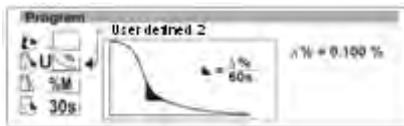
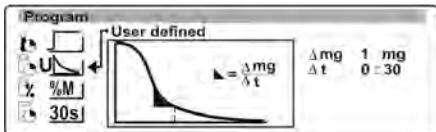


Press DOWN navigating arrow key to go to the following step of drying process determination, i.e. **Finish Mode**.



Use navigating arrow keys (procedure as in case of drying mode selection) to set one of available finish modes and determine its parameters.



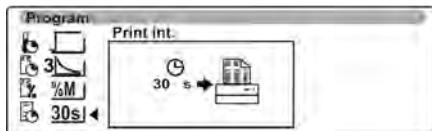
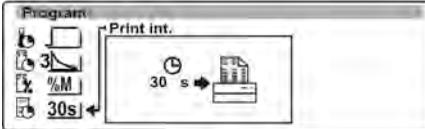
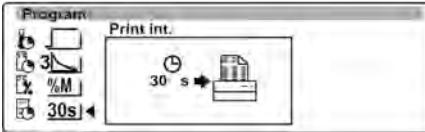
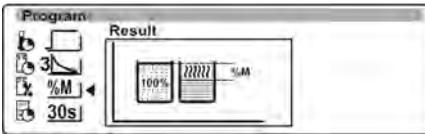
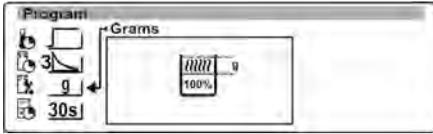


After setting the Finish mode criteria go to setting the following parameters of a drying process.

In order to set other parameters of the drying process press ENTER key. The software returns to displaying the initial window.

Press DOWN navigating arrow key to go to the following step of drying process determination, i.e. **Result**.

Use navigating arrow keys (procedure as in case of drying mode selection) to set the type of displayed measurement result.

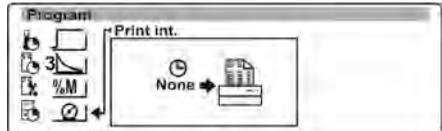


After setting the Result criterion go to setting the following parameters of a drying process.

In order to set other parameters of the drying process press ENTER key. The software returns to displaying the initial window.

Press DOWN navigating arrow key to go to the following step of drying process determination, i.e. **Printout Interval**.

The printout interval is a period of time measured in seconds in which a moisture analyzers sends current measurement result to a connected peripheral device.

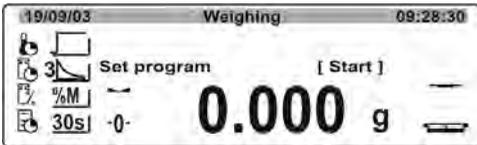


After setting the printout interval criterion the moisture analyzer is ready to start drying process of a sample to be tested.

In order to finish setting the drying mode parameters and go to the humidity content determining process press ENTER key. The software returns to displaying the initial window.



Once more press ENTER key. The software does to displaying the main window in a level which enables determining humidity content of a sample to be tested.



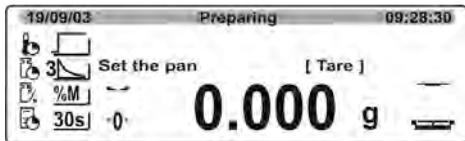
9.3. Means of drying process according to parameters set in the shortened menu



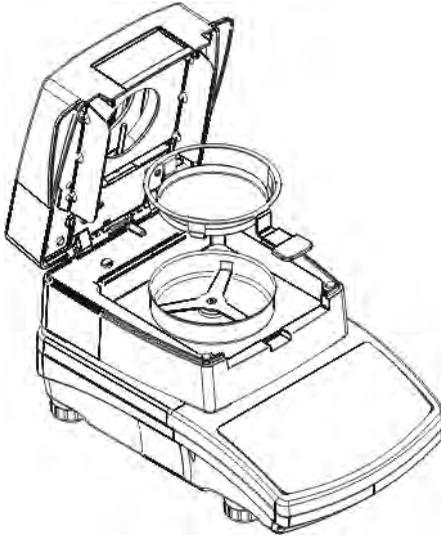
The left side of the display presents selected pictograms with set criteria of the drying process.



In order to start the drying process press Start/Stop button. The software will display the following commands aiding moisture analyzer operation. Follow the commands to ensure correct sample preparation and carrying out of the humidity content determining process of a sample to be tested.

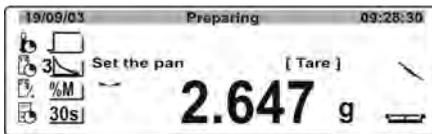


The software displays a command to prepare moisture analyzer's drying pan.

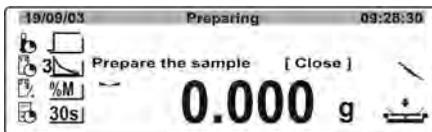


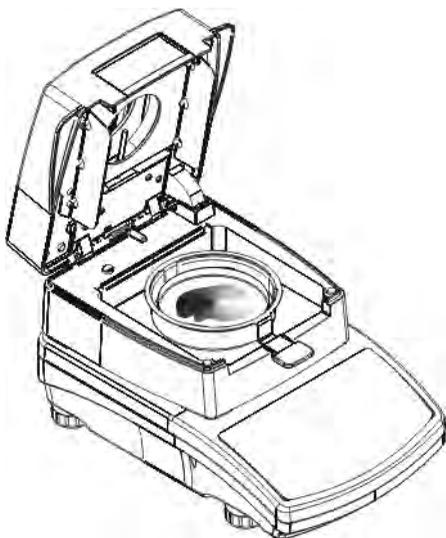
Place the disposable drying pan in its intended holder and place the assembly on the cross-shaped support. The display indicates mass of a fitted drying pan.

In order to ensure stable measurement conditions it is recommended to close the moisture analyzer's lid before tarring mass of the drying pan.

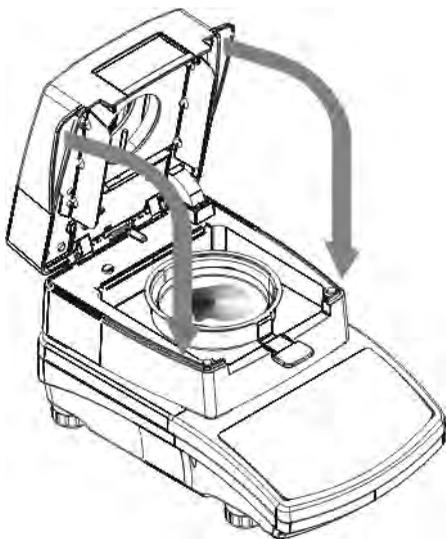
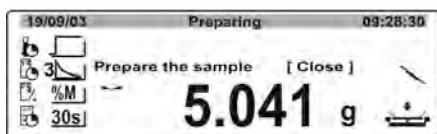


Press ZERO/TARE button to tare mass of the drying pan to moisture analyzer memory. Mass indication on the display returns to ZERO and the following command appears.

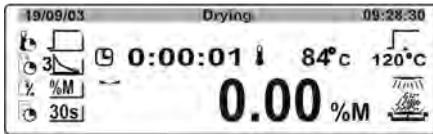




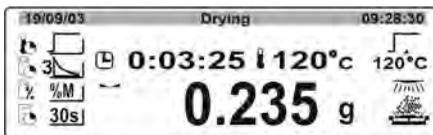
Place a sample to be tested on the drying pan. Mass of a sample should be selected according to previously conducted experiments and features of the tested substance.



After stabilization of the indication (followed by appearing of a stability pictogram on the display) close the moisture analyzer's lid. The software automatically initiates drying of a tested sample.



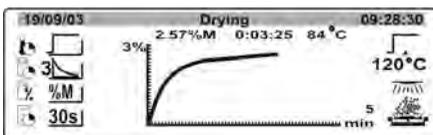
The indications on the display change and indicate data on conducted process. The moisture analyzer automatically carries out the drying process with drying parameters as set in the drying criteria. The instrument automatically conducts all needed mass measurement and calculating processes resulting from changes mass of the tested sample. At the beginning of the drying process the moisture analyzer sends via the RS 232 communication port a **header** (in accordance with pre-determined printout options – see group of parameters P6 Printouts).



During the drying process the data visible on the display is updated and indicate current measurement result (i.e. test time, temperature in the drying chamber, etc.).

Also, during the drying process the moisture analyzer automatically sends data, via the RS 232 communication port, printed in the **line** (in accordance with pre-determined printout options – see group of parameters P6 Printouts) in pre-set time intervals.

Display



DISPLAY button on moisture analyzer's overlay enables switching between types of measurement result.

After completing the drying process the moisture analyzer displays a summary from the testing procedure and locks indication with final humidity content on the display.



Additionally, the moisture analyzer automatically sends data, via the RS 232 communication port, printed in the **footer** (in accordance with pre-determined printout options – see group of parameters P6 Printouts).

10. DRYING PROCESS WITH USE OF DRYING PROGRAM LIBRARY

This section of the user manual specifies in details the procedures for determining a new drying procedure saved in the memory of the moisture analyzer MAX series.. Each drying procedure contains:

- name
- Profile (drying mode)
- Drying temperature
- Finish mode
- Type of displayed result
- Printout interval of data from a drying process
- Sample size
- Corrective coefficient

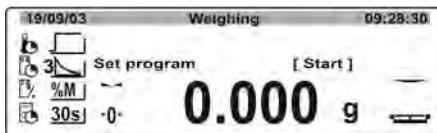
10.1. Defining a drying procedure

Use of the databases of drying programs while defining a drying process requires that they are enabled in the user menu. Go to group of parameters P7 Other, parameter P7 02 Database of drying programs (set parameter value to "1").

Means of enabling / disabling the parameter is described in point 8.7.2 of this user manual.

Before starting to operate the database of drying programs it is necessary to upload moisture analyzer memory with data on testing procedures to be carried out.

Means of setting data in the drying procedures:



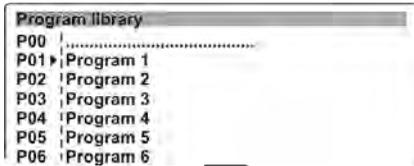
Press **TEST MENU** key which opens a window with list saved drying procedures saved in the MAX memory.

CAUTION:

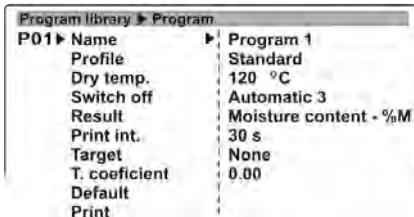
Entry P00 previews the last used drying program, or a drying program selected for drying.

Press UP or DOWN navigating arrow keys to set the cursor next to a drying program entry to be filled

with data.



Press RIGHT arrow navigating key to open an entry with data on drying program.



The opened window contains data saved in the selected drying program.

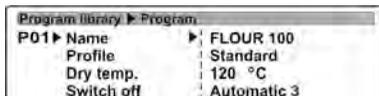
Following the means of moving in the user menu and carrying out changes set required parameters for a drying program. The parameters need to be set in a way to ensure correct performance of the drying process and obtaining of the measurement results.

10.2. Entering name of a drying program

Program name is used for quick identification of a drying procedure, and it may contain name of the dried product. The name can comprise of maximum 12 alphanumeric characters.

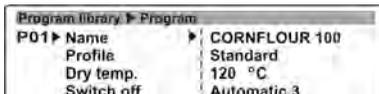
Specifying the name of the dried product considerably aids identifying and using the saved drying programs with respect to the material to be tested.

Means of entering product name:



Software structure of the moisture analyzer MAX series enables modifying a parameter which is activated by placed a cursor (black triangle) next to its name (value).

Pressing RIGHT arrow navigating key causes activating a field for editing the name. The first character of the name starts flashing.



Use moisture analyzer's keyboard or an external computer keyboard PS/2 type to enter a new name of the drying program (e.g. name of a material to be dried). Entering a new character causes erasing the flashing character.



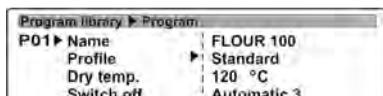
After entering the new name accept it by pressing ENTER key. The last entered character stops flashing.

After accepting the newly entered name go to setting another parameters of the drying program.

10.3. Drying mode selection

The moisture analyzer MAX series enables selecting one of four available drying modes: Standard, Quick, Mild, Step. Each mode is combined with its corresponding parameters, i.e.: drying temperature and time interval needed to reach set drying temperature. The selected drying mode should be adequate to the type of material to be tested. Selecting a drying mode to a sample to be tested is specified further in this user manual.

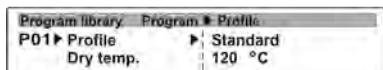
Means of selecting a drying mode:



Go to user menu. Use DOWN arrow navigating key to place the cursor (black triangle) next to a parameter **Profile**.



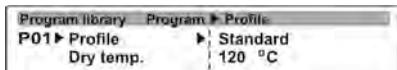
Press RIGHT arrow navigating key to go to the following window of drying mode selecting process.



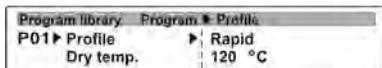
Use moisture analyzer's keyboard or an external computer keyboard PS/2 type to select a drying mode to be used with the drying program.



After selecting needed drying mode set other parameters specific for a selected drying mode – drying temperature and time intervals in which the drying temperature should be reached.

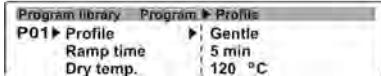


In case of the drying mode: **Standard** set drying temperature.

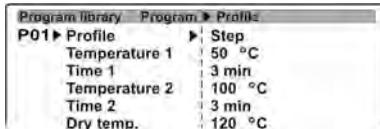


Set drying temperature for drying mode **Quick** and the heating time in the temperature which exceeds the default value by 30 %. The heating time is calculated from the moment of reaching

the set temperature by the moisture analyzer



Set drying temperature for drying mode **Mild** and time in which the moisture analyzer should reach the set temperature value.



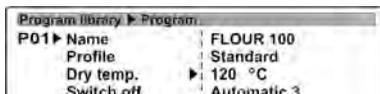
In **Step** profile set the drying temperatures for thresholds 1 and 2 and the drying temperature and their corresponding time intervals for each of the thresholds. The heating time in each of the thresholds is calculated from the moment of reaching a set temperature in each of the steps..

After setting the drying mode and the drying parameters go to programming of another software parameters.

10.4. Drying temperature setting

The drying temperature is a repetition of a parameter given in **Drying mode** settings.

Procedure:



Go to software menu. Use DOWN navigating arrow key to place the cursor (black triangle) next to a parameter **Drying temperature**.

Use function keys on moisture analyzer keyboard, or an external computer keyboard, to set needed temperature value. Set the temperature value in accordance with above specified means of moving in the user menu.

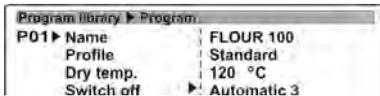
After setting and saving the new temperature value, it is also set to a drying mode.

10.5. Finish mode settings

Finishing of a drying mode can be carried out as:

- Automatic 1 (change ratio 1mg/10s)
- Automatic 2 (change ratio 1mg/25s)
- Automatic 3 (change ratio 1mg/60s)
- Automatic 4 (change ratio 1mg/90s)
- Automatic 5 (change ratio 1mg/120s)
- Time defined (max. time value 99h : 59min.)
- Manual (on pressing a button)
- Custom (a user should specify change in mass Δm 0,1-9,9mg over time Δt max 2,55sec.
- Custom 2 (a user should specify change of humidity value $\Delta \%M$ over time 60s)
- Test (intended to select the finish-mode criterion for a tested sample)

Procedure:



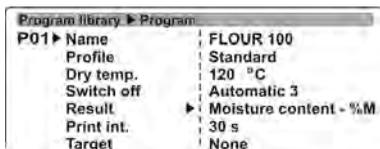
Go to menu. Use DOWN navigating arrow key to place the cursor (black triangle) next to a parameter **Finish mode**.

The criteria on available settings are described in point ref. to “shortened drying menu” (see point 9.2).

10.6. Setting the type of displayed and printed measurement result

Depending on user needs, the moisture analyzer MAX series enables setting the type of displayed and printed result of a drying process. The user can select between four available settings: %M, %D, %R, g.

Procedure:



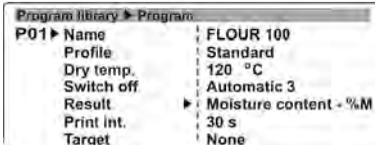
Go to software menu. Use DOWN navigating arrow key to place the cursor (black triangle) next to a parameter **Result**.

If option “**Chart**” is enabled, then the printed result is **%M**.

10.7. Setting printout interval

This parameter determines the interval of sending a measurement result on humidity content of a tested sample.

Procedure:



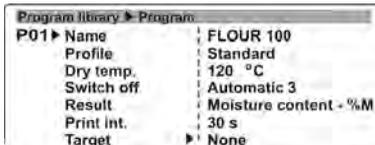
Go to software menu. Use DOWN navigating arrow key to place the cursor (black triangle) next to a parameter **Printout interval**.

If option “Chart” is enabled, then the printed result is **%M**.

10.8. Setting size of a sample to be tested

The parameter determines the need to use a sample of specific mass. The user can select one of three available options: None, Obligatory, Optional.

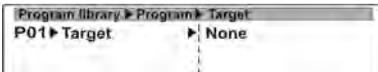
Procedure:



Go to software menu. Use DOWN navigating arrow key to place the cursor (black triangle) next to a parameter **Sample**.

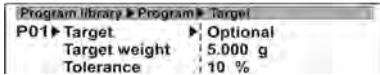


Press RIGHT arrow navigating key to enter the field for selecting one of available options.



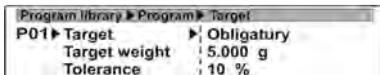
Use function keys on moisture analyzer keyboard, or an external computer keyboard. Set the sample mass value in accordance with above specified means of moving in the user menu. After setting and saving data on a mass of a sample to be tested, set another parameters on a drying process, i.e. on temperature and finish mode, as required by enabled drying mode.





In case option **Optional** is enabled the user has to enter required sample mass and tolerance value for the material to be weighed / dried.

If sample mass option is enabled, the moisture analyzer displays prompts for the user on placing a required size of a sample to be tested on the drying pan. If a user needs to dry a sample with different mass, then drying process can be started even if the mass does not comply with set parameter criterion.



In case option **Obligatory**, is enabled the user has to enter required sample mass and tolerance value for the material to be weighed / dried.

After selecting this option, the moisture analyzer displays prompts for the user on placing a required size of a sample to be tested on the drying pan. In Mandatory option the drying process will not start unless the mass of a sample to be tested complies with the parameter settings.

10.9. Setting a corrective coefficient

Coefficient correcting drying temperature

Materials of dark colours are affected by the phenomenon of heat absorption. In such case the tested sample can be overheated, i.e. when drying a dark coloured sample in a temperature 120 °C, the sample may absorb heat and heat up to approximately 135 °C. Therefore, it is necessary to determine the coefficient correcting the drying temperature. The process requires using a control thermometer with a probe (available as accessories for the moisture analyzer).

Means of determining the corrective coefficient:

1. Program all parameters of a drying process.
2. Spread evenly a sample to be tested on the drying pan and start drying process.
3. On completion of the drying process note down the drying time
4. Prepare another sample of the same material and spread it evenly on the drying pan. Prepare a thicker layer of the sample to be tested.
5. Insert the probe of the control thermometer into the tested sample, press ON/OFF button on the control thermometer
6. Start drying process
7. Monitor the temperature values displayed on the moisture analyzer and the control thermometer
8. After the time value specified for the first tested sample check both of the temperature values.
9. Calculate the corrective coefficient using an equation:

$$T_{\text{measured}} - T_{\text{set}}$$

$$T_{\text{set}}$$

Procedure:



Program library ▶ Program	
P01 ▶ Name	Program 1
Profile	Standard
Dry temp.	120 °C
Switch off	Automatic 3
Result	Moisture content - %M
Print int.	30 s
Target	None
T. coefficient	▶ 0.00
Default	
Print	

Go to software menu. Use DOWN navigating arrow key to place the cursor (black triangle) next to a parameter **Corrective Coefficient**.

Use function keys on moisture analyzer keyboard, or an external computer keyboard, to set needed coefficient value. Set the coefficient value in accordance with above specified means of moving in the user menu.

10.10. Restore default setting

The parameter enables restoring the default software settings, as determined by the software designer.

Procedure:

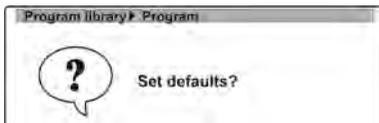


Program library ▶ Program	
P01 ▶ Name	Program 1
Profile	Standard
Dry temp.	120 °C
Switch off	Automatic 3
Result	Moisture content - %M
Print int.	30 s
Target	None
T. coefficient	0.00
Default	▶
Print	

Go to software menu. Use DOWN navigating arrow key to place the cursor (black triangle) next to a parameter **Default**.



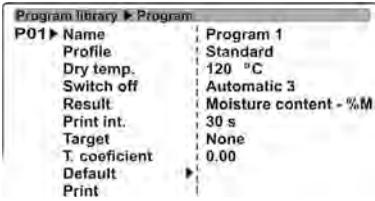
Press RIGHT arrow navigating key to display a message for accepting the restoration of default settings.



Press **ENTER** key to restore default value of all parameters in a moisture analyzer, as programmed by the software designer.



On restoring the default parameters the software moves back to the previous window.

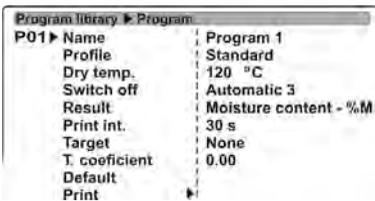


Pressing **Esc** key abandons restoring of the default parameter. The software returns to previous window without saving changes.

10.11. Printout of software settings

The parameter enables printing all current drying mode settings on a connected printer.

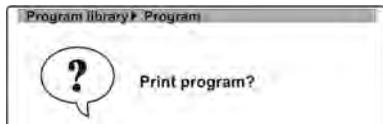
Procedure:



Go to software menu. Use DOWN navigating arrow key to place the cursor (black triangle) next to a parameter **Print**.



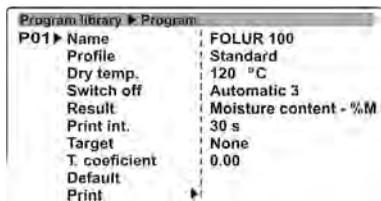
Press **RIGHT** arrow navigating key causes displaying a message to confirm printout of parameters.



Press **ENTER** key to accept the process. The moisture analyzer sends data on drying mode parameter values to a connected printer, and returns to the previous window.

----- Software parameters -----

Software no.: 1
Name: Wheat flour 100
Drying mode: Standard
Drying temperature: 120 °C
Finish mode: Automatic 3
Result: Humidity content %M
Printout interval: 30 s
Sample control: No
Corrective coef.: 0.00

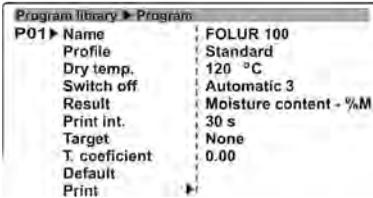


Pressing **Esc** key abandons printing of drying mode settings. The software returns to previous window without saving changes.

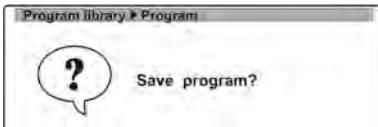
10.12. Saving drying mode settings in moisture analyzer's permanent memory

When determining parameters of a drying mode, all the settings are saved in the moisture analyzer's volatile memory. Permanent saving of the settings requires returning to the main window with procedure of saving changes.

Procedure:



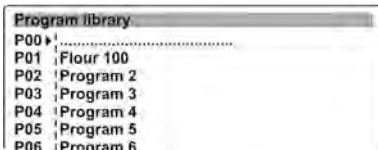
Press **Esc** key.



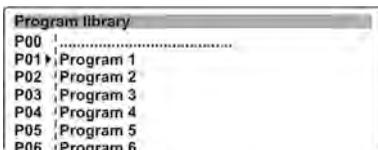
The software displays a question on saving the drying parameters.



Pressing **ENTER** key causes saving the changes and displaying a window with the library of the drying programs.



Pressing **Esc** key causes returning to displaying the library of drying programs without saving the changes.



11. TESTING PROCEDURE USING A DRYING PROGRAM FROM THE LIBRARY OF DRYING PROGRAMS

A moisture analyzer MAX series enables carrying out a drying process using programs saved in the library of drying programs. This means of using the device considerably speeds up the preparation for a testing process, as all the parameters on drying process of a material are already determined in the program, i.e. the drying parameters are not set each time before starting a testing procedure of a material.

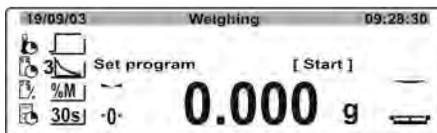
The user is able to quickly select a drying program for a substance to be tested from the library. The program contains all drying parameters for the sample to be tested. On changing the drying program, the parameters for a drying process also change.

CAUTION:

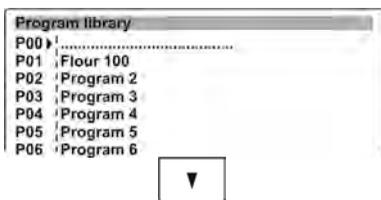
In order to enable the libraries of drying programs in the user menu, go to menu group P7 Other, parameter P7 02 Library of drying programs and set it to value "1" – i.e. enabled).

The means of enabling the parameter is described in details in point 8 of this user manual.

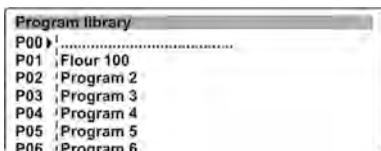
Procedure:



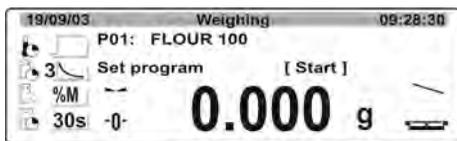
Press **Test Menu** button.



The software displays list of available drying programs.



Use UP and DOWN navigating arrow keys to set the cursor (black triangle) next to a drying program intended for testing a sample.



Press **ENTER** key to return to the main window. The moisture analyzer is ready to start testing procedure with programmed drying parameters.

The upper bar of the display indicates name of the selected drying program and its number from the library of drying programs. On the left side of the display there are pictograms indicating pre-set values of drying parameters (i.e. drying mode, temperature, finish mode, etc.).

The next steps of the drying process are the same as in case of drying process using a shortened menu (see *point 9.3. of this user manual*).

12. SAMPLE PREPARATION FOR A DRYING PROCESS

This section of the user manual presents data on obtaining optimum measurement results from drying a sample to be tested. It lists the principles of selecting drying parameters in relation to a material to be tested.

12.1. Principles of humidity content determination in a moisture analyzer

Measurement of moisture content in a tested sample is carried out by determining loss of mass in a sample by its heating (humidity evaporation from a sample).

RADWAG moisture analyzer comprises two components: a precision balance and a drying chamber. Compared to standard moisture content determining methods, the measurements with application of RADWAG moisture analyzer is much quicker and does not require additional mathematical calculations (a result of moisture content is previewed on an ongoing basis during product testing process).

Independently on moisture content determining method, the measurement accuracy is highly influenced by means of sample preparation and selection of testing parameters, such as:

- Sample size
- Sample type
- Drying temperature
- Drying time

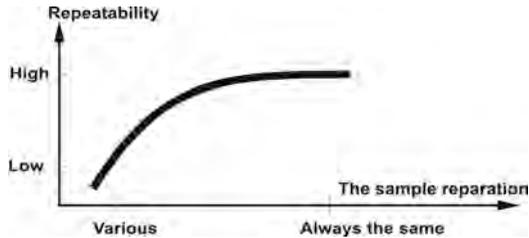
In practice, the measurement accuracy is not as important as the speed of obtaining measurement result (control over technological process). Thus, heating a sample (with application of a halogen filament) carried out by a moisture analyzer, makes the measurement process very time efficient and short. Measurement speed can be additionally increased by appropriate adjusting moisture analyzer's parameters depending on substances to be tested.

Optimum **temperature** and **drying time** depend on type and size of a sample to be tested, and anticipated measuring accuracy. **Selection of drying parameters can only be carried out on basis of test measurements.**

12.2. Sampling and preparation

Features, preparation and size of a sample are very important factors influencing the speed and accuracy of measurement process.

Means of sampling and preparation are extremely important for repeatability of measurement results, as a sample should be a representative part of tested substance.



Final measurement result is vastly conditioned by precise and considered sample preparation. A sample used for analysis has to represent the total structure of tested material. Sampling process should determine: sampling means, sample disintegrating, particle size after disintegration, sample uniformity and other. The sampling process should be carried out as quickly as possible, so that a sample does not loose or absorb humidity from surrounding area.

Applied sampling standards should match individual user needs and requirements of tested material, its consistence and sample size.

Number of samples

Increasing number of tested samples also increases statistic measurement certainty. Number of samples depends on uniformity of tested material , its purity, accuracy of applied measuring method and anticipated accuracy of obtained results.

Material mechanical disintegrating for measurements

Applied disintegrating method should be selected appropriately to tested material. Substances that are hard and brittle (crisp) can be disintegrated by cutting. Grinding such substances may cause their heating and thus humidity vaporization, resulting in unreliable measurement results. Unless a substance can be prepared for measurement otherwise than grinding, any possible moisture content loss should be calculated.

Use of high-silica sand

Ensuring optimum substance drying requires that a sample has the largest possible surface for moisture content vaporization. Test results of moisture content in substance which surface has a form of a shell (e.g. glucose syrup) or doughy (e.g. butter), can be much more reliable if a sample is mixed with a dried high-silica sand (improvement of measurement accuracy and repeatability).

When testing a substance by mixing it with high-silica sand it is recommended to use a disposable drying pan with higher edges due to larger volume of a sample to be tested).

Grease in a form of paste or melting substances

Such substance requires testing with use of a filter made of glass fiber, which considerably increases active evaporation surface by separating the substance between the fiber. Initial filter drying is necessary only in case of measurements which require very high accuracy.

Liquid substances

It refers to liquid substances, which by creation of drops on their surface, caused by surface tension, may render difficulties in drying process. In such cases, it is proved to use a glass fiber filter to shorten measurement time. The filter causes separating tested liquid around the fibers, and increasing active evaporating surface. Initial filter drying is necessary only in case of measurements which require very high accuracy.

Substances with structure of leather or temperature sensitive

In case of such substances it is proved to a glass fibre filter. While testing, a substance is placed on a drying pan, and sample surface is covered with a filter, which protects the sample from direct heat radiation. In such case, the sample is heated by convection (which is milder than radiation).

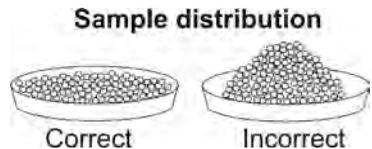
Substances containing sugar

The surface of such substances often may caramelize during testing procedure. Therefore, it is recommended to use thin layer of a sample, and moderate drying temperature.

Sample distribution on drying pan:

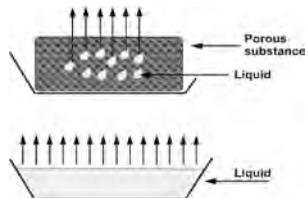
Loose materials

Dried in their natural state, i.e. in their natural form or disintegrated. Sample disintegration causes smaller dispersion between the following measurements. Sample mass should not be too high, and the sample should be evenly spread on whole surface of the drying pan.



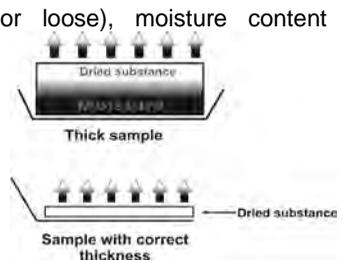
Liquid substances

Semi-fluid substances are dried in their natural form. Large amount of grease (fat) occurring in some of substances make moisture content determination difficult. In such case it is recommended to use additional components, which increase sample's active surface and aid moisture content releasing process from a sample. such components are high silica sand, blotting paper or filter. Before drying a tested substance, initially dry the additional component, so that its humidity is close to zero.



Solid objects

Depending on solid object's structure (dense or loose), moisture content determining process may take short or long time. The size of solid's surface determines the speed of drying process, and measurement reliability. Thus, the surface of a solid object should be as large as possible. Since solid objects release moisture through their outer surface, sample thickness is another important factor.

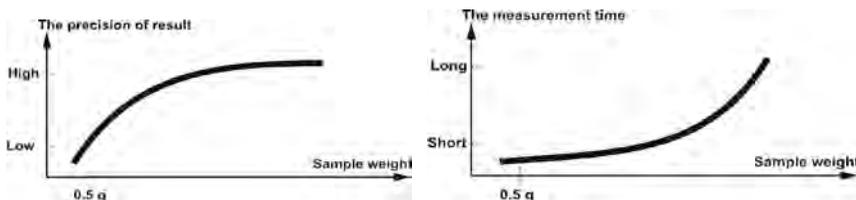


13. SELECTION OF DRYING PARAMETERS

13.1. Selecting optimum sample mass

Sample mass influences the accuracy of measurement result and measurement time. Higher mass of a sample, causes higher amount of water (moisture content) which needs to evaporate, and therefore measurement time is also longer.

Obtaining short measurement time is feasible in case of small sample mass, but sample mass cannot be too small, as it may negatively influence required measurement accuracy.



13.2. Influence of sample mass on measurement result repeatability

Sample mass has considerable influence on repeatability of measurement results obtained on a moisture analyzer. Relation between sample mass and repeatability is presented in below table.

Sample mass	Repeatability
to 2g	$\pm 0,24\%$
to 10g	$\pm 0,06\%$
over 10g	$\pm 0,04\%$

Data provided in the above table refer to a ideal and uniform sample, and an assumption, that moisture content has completely evaporated from tested sample during testing process, and the sample has not decomposed (e.g. humid high-silica sand).

Measurement results are always subject to uncertainty related to a sample and repeatability of used moisture analyzer. In practice, it means that obtained measurement result may exceed repeatability values provided above.

13.3. Drying temperature

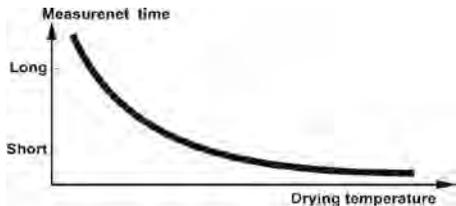
Drying temperature has the largest impact on drying time. Temperature value depends on type of dried substance. Too low drying temperature causes too low moisture content evaporation (under-dried sample), and consequently unnecessary extending of measurement

time. Too high drying temperature causes burning of dried sample (sample overheating, chemical decomposition). Drying temperature of traditional method (using a furnace) is specified in applicable industry or company standards. Unless standards apply, then temperature should be adjusted by tests.

On selecting the value of drying temperature, use the following procedure:

- Determine moisture content in a sample
- Determine temperature of substance chemical decomposition by tests
- Compare result obtained on a moisture analyzer with the one of traditional method

When drying a sample with high humidity content, it is possible to shorten measurement time by selecting “Step” or “Quick” drying mode. In such case, the majority of moisture content is released when drying temperature higher than set. Only after some time, the temperature is lowered to the set value, and maintained until completing drying process.



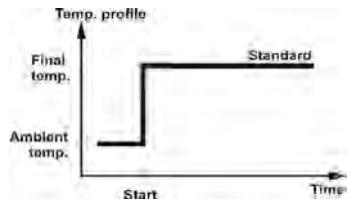
13.4. Selecting a drying mode

The software of moisture analyzer MAX series enables selecting one of four drying modes:

- Standard
- Quick
- Mild
- Step

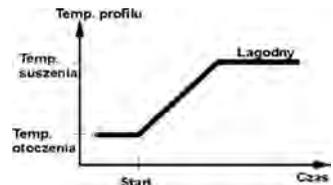
STANDARD mode

Standard mode is the most frequently used of all drying modes. It enables accurate determining of moisture content in a dried sample.



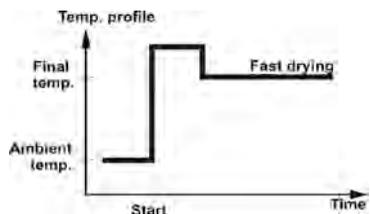
MILD mode

Mild mode is used in case of drying substances that are sensitive to rapid heat emitted by filaments operating at full power in the initial stage of drying process. This mode prevents from decomposing of substances sensitive to heat by mild temperature increase in set amount of time (time interval has to be selected by tests). Mild mode is recommended to drying samples of leather structure.



QUICK mode

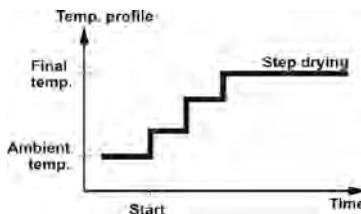
Quick mode is recommended to drying samples that moisture content varies from 5%, and 15%. In the initial stage of Quick mode, heating takes place at full power of the filaments, causing heating the drying chamber to increased temperature (maximum temperature value is higher by 30 % from set drying



temperature). Overheating compensates heat loss during evaporation of large moisture content in the test's initial stage.

STEP mode

Enables determining up to three steps with random drying temperature. Step mode is recommended for drying substances with moisture content over 15%. Temperature and heating time in each step have to be adjusted by tests.



13.5. Selecting drying time

Drying time is set by selecting one of available finish mode criteria. This means that a moisture analyzer must meet pre-set criterion (requirement) (mass over time, time) to automatically finish the drying mode.

Finish of drying process can occur on elapsing defined amount of time, independently on loss in mass. This criterion is used for substances that may decompose during drying process, and their mass does not reach constant value.

The second criterion is loss in mass (less than 1 mg) in defined amount of time.

Automatic finish mode (Auto switch off mode)

The moisture analyzer MAX series enables selecting between various types of finish modes:

- Automatic 1 (change 1mg/10s)
- Automatic 2 (change 1mg/25s)
- Automatic 3 (change 1mg/60s)
- Automatic 4 (change 1mg/90s)
- Automatic 5 (change 1mg/120s)
- Time defined (maximum drying time 99 hours 59 minutes)
- Manual (on pressing a function key)
- User defined 1 (set mass change ratio - User defined 2 (set moisture content change ratio - Test (enables adjusting finish mode parameters to a tested sample)

Automatic finish mode – user defined criterion (mass/time)

The operator determines the limit value for loss of mass and time in which the loss of mass must not exceed a pre-set value. As the moisture analyzer reaches the set criterion it automatically finishes the measurement (drying process).

Manual finish mode

An operator ends drying process manually by pressing START/STOP button on moisture analyzer's display.

Time defined finish mode

Drying process finish takes place on elapsing a set amount of time, independently on measurement result.

13.6. Drying mode analysis

In the first case the drying mode is an asymptote. The humidity content in a sample reaches a constant and it does not change after long drying time. Using this drying mode enables easy obtaining of repeatable humidity content in a tested sample.

The measurement result refers specifically to the constant asymptote value. It easily corresponds and it is simple to determine appropriate finish mode criterion.

The other type of drying mode in its initial stage is carried out rapidly, and later on it slows down. Humidity content never reaches a constant value. The drying mode in this case may form in the following way:

The sample demonstrates thermal decomposition. The decomposing is sample (product) evaporation, and the sample loses weight. The fat, oil, plastics and other volatile ingredients may cause slower evaporation process than in case of water. The ingredients that evaporate hard cause decreasing of sample mass.

The measurement result using this drying mode can be optimistic:

- Decreasing temperature may slow down ingredients' reaction.
- Selecting an appropriate finish mode criterion may enable detecting an end of the analysis in the described drying point.
- Selecting a constant drying process often ensures very good results.
- Permanent maintaining initial mass of a sample to be tested (+10%....+20%).

14. COOPERATION WITH A PRINTER OR A COMPUTER



Each pressing of < **PRINT** > key causes sending to a connected printer or computer a signal corresponding to current mass indication (display status) with enabled measuring unit. The default baud rate setting of a balance is 9600 bit/sec. If a peripheral device (a printer or a computer) requires other baud rate settings then it needs to be changed in the moisture analyzer's menu (see point 13 of this user manual).

14.1. Connecting cables

A balance: slot DB 9/F – a KAFKA printer: slot WM 560

3 (TxD)	1 (RxD)
5 (GND)	3 (GND)
7- 8 shorted	

A balance: slot DB 9/F – a computer: slot DB 9/F (if handshake is disabled)

2 (RxD)	3 (TxD)
3 (TxD)	2 (RxD)
5 (GND)	5 (GND)
4 - 6 shorted	4 - 6 shorted
7- 8 shorted	7 - 8 shorted

A balance: slot DB 9/F – a computer: slot DB 9/F (if handshake is enabled)

2 (RxD)	3 (TxD)
3 (TxD)	2 (RxD)
4 (DTR)	4
5 (GND)	5 (GND)
6 (Tara)	6
7 (RTS)	7 (CTS)
8 (CTS)	8 (RTS)
9 (Print)	9

A balance: slot DB 9/F – a computer: slot DB 25/F

2 (RxD)	2 (TxD)
3 (TxD)	3 (RxD)
5 (GND)	7 (GND)
7 - 8 shorted	4 - 5 shorted
	6 - 20 shorted

15. LIST OF COMMANDS COMPUTER - BALANCE

Function Command	INTERFACE RESET R CR LF (zeroing currently carried out commands, restoring factory default settings)
Function Command	SEND ALL IMPLEMENTED COMMANDS PC CR LF (sends information on all commands implemented in the balance's software)
Function Command	SEND MEASUREMENT RESULT IN BASIC MEASURING UNIT S CR LF (sends result in basic measuring unit on stabilization of indication)
Function Command	IMMEDIATELY SEND MEASUREMENT RESULT IN BASIC MEASURING UNIT SI CR LF (immediately sends result in basic measuring unit)
Function Command	SEND MEASUREMENT RESULT IN CURRENT MEASURING UNIT SU CR LF (sends result in current measuring unit on stabilization of indication)
Function Command	IMMEDIATELY SEND MEASUREMENT RESULT IN CURRENT MEASURING UNIT SUI CR LF (immediately sends result in current measuring unit)
Function Command	ZERO BALANCE Z CR LF (zero balance on stabilization of indication)
Function Command	IMMEDIATELY ZERO BALANCE ZI CR LF (zero balance immediately on sending the command , if possible at the moment)
Function Command	TARE WHEN STABLE T CR LF (tarring balance on stabilization of indication)
Function Command	IMMEDIATELY TARE BALANCE TI CR LF (tare balance immediately on sending the command , if possible at the moment)
Function Command	GIVE FACTORY NUMBER NB CR LF (sends factory number of a balance)
Function Command	GIVE MEASURING RANGE FS CR LF (sends maximum measuring range (maximum capacity of a balance in basic measuring unit)

Function Command	GIVE SOFTWARE REVISION RV CR LF (sends software name)
Function Command	GIVE OR CHANGE DATE IN A BALANCE PD CR LF (causes sending data on set date or changes the date)
Function Command	GIVE OR CHANGE TIME IN A BALANCE PD CR LF (causes sending data on set time or changes the time)
Function Command	GIVE ENABLED WORKING MODE PM CR LF (causes sending by a balance a code of enabled working mode)
Function Command	SEND SETUP PS CR LF (causes sending the complete setup - parameter printout)
Function Command	“BEEP” SOUND B CR LF (causes immediate activating of beep sound in a balance)
Function Command	GIVE LAST CODE ERROR ER CR LF (causes sending code of last saved error in a balance)
Function Command	DISABLE AUTOZERO A0 CR LF (causes disabling (switching off) autozero operation)
Function Command	ENABLE AUTOZERO A1 CR LF (causes enabling (switching on) autozero operation)

Caution!

If a non-existing or incorrect command finished with CR LF is sent to a balance, it responses with **E S CR LF**. Spaces between characters should be omitted, as they are added only for the purpose of proper legibility.

16. USER GUIDELINES

The measurement of relative humidity content of materials to be tested using a moisture analyzer MAX series is much shorter and simpler if compared to a traditional method (weighing – drying – weighing – calculating). It is necessary to remember that it is **a different measurement method**, this requires an individual selection of drying parameters to each dried substance, such as:

- Drying temperature,
- Sample mass,
- Drying time.

In case of a series of measurements carried out in the same drying temperature it is recommended to reject the factor of the first completed measurement – as the measurement result can be burdened with an additional error related to thermal stabilization of the drying chamber and the moisture analyzer.

The sample to be tested has to evenly spread on the whole surface of the drying pan. Substances of coarse structure has to be disintegrated (crushed or grind) before measuring their humidity content.

In case of testing humidity content of substances that easily release water it is recommended to set short sampling time, and for materials in which water is bound, set the sampling time for longer, but selected by carried out tests.

When testing relative humidity content of a sample that while drying forms an impermeable layer on its surface, it is recommended to use indirect substances, such as sand, absorbent paper, filters, etc.

ADDITIONAL EQUIPMENT OF ANALYTICAL BALANCES

1. Anti-vibrating table



2. Thermal printer: KAFKA,



5. External PC keyboard, type PS/2



17. MOISTURE ANALYZER MAINTENANCE ACTIVITIES

This section of the user manual describes procedures of maintaining a moisture analyzer MAX series in good condition, and means of replacing faulty components (filaments, fuses).

17.1. Cleaning moisture analyzer components

In order to ensure required measuring accuracy, the moisture analyzer has to be used and stored in clean conditions.

While cleaning the moisture analyzer, precautions provided in this section of the user manual must be obeyed.



REMEMBER, before initiating any maintenance or cleaning activities of moisture analyzer's inner parts (including a fuse of a filament), switch off the moisture analyzer and make sure the power cord of the moisture analyzer is unplugged from mains!

Open moisture analyzer's lid and take out all components of the drying chamber: disposable pan, pan bracket, cross shaped pan handle, drying chamber's cover, insert of the drying chamber's basis.

Clean the moisture analyzer using soft fabrics (diaper, chamois, etc.) and non-aggressive cleaning agents.



Do not use any abrasive agents or solvents to clean the moisture analyzer, as it may cause damage to the device and its components.

After cleaning, thoroughly dry each of moisture analyzer's components.
Do not allow any contamination or liquid to fall into the moisture analyzer.

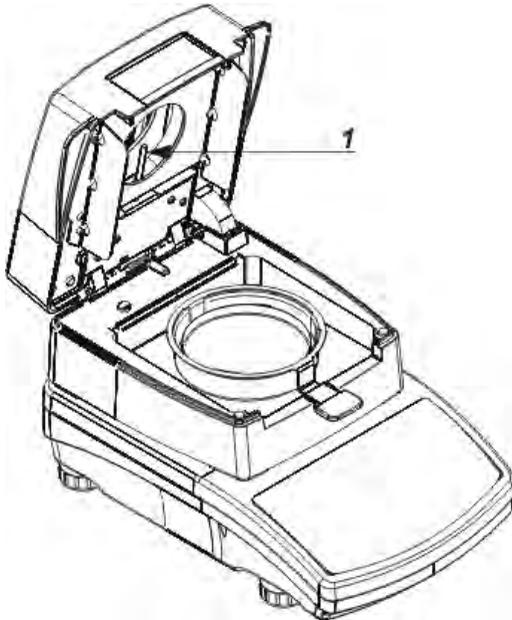
Assembly cleaned and dried components in accordance with above scheme.

17.2. Temperature sensor cleaning

In order to ensure correct temperature measurements during testing procedure, pay special attention to cleanness of the temperature sensor (1).

Any cleaning activities of the temperature sensor should be carried out while maintaining special precautions.

Temperature sensor should be cleaned using a soft fabric with addition of a mild detergent. Do not use any abrasive agents or solvents, as they may damage the temperature sensor.

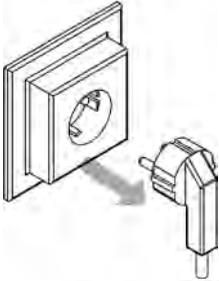


While cleaning make sure not to touch heating filament, as it may damage it.

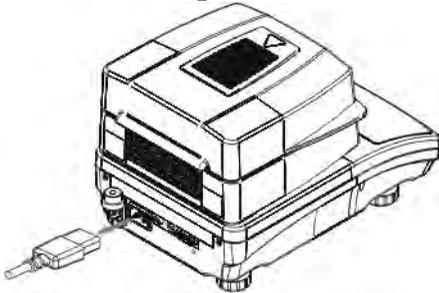
If necessary it is permissible to clean filament's shield. Clean the filament's shield using a soft and dry fabric only. Do not touch the filament while cleaning the shield.

17.3. Replacing the fuses

If after plugging to mains, a signal diode on moisture analyzer's display does not light up (lack of any reaction on the display), then possibly one of the fuses (or both) is blown.

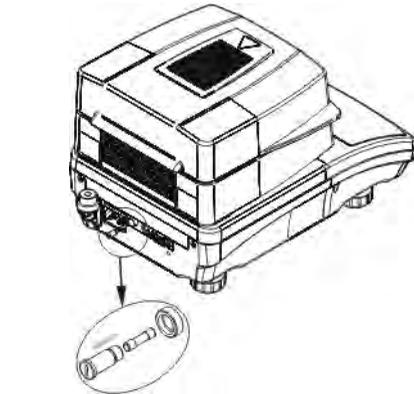


REMEMBER, before initiating any activities relates to fuse replacement switch off the moisture analyzer, and make sure the power cord of the moisture analyzer is unplugged from mains!



A moisture analyzer MAX series features two fuses.

Before replacing them unplug the power cord from the socket located at the back side of instrument's housing.



Tabular fuse ZKT 3.15A T4L 250V protects moisture analyzer's electric circuits.

Fuse replacement procedure:

1. Unscrew the fuse base from its mounting.
2. Take the fuse(s) out of the fuse base.
3. Replace the fuse(s) with new one(s).
4. Assembly the fuse base featuring new fuses into the mounting.

17.4. Troubleshooting

Problem: no reaction to pressing main switch on/off key (display remains dark).

Probable cause:

- No voltage in mains
- Damaged power cord
- Damaged fuse of the moisture analyzer
- Moisture analyzer defect

Problem: too long pending time for drying process finish.

Probable cause::

- Selected finish mode of drying process is incorrect. Carry out experimental tests to select a proper means of finish mode.

Problem: measurements are not repeatable

Probable cause:

- non-uniform sample content. Prepare the sample from larger amount of substance.
- the drying time is too short. Change testing process finish mode criteria.
- drying temperature is too high, causing sample's oxidizing. Lower drying temperature.
- tested sample boils. Lower the drying temperature.
- the temperature sensor is contaminated or defected. Clean the temperature sensor.
- the workbench on which the moisture analyzer is located is unstable. Change the location of instrument's operation.
- the ambient area is incompatible with the requirements (vibrations, drafts, etc.). Change the ambient conditions for compatible ones according to the guidelines of this user manual.

17.5. Error messages

Detecting of an error is signaled by the moisture analyzer by displaying a message corresponding to the error. The message contains number of the error and a short description informing on the possible causes of error occurrence.

List of error messages in a moisture analyzer:

Error message	Error no.	Error description
"Control sum error"	1.1	Error related to data transmission.
"A/D error"	1.2	Converter error.
„AD TcL error”	1.3	The value of A/D divisions of actuator thermometer = 0 temperature sensor defected, return to weighing mode by pressing ESC key.
AD TcH error	1.3	The value of A/D divisions of actuator thermometer = 1024 temperature sensor defected, return to weighing mode by pressing ESC key.
AD ThL error	1.3	The value of A/D divisions of the thermometer in the weighing chamber = 0 temperature sensor defected heating of weighing chamber shall not start, return to weighing mode by pressing ESC key.
AD ThH error	1.3	The value of A/D divisions of the thermometer in the weighing chamber = 1024 temperature sensor defected heating of weighing chamber shall not start, return to weighing mode by pressing ESC key.
"Range exceeded "	2.1	Maximum measuring range of a balance exceeded.
"Range exceeded "	2.2	Maximum measuring range of a balance exceeded.
"A/D Null"	2.3	A/D converter error.
"A/D Full"	2.4	Maximum number of divisions from converter exceeded.
"Tare/Zero out of range "	2.5	Permissible value of zeroing or tarring for a balance is exceeded.
"Tare out of range "	2.6	Permissible value of tarring for a balance is exceeded.

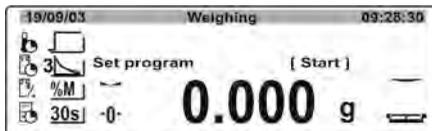
"Result > 10% Max"	2.7	The difference between initial zero value and the factory value is more than 10 % from (controlled after zero initiation).
"Result > 4% Max"	2.8	The difference between the start mass (mass of the drying pan and cross shaped pan holder) and its value saved in the memory is greater than 4 % on moisture analyzer start (moisture analyzer started with a load on the drying pan).
"Difference > 1% Max"	2.9	The difference between mass of a currently measured adjustment weight and mass saved in balance memory is greater than (difference >1%).
" Sample mass < 20gm "	2.10	The value of sample mass is below 20 mg.
"Sample mass out of range "	2.11	Sample mass is below the value determined in the parameter "Sample – mandatory" in the database of drying programs.
„Ref < 1000 Div”	2.12	Value of a reference mass in Percent Setup mode in smaller than 1000 reading units
„Difference > 20%”	2.13	The adjustment coefficient of the drying chamber differs from the factory adjustment coefficient by more than 20%
"Out of range "	3.1	Parameter value exceeds permissible value.
"Incorrect value "	3.2	Impermissible parameter value
"Incorrect password "	3.4	
"Overwriting error "	4.1	Errors relating to data transmission to a computer or a printer connected to a moisture analyzer.
" Parity error "	4.2	
" Frameerror "	4.3	
"CTS transmission suspended "	4.4	
" XOFF transmission suspended"	4.5	
"Incorrect date "	5.1	
"Time value exceeded "	6.1	Timeout error for carrying out a given process (e.g. zeroing).

CAUTION:

If the carried out activities related to dealing troubleshooting or maintenance are other than expected, please immediately contact you local RADWAG dealer or service point.

18. MEMORY OF CARRIED OUT MEASUREMENTS

A moisture analyzer MAX series enables storing **Maximum 100** last carried out measurements that comprise the following set of data: date, time, measurement time, name, drying mode, drying temperature, drying time, start mass, end mass, final result. The measurements are saved in a pile. After saving over a 100 a measurement in a pile, the record with no. 101 is overwritten on the record no. 99, and the whole list is moved upwards by one. It causes deleting the measurement record in position 00. Means of entering the memory of measurements:



When in main window press **Display** button on the moisture analyzer's overlay.

A window is opened containing list of stored measurement records.

Results			
00	28/06/05	10:19:26	
01	28/06/05	11:15:30	
02	29/06/05	09:45:30	Tea
03	29/06/05	09:56:45	Tea

The data is ordered according to its performance schedule. If a measurement was carried out using the Mode from Database, then next to the measurement date and time the record displays mode name. In order to print data place the cursor (black triangle) next to a needed record and press **Setup** key.

Results			
00	28/06/05	10:19:26	
01	28/06/05	11:15:30	
02	29/06/05	09:45:30	Tea
03	29/06/05	09:56:45	Tea

The detailed data on a measurement is displayed (data order as on a printout).

Results		29/06/05	09:45:30
02	Name	Tea	
	Profile	Standard	
	Dry temp.	160°C	
	Total time	0:43:20	
	Start weight	5.6783 g	
	Final weight	5.3218 g	
	Final result	5.26%M	

In order to print data press **PRINT** key. The set of data is sent via RS 232 interface to a connected printer / computer.

19. MEANS OF USING A MOISTURE ANALYZER FOR DRYING IN TEMPERATURE OVER 160°C

In case of drying a sample in a temperature ranging between 161°C – 250°C the maximum time of maintaining the temperature is determined proportionally from the range: 1 hour for 161 °C – 20 minutes for 250°C.

When drying a sample in temperature 250°C, the maximum temperature value is maintained by the instrument for 20 minutes, and then the software decreases the temperature value to 160 °C without stopping the drying process.

Time interval of decreasing the drying temperature from 250 °C to 160 °C is 20 minutes.

In case of drying mode „Quick“ the maximum drying temperature is exceeded by 30 % but its value is not higher than the temperature value set in instrument's factory menu.

In case of drying mode „Step“ the maximum time interval of maintaining a set temperature value in each step is limited to 20 minutes.

*User manual no.
LMI-49-05/04/13/A*

**MANUFACTURER
OF ELECTRONIC WEIGHING INSTRUMENTS**



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