User Manual

User manual no.:
LMI-51-08/07/13/A

MOISTURE ANALYZER MAC SERIES

BALANCES AND SCALES
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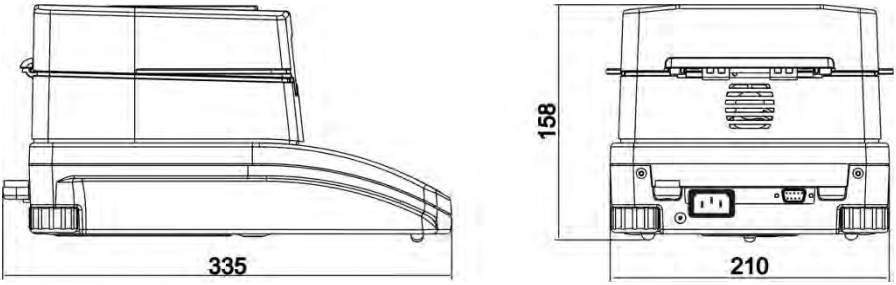
1. TECHNICAL DATA

Type	**MAC 50/1**	**MAC 50**	**MAC 110**	**MAC 210**
Max capacity	50 g	50 g	110 g	210 g
Readability	0,1 mg	1 mg	1 mg	1 mg
Tare range	- 50 g	- 50 g	- 110 g	- 210 g
Max sample mass	50 g	50 g	110 g	210 g
Readability of moisture readout	0,0001%	0,001 %		
Repeatability of moisture content reading	+/-0,24% (sample mass up to 2g), +/-0,06% (sample mass up to 2-10g), +/-0,04% (sample mass over 10g)			
Drying temperature range	max. 160 °C max. 250 °C (model WH)			
Heating module	infrared emitter halogen (model WH) - optional heater in metal cover (model NS) - optional			
Drying modes	4 drying modes: standard, quick, step, mild			
Finish mode	3 modes: automatic, time defined, manual			
Working temperature	+10 °C - +40 °C			
Power supply	230V 50Hz AC / 400W			
Display	LCD (backlit)			
Pan size	Φ 90 mm, h = 8 mm			
Drying chamber dimensions	120 x 120 x 20 mm			
Net weight / Gross weight	4.9 / 6.4 kg			
Packaging dimensions	470 x 380 x 336 mm			

Dimensions:



2. GENERAL SAFETY INFORMATION

2.1. Definitions of signals and warning symbols

Safety precautions are marked with special descriptions and warning symbols. They inform and warn a user of possible dangers. Ignoring the safety warnings may cause injuries, damage of the moisture analyzer, its inappropriate use and errors of measurements.

2.1.1. Warning descriptions

WARNING	Dangerous situations of high risk. These situations can cause serious injuries or death if the safety precautions are not taken.
CAUTION	Dangerous situations of low risk. These situations can cause damage of the instrument or its functions as well as minor or moderate body injuries.
ATTENTION	Important information related to the moisture analyzer.

2.1.2. Warning symbols

Electric shock risk

Acid / Corrosion

Danger

Flammable or explosive substances

Toxic substances

Hot surfaces

2.2. Safety information

WARNING!
Use of moisture analyzer MAC series against safety provisions and other than following guidelines of this user manual may be hazardous to human health and life.

WARNING:

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. The moisture analyzer is equipped with a three-conductor power cable and grounding pin. If necessary, an extension cord can be used as long as it meets the applicable standards and has a protective ground conductor. It is forbidden to deliberately disconnect the grounding cable from the instrument.

CAUTION:

You must not open the drying chamber while in use because the round heating lamp and its glass shield can reach the temperature of up to 400 C.
When setting up the moisture analyzer leave enough space to prevent heat from building up and to keep your analyzer from overheating. Leave about 20 cm around the instrument and about 1 m above.
Air vents that are located in the housing cannot be covered, sealed or blocked in any other way.
Do not put any flammable substances on, under or near the moisture analyzer.
Be particularly careful when removing the sample from the drying chamber: the sample itself, the drying chamber, shields and the pan can still be extremely hot.
If some maintenance work is needed (cleaning the inside of the drying chamber), the moisture analyzer must be switched off. Wait until all the components have cooled down. Do not perform any modification to the heating module.

Same types of samples require taking particular safety precautions. They can pose a danger for people and objects. It is always the user who is liable for possible damages caused by the use of an inappropriate sample.

CAUTION:

Corrosion

Substances that release aggressive vapours (e.g. acids) during the heating process. In this case, it is recommended to work with small samples. Otherwise, vapours can condense on cold housing parts and cause corrosion.

WARNING:

Fire or explosion

Flammable or explosive substances, substances containing solvents or releasing flammable or explosive gases or vapours. Perform a risk analysis when in doubt relating to the sample characteristics before performing the procedure.
For this type of samples apply the drying temperatures as low as to prevent flames or explosion. During the analysis it is necessary to wear protective glasses and gloves. The samples should be relatively small.
Under no circumstances can the instrument be left unsupervised.

WARNING:

Substances containing toxic and caustic or corrosive substances

Substances that release toxic gases or vapours can cause irritations (eyes, skin or respiratory system), illnesses or even death. Dry such substances only in fume hood.

Under no circumstances should the instrument be used in an area with any risk of explosion. The moisture analyzer is not designed to operate in hazardous areas.

2.3. Intended use

A moisture analyzer MAC 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.
MAC series ensures fast and precise determination process of water content in a tested sample, and application of a LCD display considerably simplifies functioning, operation and carrying out measurement processes. Moisture analyzer MAC 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 or a

heater in metal cover, 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 MAC 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.).

2.4. 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 no 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 MAC 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 only 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 balance 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.

2.5. Principles of safety use

Use of moisture analyzer MAC 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.

2.6. 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.

2.7. 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.

2.8. 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.

2.9. Staff competence

Moisture analyzer MAC series should only be operated and maintained by personnel who is trained and experienced in using this type of instruments.
In order to use the moisture analyzer, first read the user manual. Keep these instructions for the future reference.

Do not make any structural modifications. Additional equipment, which can be connected to the moisture analyzer, should be supplied by RADWAG or an authorized distributor.

Protective clothing

The use of protective clothing is highly recommended while working with the instrument in order to take safety precautions against potential hazards resulting from tested samples and ingredients.

Use the following while carrying out tests:
-protective apron,
-protective glasses,
-protective gloves (while working with hazardous chemical substances).

Before the use of the above-mentioned protective clothing, make sure that they are designed to be used with specific samples and they are not damaged.

3. TRANSPORT I 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

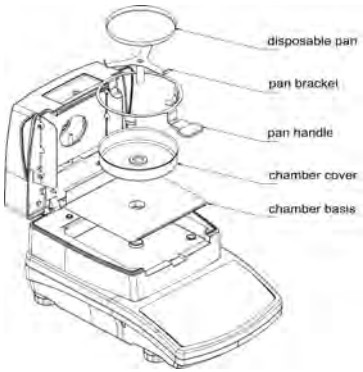
4.1. Assembling and place of use

- 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 fee 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 °C ÷ +40 °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 balance is a strong magnet.

4.2. Unpacking

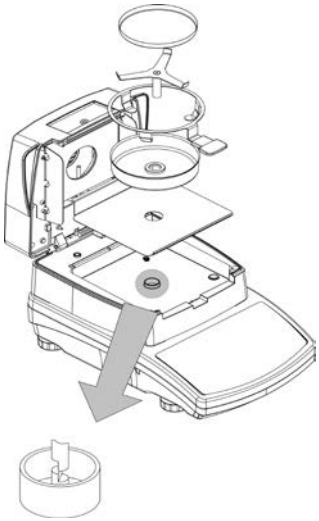
Carefully remove the moisture analyzer from its packaging, remove the plastic and foil transport protective elements. Gently place the moisture analyzer in its intended place of use.
Assembly the components of drying chamber, following guidelines from below figure:

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).

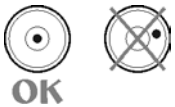


When assembling the pan supporter (bracket) pay special attention to the correct positioning of its mandrel. The mandrel features a cut for its unique positioning against the pan handle, thus preventing their contact and friction.

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 MAC series
- Insert of drying chamber basis.
- Drying chamber shield.
- Drying pan handle.
- Drying pan bracket.
- Disposable pan.
- Power cord.
- User manual (CD).

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**.**

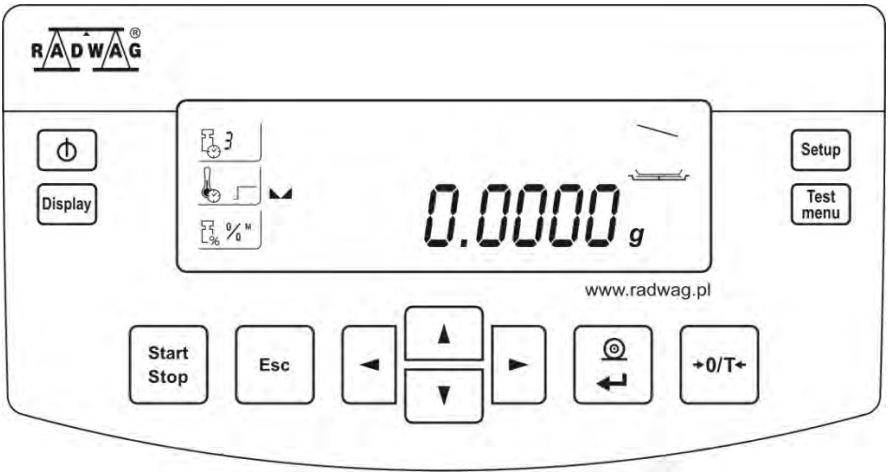
4.6. Plugging to mains

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 **O/T** 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 – FUNCTION KEYS



Start Stop	**Start/Stop** key – starting / ending drying process according to selected drying mode.
Esc	**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).
→0/T←	**ZERO/TARE** key – zeroing moisture analyzer's indication.
	On/Off key – switch on/off display of moisture analyzer. On switching of the display of the device, other subassemblies are continuously supplied, and the moisture analyzer is in standby mode.
Display	**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. START-UP

On plugging to mains the moisture analyzer carries out a display test (all pictograms and digits appear on the display). Then the display shows software name and number, and enters weighing mode.

6.1. Moisture analyzer temperature stabilization period

Before start of measuring processes, it is necessary to wait until the moisture analyzer is thermally stabilized. It is a period of so called moisture analyzer's self-heating. For moisture analyzer MAC series which before plugging to mains was stored in room temperature, self-heating period takes approximately 30 minutes. For moisture analyzers that were stored in much lower temperatures before plugging to mains (e.g. during winter period) thermal stabilization should last approximately 4 hours. During self-heating period the indications on moisture analyzer's display may change. Correct operation of a moisture analyzer is possible within temperature range specified in the technical parameters, see point 1. It is recommended that ambient temperature changes at moisture analyzer's place of use are very small (slow).

7. USER MENU

User menu is divided into 5 basic function groups.

7.1. Moving through user menu

An operator moves through moisture analyzer's menu using keys on overlay's keyboard:

	**Setup** key. Entering main menu.
	Navigating key **UP** – Selecting group of parameters one by one upwards / changing parameter value by one value upwards.
	Navigating key **DOWN** – Selecting group of parameters one by one downwards / changing parameter value by one value downwards.
	Navigating key **RIGHT** – Selecting group of parameters for activating. On pressing the key, the display indicates the first parameter in a selected group.
	Navigating key **LEFT** – Exit to previous menu level, e.g. to main menu.
	**Esc** key. Abandon parameter changes.
	**Print/Enter** key. Accept / confirm introduced changes

Names of function groups and their content:

P1 CAL [Adjustment]

P1-01 ECAL		[external adjustment]
P1-02 tCAL		[adjustment test]
P1-03 tE_CAL		[drying chamber adjustment]
P1-04 CALr		[adjustment report printout]
P1-05 tSt_Co		[drying test]

P2 GLP [Good Laboratory Practice]

P2-01 USr		_	[name of user]
P2-02 PrJ		_	[name of project]
P2-03 Ptin		YES/no	[printout of measurement time]
P2-04 PdAt		YES/no	[printout of measurement date]
P2-05 PUSr		YES/no	[printout of user name]
P2-06 PPrJ		YES/no	[printout of project name]
P2-07 PId		YES/no	[printout of moisture analyzer's factory no.]
P2-08 PFr		YES/no	[printout of frames]

P3 tinnE [Setting time and date of the moisture analyzer]

P3-01 StinnE		[setting time]
P3-02 SdAtE		[setting date]

P4 rEAd [Main user parameters]

P4-01 AuE	Stand/SLouu/Fast	[filtering level]
P4-02 Auto	On/OFF	[autozero]

P5 Print [Data transmission – RS 232]

P5-01 bAud	2400/4800/9600/19200	[baud rate]
P5-02 PStb	YES/no	[measurement result printout: stable / unstable]
P5-03 LinE_t	1/2/3/5/10/20/30/60/120/180	[printout interval]
P5-04 Prn_Pc	YES/no	[printout to computer]

P6 othEr [Other functions]

P6-01 Libr	|	YES/no	[access to drying modes library]
P6-02 bL	|	YES/no	[display backlight]
P6-03 bLbA	|no/20/30/40/50/60/70/80/90/100		[display brightness]
P6-04 bEEP	|	YES/no	[beep sound on pressing keys]
P6-05 PrnS	|		[printout of moisture analyzer parameters]
P6-06 Preuer	I	YES/no	[previous version of moisture analyzer]

7.2. Return to weighing mode

CAUTION

Changes introduced in moisture analyzer memory will be permanently saved on return weighing with procedure of saving changes.

Press **Esc** key for several times, until the display indicates command **SAuE ?**

Then select one of below option:

- **Print/Enter**  - key – save (accept) changes
- **Esc**  *- key – abandon introduced changes, and leave to balance menu*.

8. WEIGHING

Before start of measuring process or in case of essential change of ambient conditions at a workstation (e.g. ambient temperature change at a workstation) the moisture analyzer requires adjusting. The procedure of moisture analyzer adjustment is described further in this user manual.

- Before start of measuring procedure, it is recommended to load the moisture analyzer's pan a few times with mass close to the max capacity,
- Check if unloaded moisture analyzer indicates "precise zero" - -0- and whether measurement is stable - ◣◢, if not press **ESC/TARE** key,
- Place weighed object on moisture analyzer's weighing pan and read result only on stabilization of measurement result,
- Mass indication of a load placed on moisture analyzer's weighing pan can be tarred for multiple times by pressing **ESC/TARE** key (pay attention not to exceed maximal capacity of a moisture analyzer by applying multiple tare function).

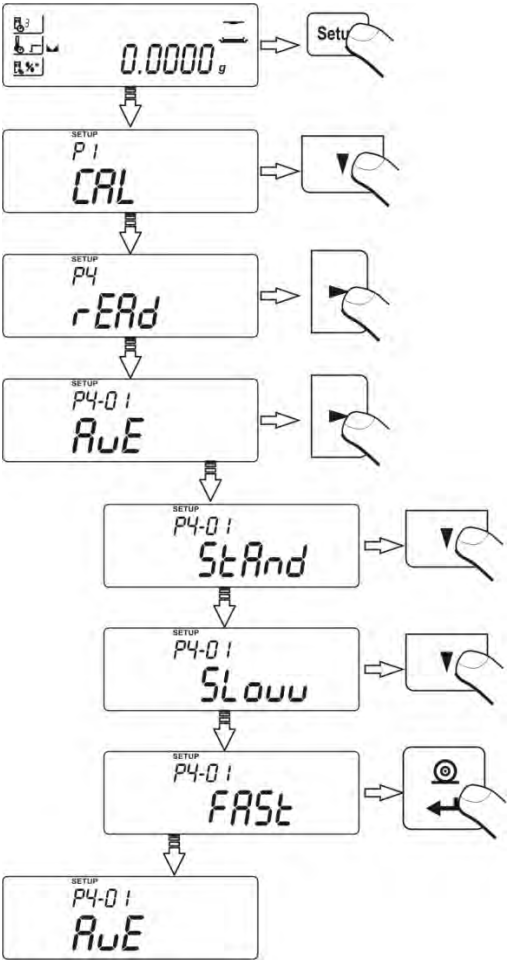
During times between carrying out the following measurement series do not unplug the moisture analyzer from mains. It is recommended to switch off moisture analyzer's display by pressing **ON/OFF** key. On repeated pressing of the **ON/OFF** key the moisture analyzer is ready for operation and carrying out the following measurements.

9. MOISTURE ANALYZER MAIN PARAMETERS. ADJUSTING MOISTURE ANALYZER OPERATION TO AMBIENT CONDITIONS AT A WORKSTATION

- Setting filtering level – **AuE**.
- Autozero function – **Auto**.
- Access to library of drying modes – **Libr**.
- Backlight of measurement result - **bl**.
- Display brightness - **bIbA**
- "Beep" sound – reaction on pressing a key – **bEEP**.

User of a moisture analyzer can adjust its operation to current ambient conditions at a workstation (by changing the value of digital filters), or according to user needs (autozero operation or display backlight) by using parameters grouped in this function.

9.1. Setting filtering level



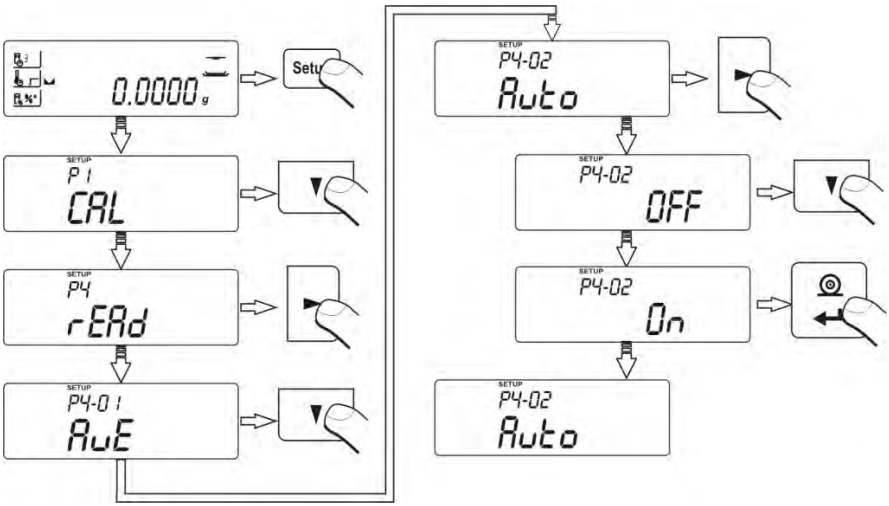
- use navigating keys to select desired filter value,

AuE = StAnd - (normal) – normal operation conditions,
AuE = Slouu - (slow) – harsh operation conditions – vibrations, etc.,
AuE = Fast - (fast) – good operation conditions – no vibrations, etc.

CAUTION:
The stronger filtering setting the longer weighing time.

9.2. Autozero function

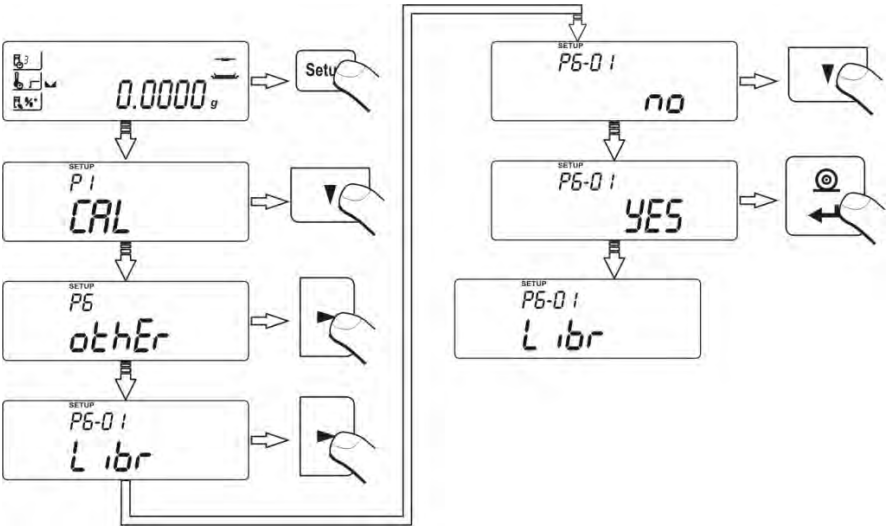
In order to ensure moisture analyzer's precise mass indication, autozero (**Auto**) software parameter has been introduced. The application of this function is automatic control and correction of zero indication. When function is enabled, it compares moisture analyzer indications at declared time interval e.g. 1 s, on conditions that weighing pan is unloaded and display indication is close to zero. If results vary less than declared AUTOZERO range e.g. one division, the moisture analyzer will zero automatically, display marker of stable measurement result and precise zero marker →0←.
If AUTOZERO function is enabled, then each weighing process starts from precise zero point. There are, however, some cases when this function can be a disturbing factor of measuring process; for instance very slow placing of load on the weighing pan (e.g. load pouring) – in such case system of zero indication correction can also correct actual indication of loaded mass.



Auto = On - autozero enabled,
Auto = OFF - autozero disabled.

9.3. Access to library of drying programs

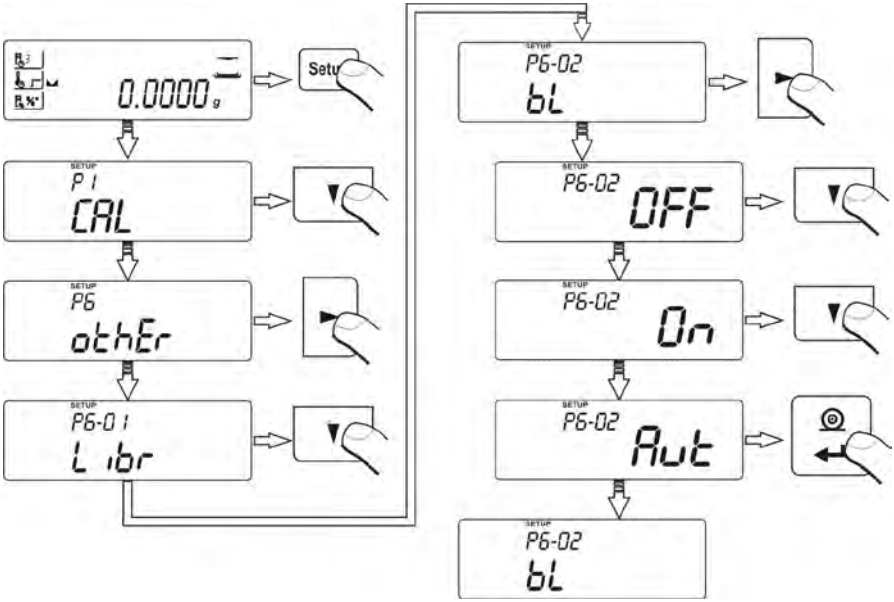
In order to use the library of drying programs set parameter <Libr> to value <YES>:



no - libraries of drying programs disabled,
YES - libraries of drying programs enabled.

9.4. Backlight of measurement result (display backlight)

The function enables switching on and off backlight of measurement result on the display.

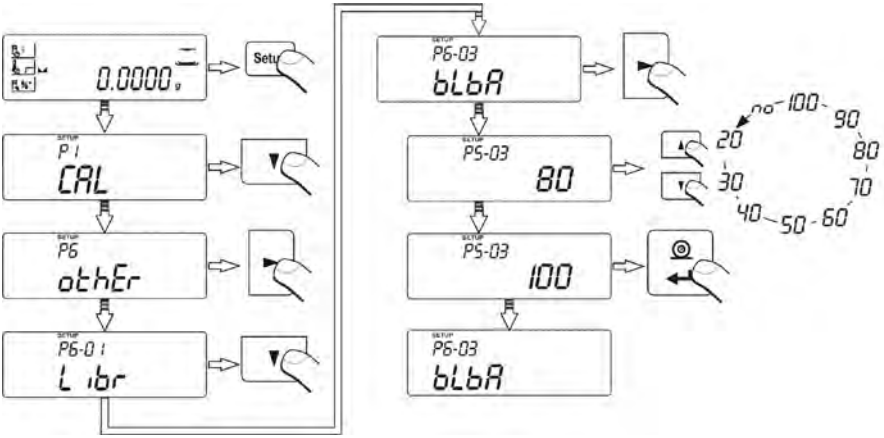


OFF - backlight disabled
On - backlight enabled
Aut - backlight disabled automatically if measured indication does not change within 10 seconds.

CAUTION

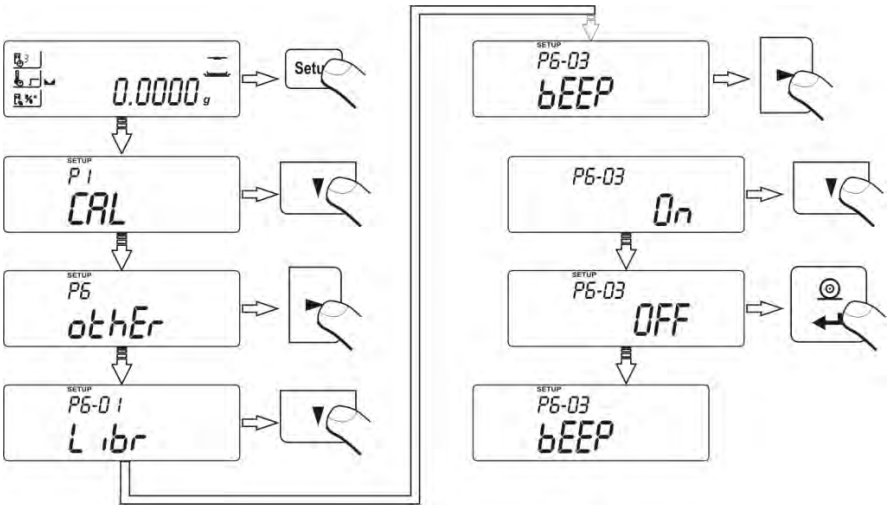
*Moisture analyzer software has implemented option of automatic backlight switch off **bl = Aut.** In case of this setting, the backlight is switched automatically off if measurement results does not change within 10 seconds. Backlight is automatically activated at the moment of weighing result change on moisture analyzer's display.*

9.5. Brightness adjustment of display backlight



100 - maximum display brightness
20 - minimum display brightness
no - display brightness disabled

9.6. "beep" sound – reaction on pressing a function key



bEEP = On - signal of pressing function key enabled,
bEEP = OFF - signal of pressing function key disabled.

10. MOISTURE ANALYZER ADJUSTMENT

As the gravitational acceleration force has different value at various latitudes and altitudes, a moisture analyzer should be adjusted to present working conditions. This process should take place at the first installation of the instrument on site and at its every re-location – as in case of ambient temperature changes.
In order to ensure the highest weighing accuracy, it is recommended to periodically refresh moisture analyzer's accuracy by carrying out adjustment process.

Adjustment should be carried out:

- Before the beginning of measuring process,
- If long breaks between following measuring series occur.

Types of adjustment:

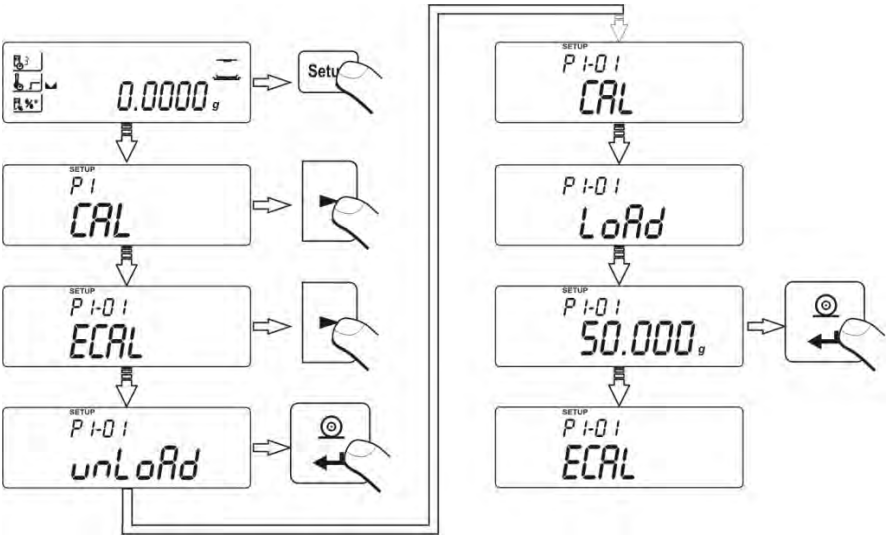
- adjustment with an external weight

Remember to carry out adjustment process only when there is no load on the weighing pan! In case there is load on the weighing pan, the display will indicate a command **Er1 Hi**. It is a command of unloading the pan. Adjustment process can be aborted if necessary by pressing **Esc** key!

10.1. External adjustment

External adjustment in moisture analyzer MAC series should be carried out with an external mass standard / weight class F2 or higher.

Start of external adjustment process,



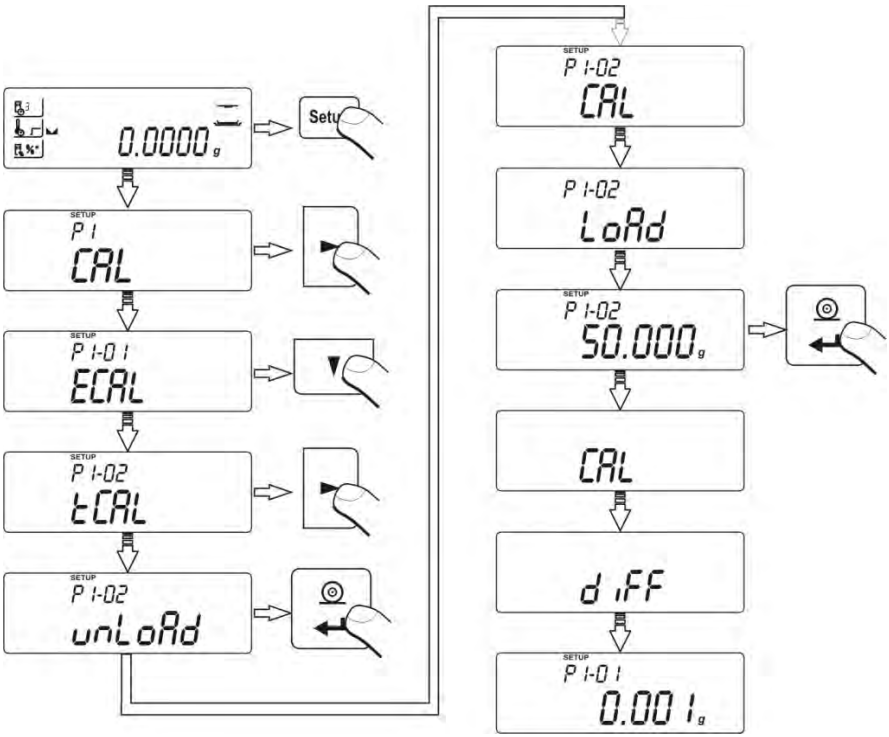
On selecting **CAL** mode, the moisture analyzer displays a command **unLoAd** – ordering unloading of the weighing pan (**the weighing pan must be empty)**. When the weighing pan is empty press **Print/Enter** key. The moisture analyzer initiates adjustment procedure. In a moment the display indicates mass of a standard / weight to be loaded on the weighing pan – on loading the mass standard / weight press **Print/Enter** key. On completing adjustment process the moisture analyzer returns to submenu **P1-01 ECAL**, (if a moisture analyzer is connected to a printer or a computer, then it automatically sends a report from adjustment process to be printed – only if corresponding option has been enabled in moisture analyzer's settings).

CAUTION
*- Press **ESC** key to abort adjustment process.*
*- If during adjustment process, weighing pan of a moisture analyzer is loaded, then moisture analyzer displays an error message **Er 1 Hi**.*

Return to weighing mode
(see point 7.2 – return to weighing mode).

10.2. Adjustment test

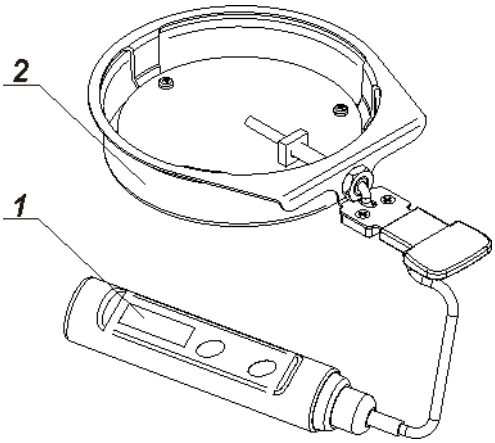
Adjustment test is a comparison of mass of an adjustment weight with the value of last adjustment saved in moisture analyzer's memory. This process is automatic and its result is previewed on the display (if a moisture analyzer is connected to a computer or a printer through RS 232 interface, data on adjustment test is printout – only if corresponding option has been enabled in moisture analyzer's settings). Press **Print/Enter** key to return to previous display in moisture analyzer's menu structure.



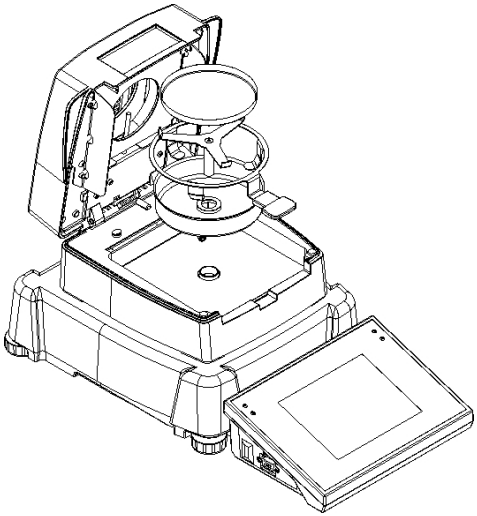
10.3. Drying chamber adjustment

A special set enabling temperature adjustment is one of the additional sets that Radwag has in its offer.

Drying chamber adjustment is a process aimed at adjusting the temperature sensor of a moisture analyzer. To carry out temperature adjustment of a moisture analyzer place a control thermometer in an opening of the drying chamber, as shown on below picture.



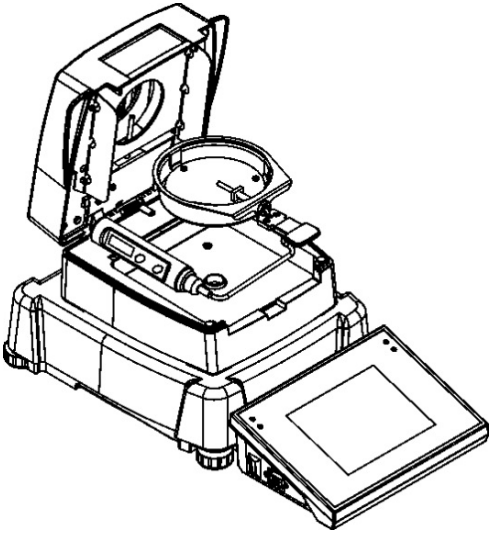
1. Thermometer
2. Thermometer holder and drying chamber shield



Step 1.

Remove from the drying chamber the following:

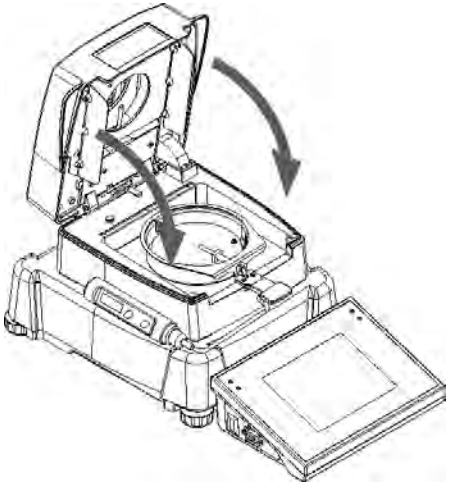
- disposable drying pan
- drying pan handle
- drying pan bracket
- drying chamber shield



Step 2.

Assemble in the drying pan the components of temperature adjustment kit:

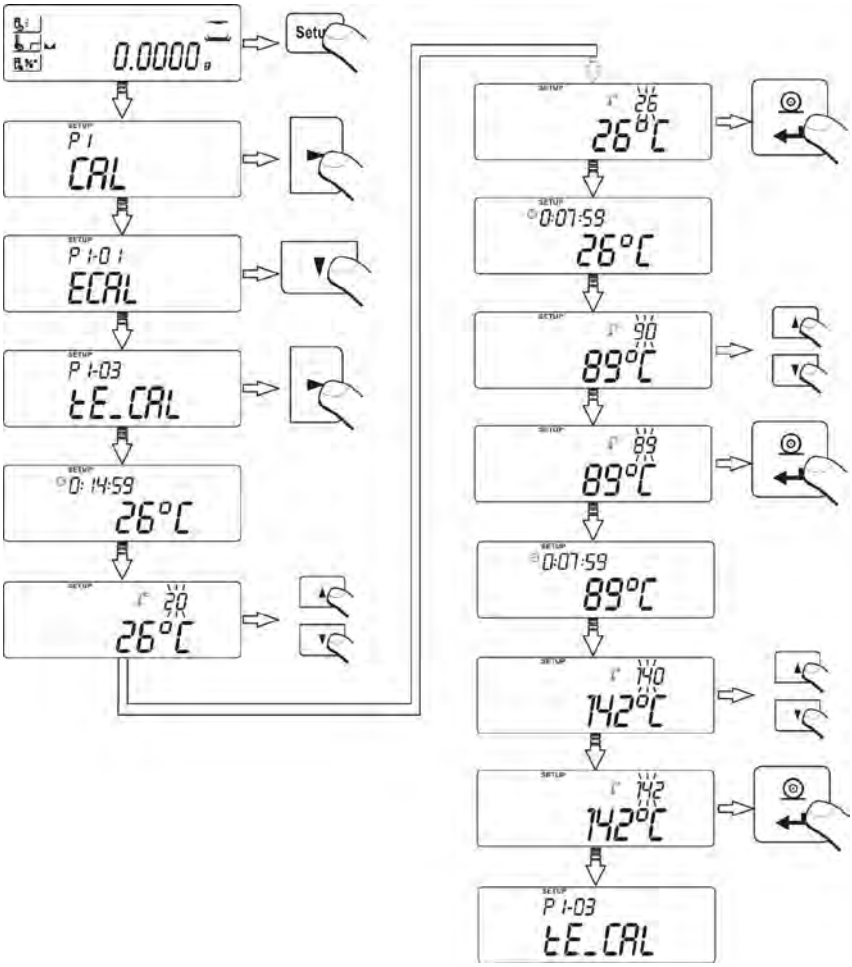
- drying chamber shield
- thermometer holder and the thermometer



Step 3.

After assembling the kit start temperature adjustment process.

CAUTION:
All the activities must be carried out with great caution not to damage the measuring mechanism of the moisture analyzer.



Go to menu **P1-03 tE_CAL**, adjustment process is initiated automatically.
The moisture analyzer displays current temperature in the drying chamber. After 8 minutes the display indicates (pulsating) temperature value. Use navigating keys (up and down arrow) on moisture analyzer's overlay to set temperature value to be equal to the current temperature displayed on the control thermometer. Use **Print/Enter** key to start part two of temperature adjustment process. The moisture analyzer switches on the halogen lamp and heats the drying chamber to a defined temperature value. The temperature value is maintained for 8 minutes, and its value is visible on moisture analyzer's display. After 8 minutes the display indicates (pulsating) temperature value. Use navigating keys (up and down arrow) to set temperature value to be equal

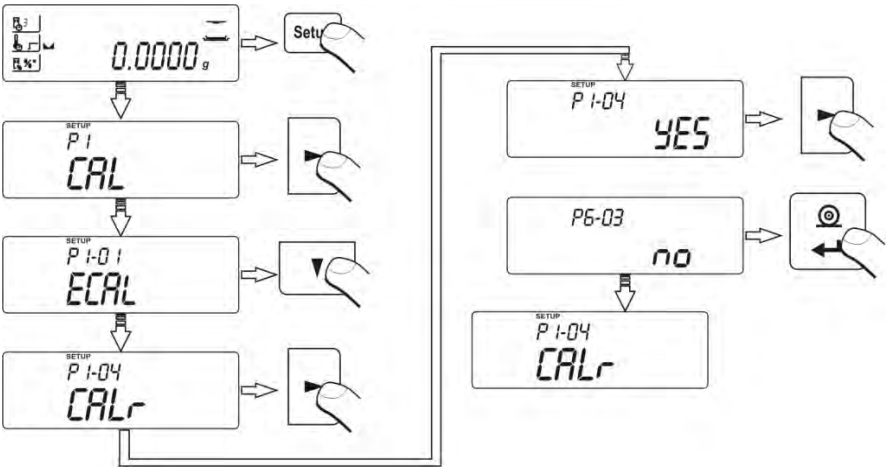
to the current temperature displayed on the control thermometer – as in previous step. On entering the temperature value and accepting it by pressing **Print/Enter** key, the software starts the last part of temperature adjustment process. The moisture analyzer heats the drying chamber to another temperature value, which is maintained for 8 minutes. Current temperature of the dying chamber is visible on the display. After 8 minutes the display indicates pulsating temperature value, which should be changed to be equal to the one indicated on control thermometer (as in previous steps). On entering temperature value accept it by pressing **Print/Enter** key. Temperature adjustment process is completed, and the display indicates name of the parameter: **P1-03 tE_CAL.**

In case of moisture analyzer with maximum heating temperature 250 °C, the temperature adjustment process is the same, with only difference in higher temperature values in each part of the process.

Return to weighing mode
(see point 7.2 – return to weighing mode).

10.4. Adjustment report printout

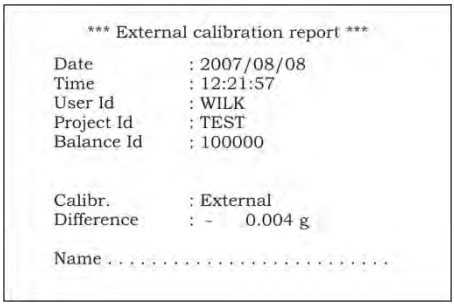
On completing an adjustment process, the moisture analyzer enables generating a report from adjustment process. The report can be printed on a connected printer and sent to a computer and saved in a form of file for future records.



YES - report is printed.
no - report is not printed

Remember, that if the parameter is set to **YES**, then a report is generated and sent (printed) automatically.
Content of report from adjustment process depends on the settings of GLP parameters. Any option in the GLP submenu which attribute is YES is included in a report from adjustment process.

An instance of a report from adjustment process:



*** External calibration report ***

Date : 2007/08/08
Time : 12:21:57
User Id : WILK
Project Id : TEST
Balance Id : 100000

Calibr. : External
Difference : - 0.004 g

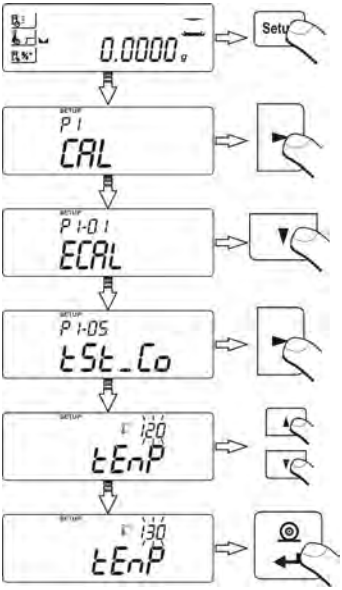
Name . . . . . .

10.5. Drying test

Parameter <Drying test> enables monitoring the temperature as indicated by the moisture analyser's internal thermometer. The testing procedure is carried out using a designated kit, available as optional equipment of the moisture analyser. Means of assembling the testing kit is described in the paragraph Temperature adjustment.

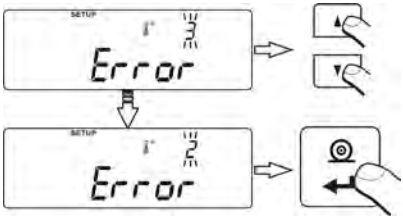
In order to start the procedure, mount the set in the drying chamber and enter in a group menu <CAL> and start the process **P1-05 tSt_Co** by following the instructions below**.**

Remember to close the drying chamber after mounting the thermometer and before performing the test.

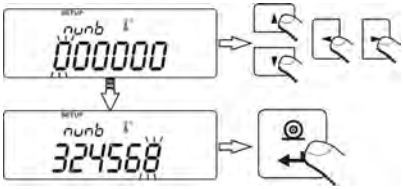


Enter the group **P1 CAL** and initiate the procedure **P1-05 tSt_Co.** Before the very test starts, set the test parameters as shown below.

Enter the temperature value in which the moisture analyzer is to be tested. Using the navigating buttons enter the temperature value and confirm by pressing ENTER.

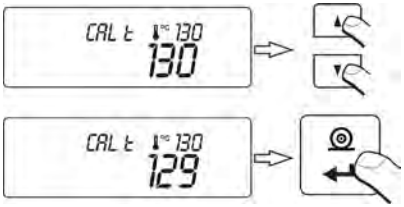


Then enter a permissible error for the set temperature value. Using the navigating buttons enter the error and confirm by pressing ENTER.

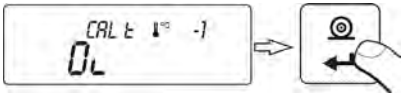


Next enter the factory number of the temperature adjustment kit. Using the navigating buttons enter the number and confirm by pressing ENTER.

After confirming the set number, the analyzer's software automatically starts the drying chamber procedure until it reaches the set temperature. The information relating to the time and temperature of the chamber will be displayed. The processlasts about 8 minutes.



After the test completion the software displays a window for entering the temperature valueas specified on the external thermometer of the temperature adjustment kit.using the navigating buttons enter the temperature value and confirm by pressing ENTER.



A window is displayed with an error of the chamber temperature and the temperature of the adjustment kit.

```
------------------------
Drying test
------------------------
Date:              2013/05/24
Time:                09:21:18
Balance Id:            349011
Calibr. Id:            324568
Set temp:                 130
End temp:                 130
Measured temp:            129
Acceptable error:           2
Status:                    OK
------------------------
```

It is possible to print out the test result by pressing PRINT button.
An example report is shown on the left side.

To return to the main window press Esc repeatedly.

11. DETERMINING CONTENT OF A PRINTOUT FOR GLP PROCEDURES

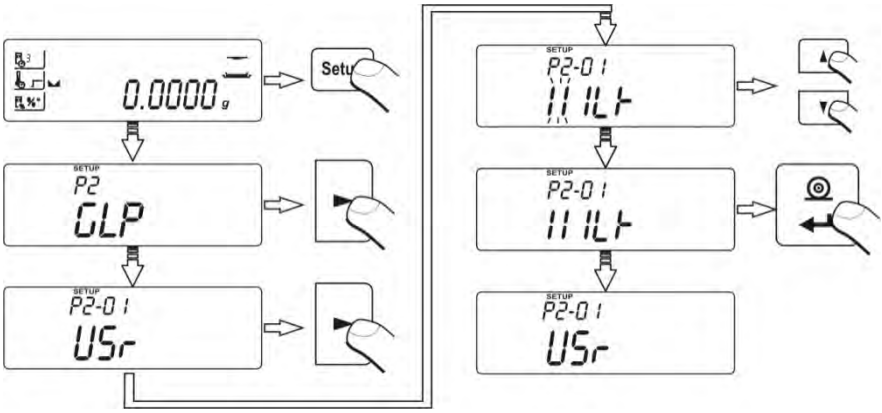
Group of parameters **P2 GLP** enables declaring variables that are present on an adjustment printout and printout activated after a measurement.

P2 GLP

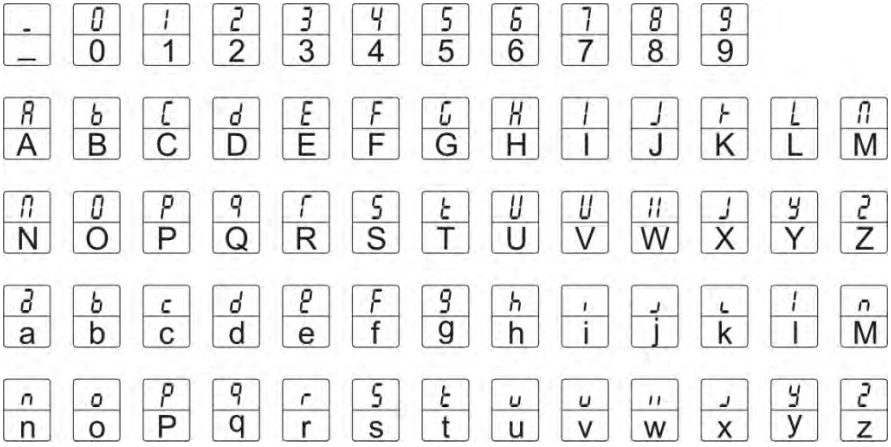
P2.1	USr	|	
P2.2	PrJ	|	
P2.3	Ptin	|	YES
P2.4	PdAt	|	YES
P2.5	PUSr	|	YES
P2.6	PPrJ	|	YES
P2.7	PId	|	YES
P2.8	PFr	|	YES

- **P2-01 USr**

  The parameter enables determining name of a operator who works with a moisture analyzer. User name contains maximally 6 alphanumeric characters. User name is inserted using moisture analyzer's keyboard and navigating arrows **Up**, **Down**, **Left**, **Right**.



Accessible characters and their equivalents displayed by the moisture analyzer:



An instance of a user name inserted to a moisture analyzer using capital letters takes below form:

WILK

An instance of a user name inserted to a moisture analyzer using small letters takes below form:

wilk

- **P2-02 Prj**

  The parameter enables determining name of a project (e.g. related to a specific type of carried out test).
  An instance of project name inserted to a moisture analyzer using capital letters takes below form:

POLON

  An instance of project name inserted to a moisture analyzer using small letters takes below form:

polon

- **P2-03 Ptin**

Option determining presence of measurement time on a printout.

- **P2-04 PdAt**

Option determining presence of measurement date on a printout.

- **P2-05 PUSr**

Option determining presence of user name on a printout.

- **P2-06 PPrj**

Option determining presence of project name on a printout.

- **P2-7 Pld**

Option determining presence of moisture analyzer's factory number on a printout.

- **P2-08 PFr**

Option enabling printing frames on a printout.

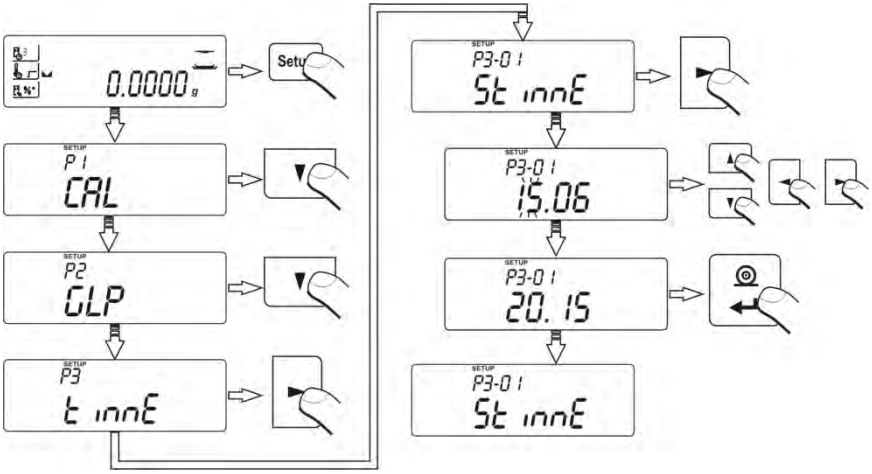
For above parameters please select one of two available settings:

no - variable absent on a printout,
YES - variable present on a printout

Return to weighing mode
(see point 7.2 – return to weighing mode).

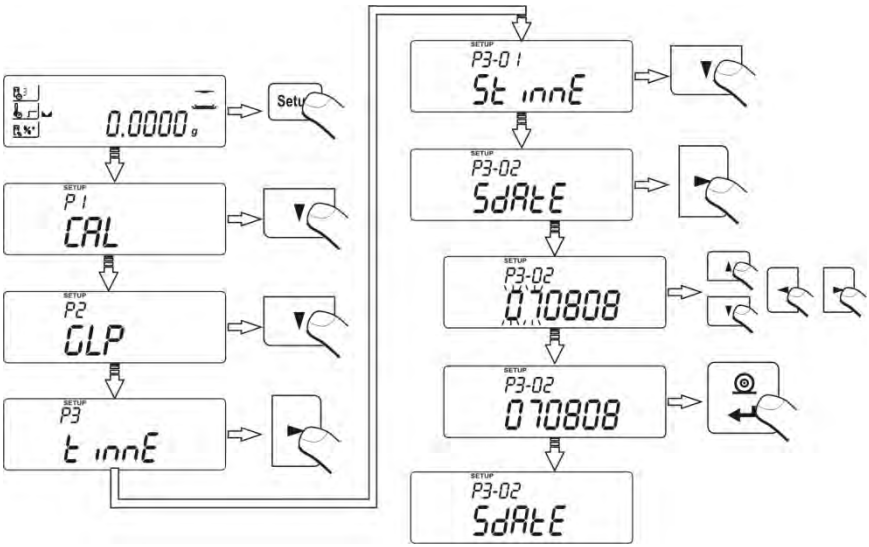
12. DATE AND TIME SETTINGS

12.1. Setting time



This parameter enables setting time in a moisture analyzer. In order to change time settings use navigating keys **Up**, **Down**, **Left**, **Right**.

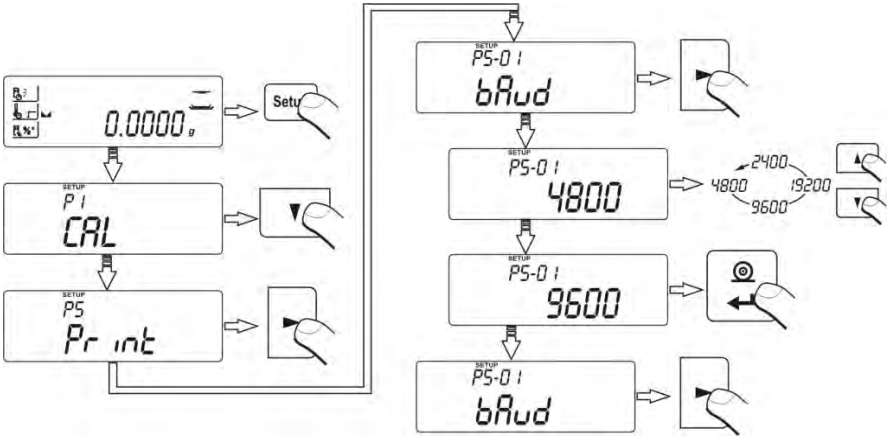
12.2. Setting date



This parameter enables setting date in a moisture analyzer. In order to change date settings use navigating keys **Up**, **Down**, **Left**, **Right**.

13. RS 232 FUNCTIONS

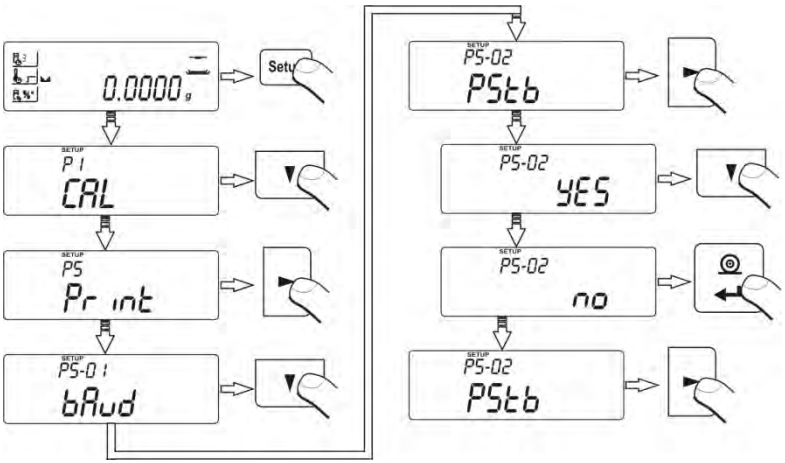
13.1. Baud rate setting



Select one of available baud rates:
- 2400 bit/s
- 4800 bit/s
- 9600 bit/s
- 19200 bit/s.

Return to weighing mode
(see point 7.2 – return to weighing mode).

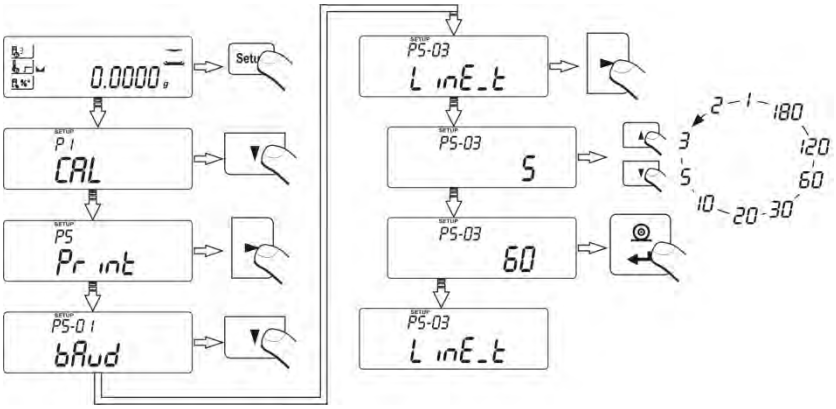
13.2. Determining data type sent via RS 232 output



YES - sending stable measurement result,
no - sending stable or temporary (unstable) measurement result.

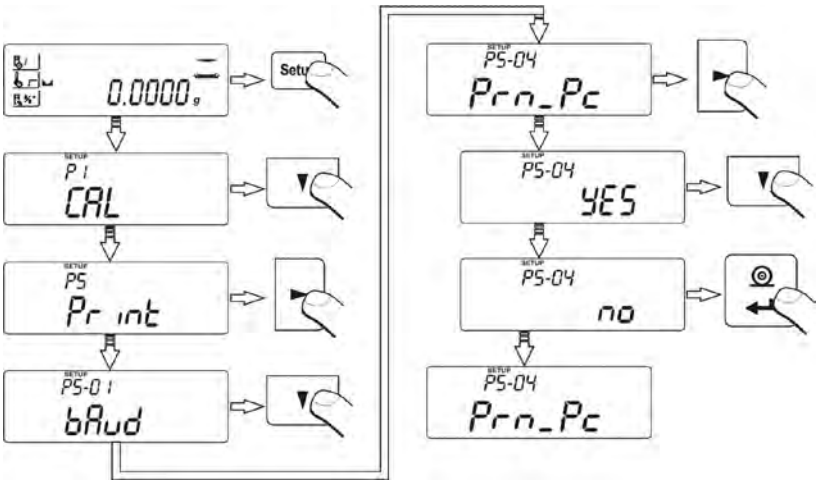
Return to weighing mode
(see point 7.2 – return to weighing mode).

13.3. Printout interval



Printout interval determines how often data on drying process is sent through RS 232 port. Available settings: **1**, **2**, **3**, **5**, **10**, **20**, **30**, **60**, **120**, **180** seconds.

13.4. Determining range of data sent during drying process



YES - data limited to drying process result only (printout of a single like).

no - printout of complete report from drying process: header, line, footer.

Return to weighing mode
(see point 7.2 – return to weighing mode).

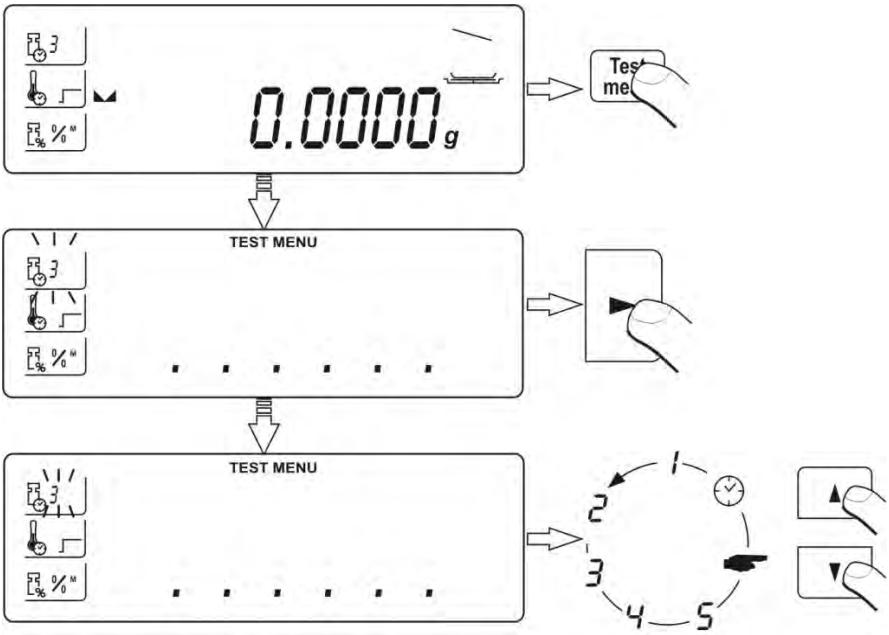
14. DRYING PROCESS WITH USE OF SHORTENED MENU

Menu of drying mode enables setting the following parameters:
- means of drying process finish mode,
- drying mode for carrying out the drying process,
- type of displayed measurement result.

In order to start drying process with use of shortened menu, disable access to libraries of drying programs – go to menu – **P6-01 Libr**.

In order to change parameter settings, enter the drying menu by pressing **Test menu** key. Marker of submenu group **drying process finish mode** starts flashing. Then, using **Right** navigating key enable menu of changing settings of this parameter group. Use navigating keys **Up** and **Down** to set one of available options and accept changes (by double pressing of **Print/Enter** key) or continue parameter settings (single pressing of **Print/Enter** key).

14.1. Setting means of finish mode

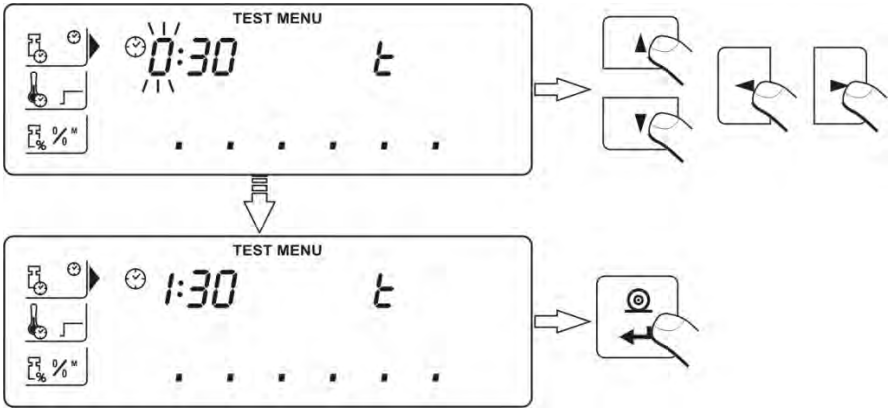


Parameter **finish mode** can take the following values:

1 – automatic finish (mass change 1mg / in 10s time)
2 – automatic finish (mass change 1mg / in 25s time)
3 – automatic finish (mass change 1mg / in 60s time)
4 – automatic finish (mass change 1mg / in 90s time)
5 – automatic finish (mass change 1mg / in 120s time)

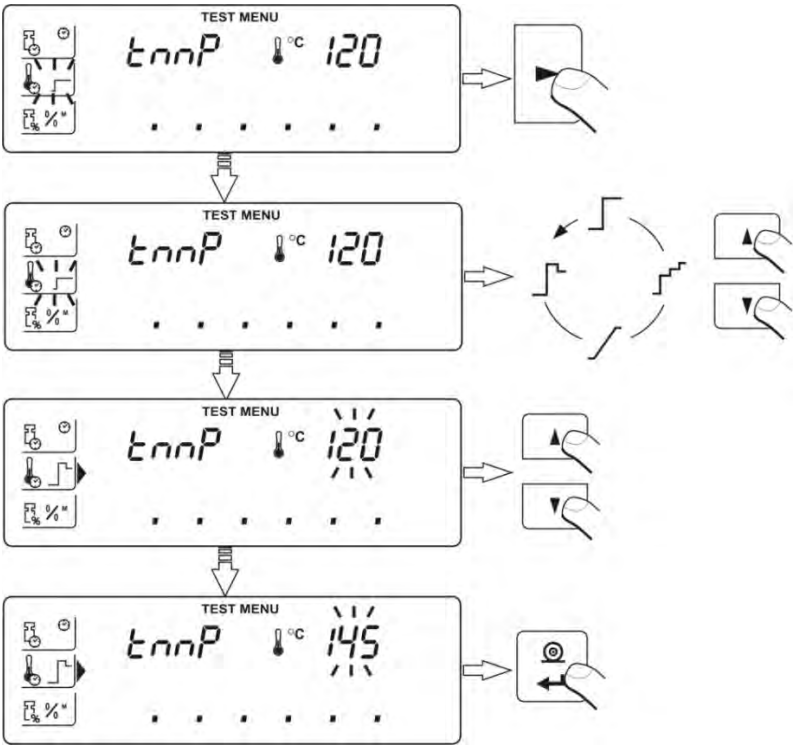
 - manual finish (on pressing **Start/Stop** key)

 - time defined (max time setting 9 hours 59 minutes):



In order to accept carried out changes, press **Print/Enter** key for three (3) times.

14.2. Active drying mode



In order to accept carried out changes, press **Print/Enter** key for three (3) times.

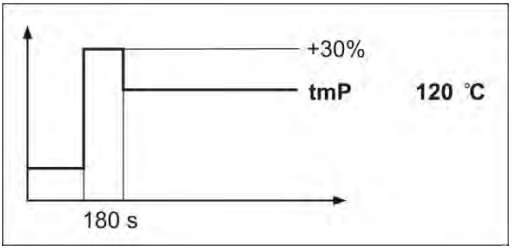
Parameter **active drying mode** can take the following values:

- Drying mode **STANDARD**

In standard mode, user should set drying temperature **tmP** in which a sample should be tested,

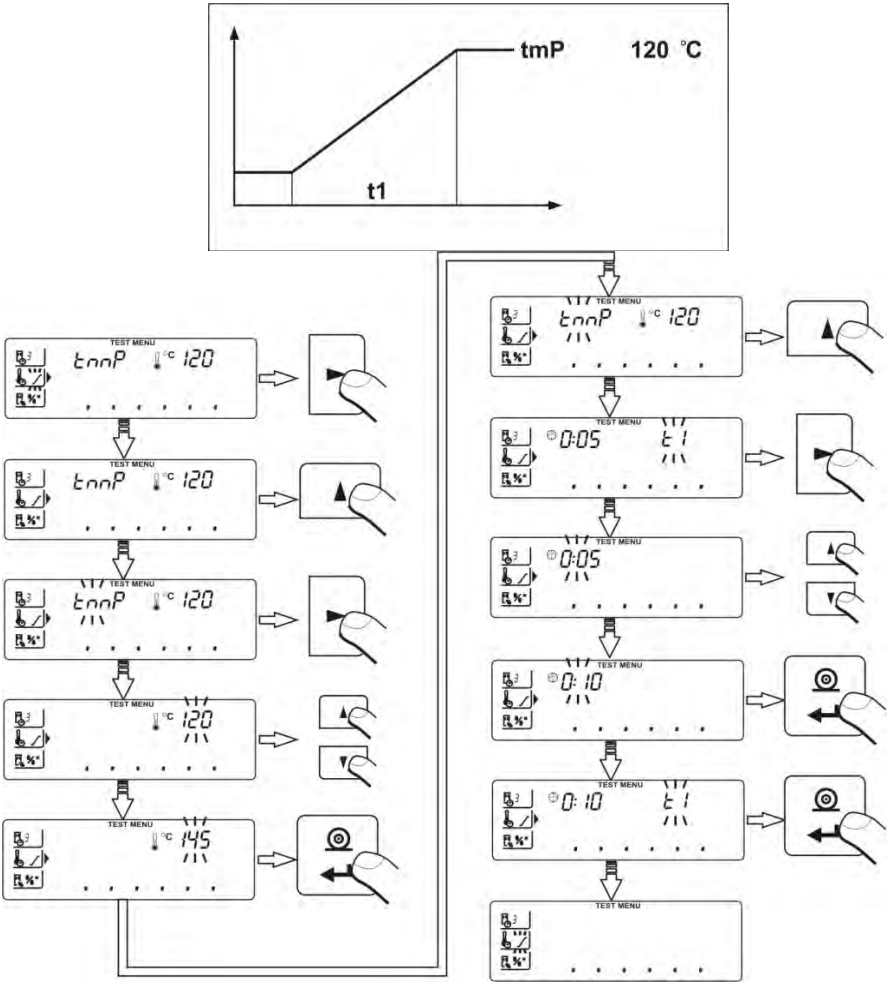
- Drying mode **QUICK**

In quick mode, user should set drying temperature **tmP** in which a sample should be tested,
Specific feature of this drying mode is fast increase of drying temperature in short period of time. Drying temperature for the time of 180 seconds is exceeding the pre-set value by 30 %, after which is drops to temperature value set in the parameters of the drying mode.



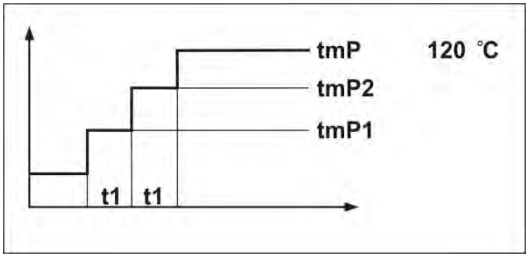
- Drying mode **MILD**

In mild mode, user should set drying temperature **tmP** in which a sample should be tested, and time **t1** in which a moisture analyzer should reach pre-set temperature value.



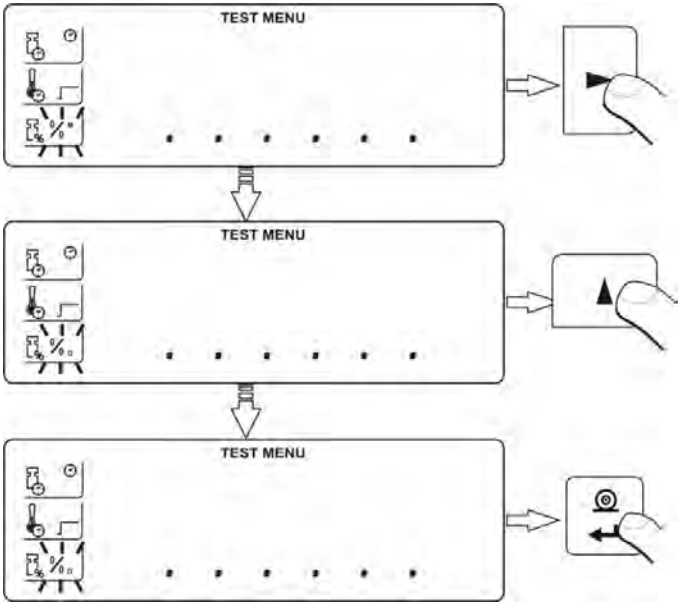
- Drying mode **STEP**

In step mode, user should set drying temperature **tmP** in which a sample should be tested, temperature values **tmP1** and **tmP2** and time values **t1** and **t2** between reaching the temperature values in each of the steps.



ATTENTION:
For the mode FAST set the drying temperature and the drying time in the temperature 30% higher that the set temperature. The drying time is counted from the moment of reaching the temperature.
For the mode STEP set the threshold temperatures "1" and "2" and the drying temperature as well as the drying times in these temperatures (1 and 2). The drying time in the particular steps is counted from the moment of reaching the temperature set for each step.

14.3. Type of displayed measurement result



In order to accept carried out changes, press **Print/Enter** key for two times.

- Percent loss of mass

Displays mass change recorded during drying process, and expressed in percent,

- Part of dry mass obtained in drying process, and expressed in percent

Measurement result is part of mass that is remaining on the drying pan after humidity content evaporation,

- Humid / dry ratio obtained as a result of drying process, and expressed in percent.

Measurement result is part of mass that evaporated from the dried sample in drying process,

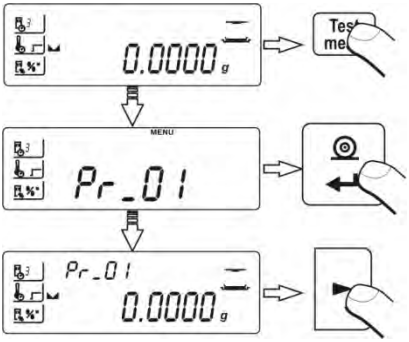
- Mass change

Measurement result is mass change recorded by the moisture analyzer in the drying process.

15. DRYING PROCESS WITH USE OF DRYING PROGRAM LIBRARY

In order to start drying process with use of drying program library, the user has to enable access to the libraries in moisture analyzer's menu: parameter – **P6-01 Libr** has to be attributed <**YES**> (*see point 9.3. of this user manual*). The moisture analyzer MAC series can comprise up to 20 drying procedures / programs, which are optionally configured, saved and used by selecting one of them.

Should one of drying procedures / programs be used, follow below guidelines:



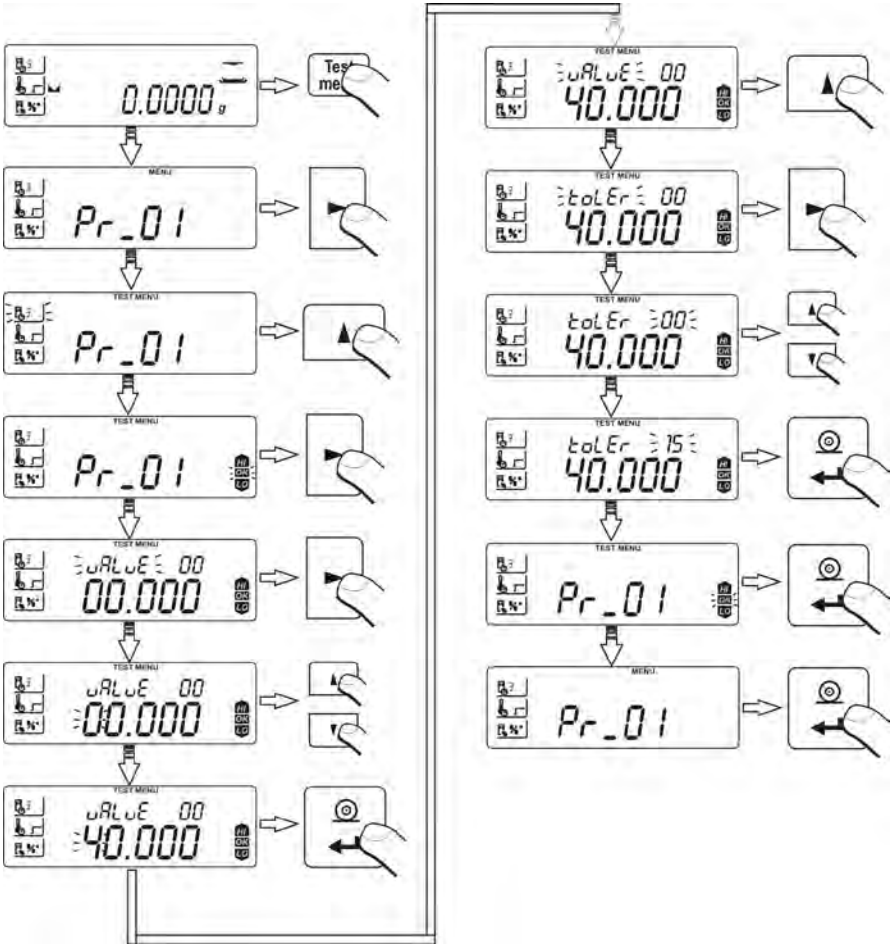
In order to exit the option of using drying program libraries, disable access to libraries in moisture analyzer's menu (**see point 9.3. of this user manual**).

Changing settings of any drying program (finish mode, drying mode, drying temperature, data to be displayed and printed) in the library, requires selecting one of drying programs, and then acting as specified in **point 14: DRYING PROCESS WITH USE OF SHORTENED MENU**.

Additionally, each drying procedure stored in the library allows for using an option of sample mass control. When enabling the option, a moisture analyzer software informs the user whether the mass to be tested is within set thresholds, regarding the mass and tolerance values, on condition that the parameters were determined for the sample. The sample mass control is visualized by displaying pictograms LO, OK or HI on moisture analyzer display. The option is implemented for information purpose only and facilitates a user in preparing the same or very similar sample to be tested, thus increasing repeatability of measurements. If the pre-determined mass control criteria are not met (i.e. pictograms LO or HI are displayed), the moisture analyzer still starts the drying process. Settings of mass control option are provided below.

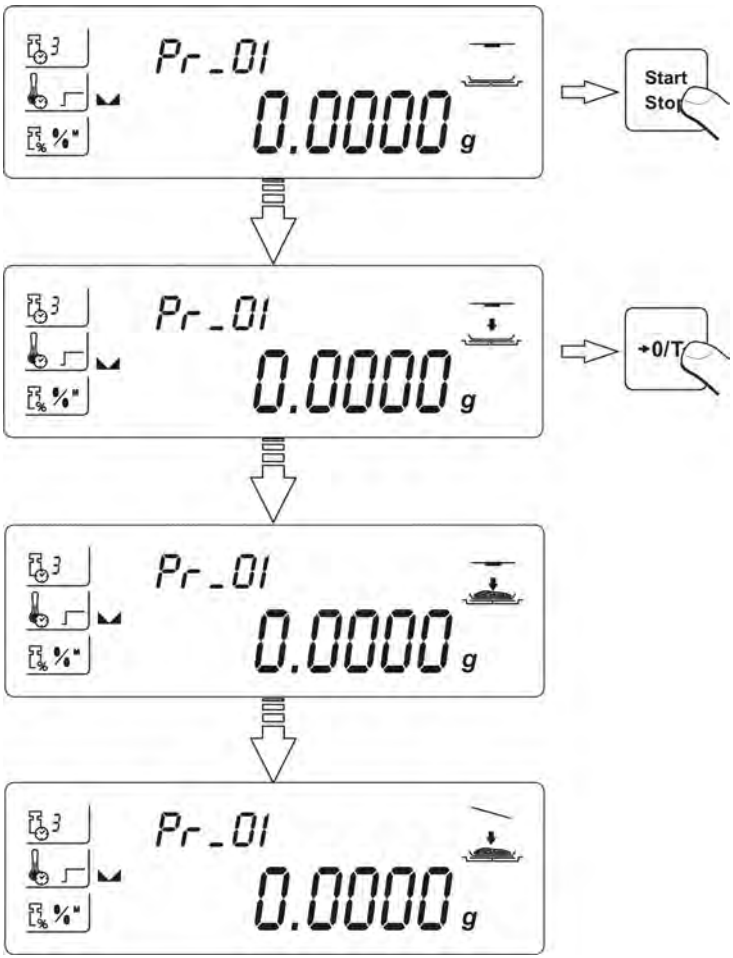
15.1. Sample mass control

Sample mass control option is active only in case of enabled access to library of drying programs – P6-01 Libr (parameter set to YES).
The mass control value and tolerance value are set in the following way:

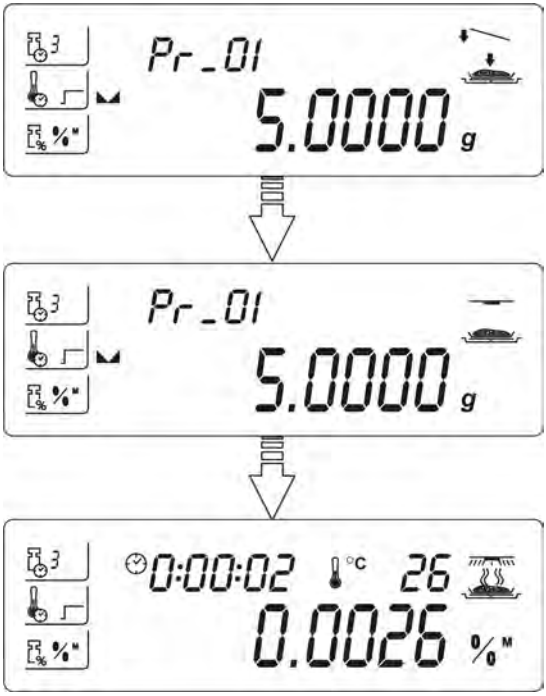


16. DRYING PROCESS

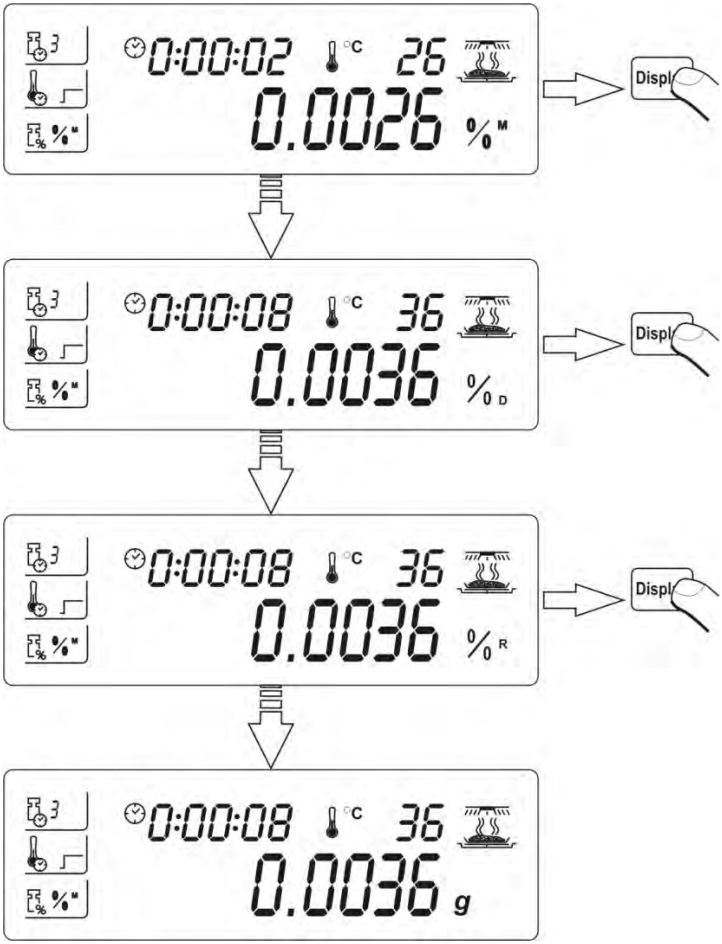
In order to start the drying process, a user should select a drying mode, and then act according to below guidelines:



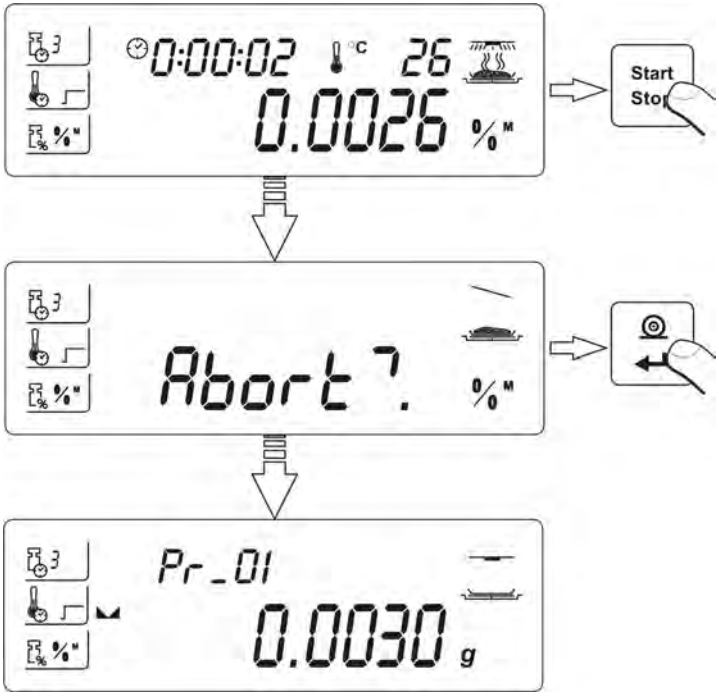
Start drying process by pressing **Start/Stop** key, and on emptying moisture analyzer's drying pan, pressing **TARE** key. Open the drying chamber's lid, place test sample on the drying pan, and close the drying chamber's lid.



Changing of displayed data during drying process is carried out by pressing **Display** key.



In order to abort drying process, press **Start/Stop** key and accept finish of drying process by pressing **Print/Enter** key. An exception from the above procedure is means of aborting the drying process in manual mode – on pressing **Start/Stop** key the moisture analyzer aborts drying process with no need to confirm the action by pressing **Print/Enter** key.



17. SET OF COMPUTER – MOISTURE ANALYZER COMMANDS

Function **INTERFACE RESET**
Command **R CR LF** (zeroing of currently carried out commands, i.e. “tare” which waits for stable result).

Function **SEND ALL IMPLEMENTED COMMANDS FROM THE INSTRUMENT**
Command **PC CR LF** (sends information on all implemented commands in the program from the instrument)

Function **SEND STABLE RESULT IN BASIC UNIT**
Command **S CR LF** (sends result in basic unit from the instrument on stable mass readout)

Function **IMMEDIATELY SEND THE RESULT IN BASIC UNIT**
Command **SI CR LF** (sends result in basic unit from the instrument)

Function **SEND THE RESULT IN CURRENT UNIT**

Command **SU CR LF** (sends the result in current used result on stable mass readout)

Function **IMMEDIATELY SEND THE RESULT IN CURRENT UNIT**
Command **SUI CR LF** (sends the result in current used unit from the instrument)

Function **ZERO THE INDICATION**
Command **Z CR LF** (zeroes the indication on stable readout)

Function **TARE WHEN STABLE**
Command **T CR LF** (TARE the indication on stable readout)

Function **SWITCH OFF CONTINUOUS TRANSMISSION IN BASIC UNIT**
Command **C0 CR LF** (stops continuous transmission in basic unit)

Function **SWITCH ON CONTINUOUS TRANSMISSION IN BASIC UNIT**
Command **C1 CR LF** (starts continuous transmission in basic unit)

Function **GIVE SERIAL NUMBER OF THE INSTRUMENT**
Command **NB CR LF** (sends factory number)

Function **GIVE WEIGHING RANGE**
Command **FS CR LF** (send instrument's value of max capacity in basic unit)

Function **GIVE SOFTWARE VERSION**
Command **RV CR LF** (sends name and version of the instrument's software)

Function **SEND SETUP**
Command **PS CR LF** (sends all instrument's setup – printout of the parameters)

Caution!

*Sending a command to the instrument which is not in the above list or has an error, and it is finished with CR LF, causes instrument's response in format **E S CR LF**. Spaces provided in the command formats should be omitted, as they are given for proper legibility of the commands.*

18. ERROR MESSAGES

If moisture balance software detects an error a proper error message appears on the graphic display. The error message contains number of error which informs about its source.

Error message	Error description
Er1 Hi	Start mass exceeds permissible range (it refers to start and adjustment – start mass)
Er2 nu	Low limit of converter range exceeded
Er3 Fu	High limit of converter range exceeded
Er4 ro	Value of mass or temperature exceeds permissible range (it refers to mass or temperature adjustment – final mass or temperature)
Er5 Ad	A/D converter error
Er6 to	Operation time exceeded (tarring or printing caused by lack of stability status in set time)
Er7 ou	Inserted value is out of range (reg. setting reference mass, date, etc.)
Error 1.3 AD Th L	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.
Error 1.3 AD Th H	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.
Error 1.3 AD Tc L	The value of A/D divisions of actuator thermometer = 0 temperature sensor defected, return to weighing mode by pressing ESC key.
Error 1.3 AD Tc H	The value of A/D divisions of actuator thermometer = 1024 temperature sensor defected, return to weighing mode by pressing ESC key.

19. USING THE MOISTURE ANALYZER FOR THE DRYING TEMPERATURES OVER 160°C

This parameter automatically determines reducing the drying temperature after a time interval specified for a moisture analyzer with Max drying temperature of 250 °C.

While drying temperature holds within a limit between 161 °C and 250 °C then the drying temperature can be maintained proportionally to set temperature value, i.e. 1 hour for the temperature 161 °C and 20 minutes for the temperature 250 °C.

While drying a sample in a temperature set to 250 °C, this temperature can be maintained for the time of 20 minutes, and afterwards the software automatically reduces the temperature to 160 °C (drying process is continued without break). The time of reducing the temperature from 250 °C to 160 °C is 20 minutes.

For the QUICK MODE the initial exceeding of the Max drying temperature is 30 %, but not higher than the maximum drying temperature of a moisture analyzer.

20. PREVIOUS VERSION OF MOISTURE ANALYZER

Parameter **<P6-06Preuer>** set to value <YES>.

The parameter enabling the operation of moisture analyzer in a similar way to the previous version. This means that after setting the parameter to value <YES>, the moisture analyzer operates similarly to the previous version(older version) when it comes to the range of temperatures of drying and controlling the drying process (in comparable temperature conditions).
This allows the user to apply settings for the drying processes for the older moisture analyzers of this type. Consequently, once a new moisture analyzer has been purchased, a user does not have to select new drying parameters for the tested products, but can access the ones used on older moisture analyzers.

MANUFACTURER

O F E L E C T R O N I C W E I G H I N G I N S T R U M E N T S

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