RADWAG BALANCES AND SCALES
ADVANCED WEIGHING TECHNOLOGIES



Moisture Analyzers

NEW METHODS OF MOISTURE CONTENT ANALYSIS

Moisture Analyzers of 3Y series

The best possible functionality and professionalism for a drying process and moisture content analysis!

- 5,7” touch screen display
- Interactive menu
- Wireless connection - Wi-Fi
- Adjustment system for a drying chamber (GMP)
- Compliance with regulations (GLP System)
- Databases (products, users, drying programs)
- Dynamic control of sample weight (bargraph)
- Drying parameters optimization (Auto Test)
- Drying process visualization (%M, %R, %D, graph)
- Statistics (trend of sample humidity over time)
- Printouts, reports (standard PCL)
- Multilingual menu
- Interfaces: Ethernet (network applications), USB, RS 232
- Wide spectrum of applications (industry, laboratories, universities, research and development institutes)



Main Window

- A Information on a selected working mode and on a current drying mode
- B Information on a logged in user
- C Area for date, time, information on connection, battery level, etc.
- D Pictogram informing on levelling status
- E Moisture analyzer indication area
- F Weight bargraph
- G Bargraph for sample weight control
- H Configurable area for supplementary information
- I Drying mode / temperature selection
- J Auto switch-off option (3)
- K Printout interval
- L Temperature and elapsed analysis time
- M Area defining the drying chamber (Opened / Closed / Drying Process)
- N Quick launch bar providing access to functions
- O Proximity sensors (optimization of operation)







USB ×2, Ethernet, RS 232, In/Out x4.



A cooling fan, a switch-key and a power outlet

.3Y

Maximum efficiency and productivity.
Arranging work through databases.
History of moisture content variations for a given sample.
Easy data exchange between devices.
Data protection and access control.
Fully configurable screen menu.

Moisture Analyzers of R series

Advanced technology for a drying process and moisture content analysis!

- LCD display
- Cascading menu
- Wireless connection - Wi-Fi (option)
- Adjustment system for a drying chamber (GMP)
- Compliance with regulations (GLP System)
- Databases (users, products, weighing records, tares, drying programs, reports)
- Drying parameters optimization (Auto Test)
- Drying process visualization (%M, %R, %D, graph)
- Printouts, reports (standard PCL)
- Multilingual menu
- Wide spectrum of applications (industry, laboratories, universities, research and development institutes)



Main Window

- A Elapsed drying time
- B Drying temperature
- C Area defining the drying chamber (Opened / Closed / Drying Process)
- D Moisture content result for a given sample
- E Auto switch-off option (3)
- F Drying mode
- G Measuring unit %M, %D, %R
- H Information area
- I Direct access to reports on performed drying processes
- J Direct access to databases (clients, samples, drying programs)
- K Switching drying mode and changing drying temperature
- L Selecting sample out of the database









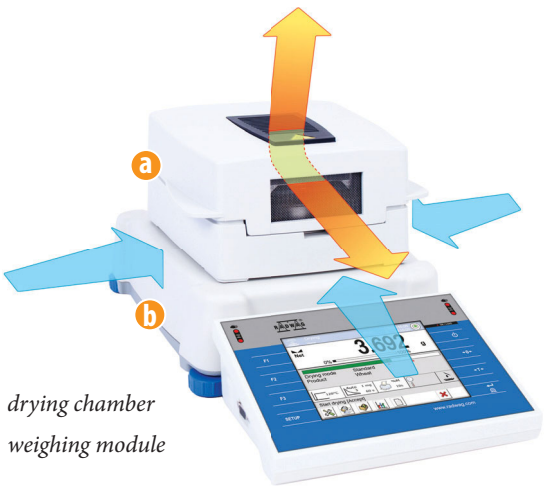
USB A, USB B, RS 232. A cooling fan and a power outlet.

Compact size and design.
Easy and intuitive operation.
Direct access to history of reports and product databases.
Ease of data exchange between devices.
Versatility of applications in various workstations.

Design and construction

Measurement precision
in all thermal conditions

Moisture analyzer comprises precision balance and a drying chamber joined together. High resolution weighing module is designed to provide quick and precise measurement of a particular sample weight, independently from its thermal condition. The module is stabilized by means of a drying chamber cooling system.



a *drying chamber*
b *weighing module*



For precise determination of sample weight it is necessary to perform adjustment procedure using external mass standard characterized by a respective accuracy class.

Date	2014.03.12
Time	14:06:27
Balance type	MA 3Y.NP
Balance ID	365661
Operator	Admin
Level status	Yes
Nominal mass	50 g
Current mass	50.0001 g
Difference	0.0001 g
Temperature	22 °C
Signature	

Accuracy is confirmed by a report presenting value of deviation.

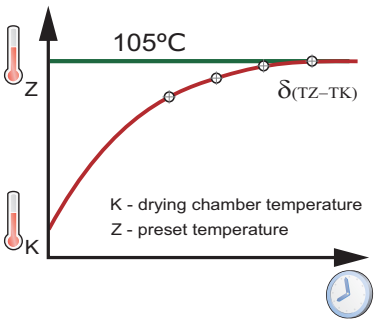
Drying
temperature stability

Drying temperature stabilization is ensured by a heating element (IR emitter) coupled with a temperature sensor. Proper operation of this system is possible owing to adjustment performed in the course of a manufacturing process.

The emitter, as a heat source, is effective when carrying out analysis of various materials: powders, liquids, paste, semi-liquid substances, solid bodies etc.



Graduating drying temperature means comparing and correcting indications of moisture analyzer thermometer. The correction is referred to indications of control thermometer, three measuring points are used for comparison. During the test, the control thermometer replaces a weighing pan.

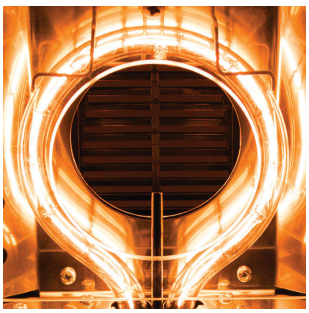


Correctness of thermometer indications (GLP) is checked periodically in course of operation.

A specific algorithm controlling heating elements operation is needed in order to maintain a particular temperature throughout the drying process. **RADWAG has designed such an algorithm thus ensuring quickness and accuracy of operation independently from analysis duration.**

Drying temperature

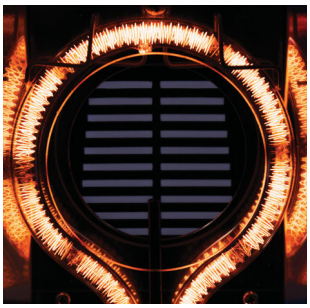
Heat source
types and intended use



IRS Halogen

Infrared short
λ = ~ 1,2 μm
mainly convection,
surface heating.

Intended for:
powders, semi-liquids,
liquids.



IRM Emitter

Infrared medium
λ = ~ 3,0 μm
convection and radiation,
deeper layers heating.

Intended for:
most samples of liquid or
semi-liquid consistence,
powders, crushed solids.



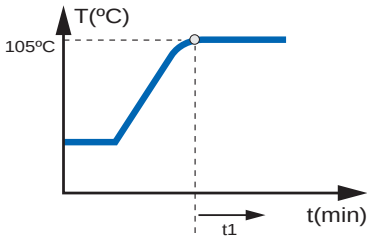
IRL Emitter

Infrared long
λ = ~ 5,0 μm
mostly radiation,
sample volume heating.

Intended for:
bodies of thick consistence
and for solids.

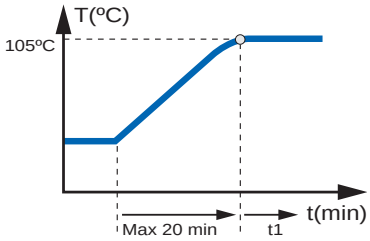
IR emitter is one of the moisture analyzer heat sources, it operates in a feedback loop. This ensures thermal conditions stability for the time of analysis. **Designed by RADWAG method for dynamic control of drying chamber temperature is one of the factors allowing to obtain short time for analysis process and repeatability within drying series.**

Methods
for obtaining the preset temperature



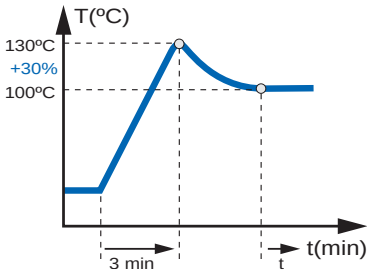
Standard mode

Intended use:
Solid, powder
and semi-liquid samples.
Temperature grows until
the determined value is
reached.
99% of applications.



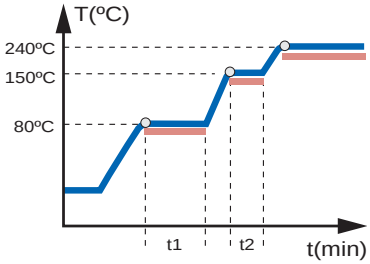
Mild mode

Intended use:
Mild mode shall be
applied when too fast
temperature growth
eliminates components
other than water.
Possibility of adjusting
the speed of temperature
growth.



Quick mode

Intended use:
Samples of high humidity.
The temperature drops until
the determined value is
reached.
Temperature drop caused
by heat coming from
evaporation is eliminated.



Step mode

Intended use:
Drying minerals.
Chemically bound water
and surface bound water is
eliminated.
Sample analysis for various
temperature values is
possible.

Drying methods

Samples
types and preparation

Size of the sample and its preparation shall provide the following: sample structure homogeneity, short time of drying, good repeatability of measurement within a measurement series and drying process result comparable to a reference result (standardized method).





Solid bodies
- Light sample
- Requires grinding



Samples of low humidity
- Heavy sample (10 – 15g)



Liquids
- Increasing active surface of evaporation is recommended

Methods
of ending the analysis

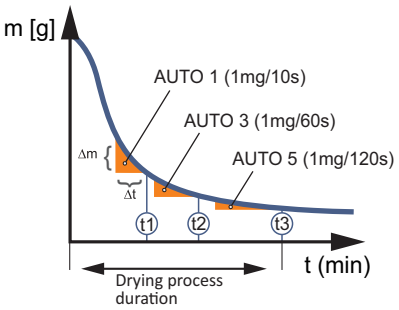
Initial mass	2.7548 g
0:00:10	0.1503% M
0:00:20	0.6258% M
---------- Auto switch off ---------	
0:08:08	Auto 1
Result	11.4789% M
---------- Auto switch off ---------	
0:11:05	Auto 2
Result	11.9058% M
---------- Auto switch off ---------	
0:13:55	Auto 3
Result	12.0502% M
---------- Auto switch off ---------	
0:15:20	Auto 4
Result	12.0858% M
---------- Auto switch off ---------	
0:18:10	Auto 5
Result	12.1526% M

Demonstrative printout of TEST function.

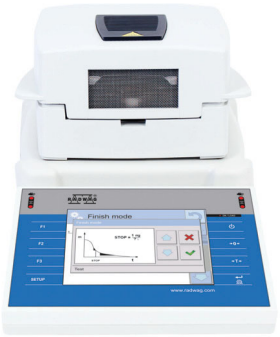
TEST function analyses weight variation for a particular sample, occurring during the drying process. There are 5 different auto switch-off options.

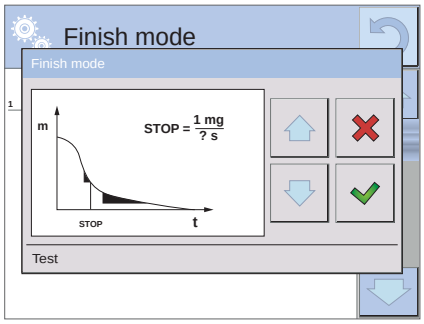
The user shall select option allowing him to end the drying process in a way ensuring that the obtained humidity value is as close as possible to a reference value.

Among other auto switch-off possibilities there are time-defined, manual and user-defined options, the latest one being the best adjusted to a particular sample characteristics.



Relation of weight decrease within a specified time interval.





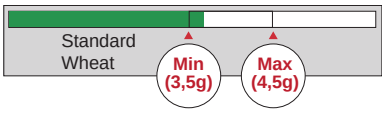
Obtained humidity value depends on start mass of a particular sample – an optimal mass value shall be selected prior running the tests.

Drying process optimization

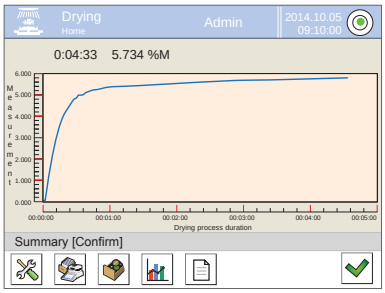
Automatic control
of sample weight

Obtaining optimal results for a drying process is dependent on samples quantity and weight. Too heavy sample lengthens duration of the drying process. Too light sample works against repeatability of the results. This proves that control of the sample weight is inevitable.

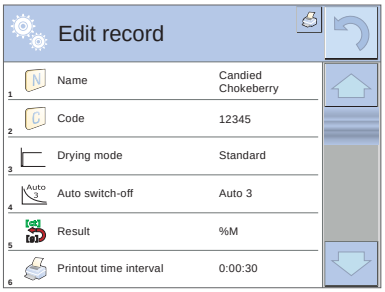




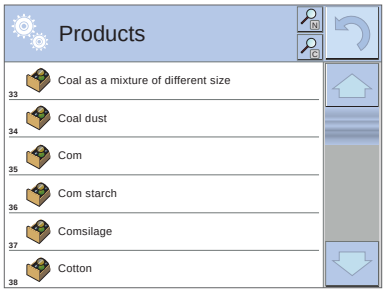
A ***WEIGHT CONTROL*** *(checkweighing thresholds)*



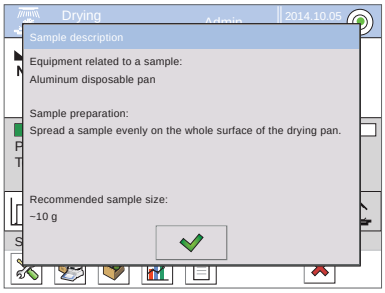
B ***GRAPH*** *(drying process curve, registered for dynamic state)*



C ***DRYING PROGRAMS*** *(drying mode type, temperature, auto switch-off)*



D ***SAMPLES*** *(name, code, end mass, tolerance, etc.)*



E ***SAMPLE DESCRIPTION*** *(information on how to prepare a sample for a drying process)*

Sample
structure transformation

Unfavorable physical processes, effecting the sample structure, may occur during the drying process. These are caused by dispersion of indications and mistakes made when undertaking assessment of actual moisture content for a particular sample.

Respective method for a particular sample drying, shall be selected based on tests optimizing the sample size, drying temperature and method of analysis end procedure.



Crust formation
It is a process where an impermeable layer is formed on a sample surface. This makes removal of humidity from the sample impossible. As a result the indication being an outcome of an analysis is lower than the sample reference value.



Sample burning
Such a process is a consequence of too high drying temperature. It results in a change of sample colour. When sample burning occurs then the sample humidity value is greater than its reference value.



Heat absorption
Dark in colour samples absorb more heat than the light ones. this accounts for application of lower drying temperatures while drying light in colour samples. Tests need to be carried out in order to select the right temperature value.

GLP and the drying process

Drying
temperature control

Drying temperature is a decisive factor for moisture content of a particular sample. The temperature is controlled periodically according to an adopted timetable, wherein the said timetable is specified for a particular temperature value.



Temperature test	
Start time	2014.01.30 13:57:05
Balance type	MA 3Y.NH
Balance ID	1352
Adjustment kit no.	489/13
Preset temperature	120 °C
Target temperature	119 °C
Measured temperature	121 °C
Permissible error	+/- 3 °C
Status	OK

The temperature test is performed by means of a special control thermometer.



Drying mode
Temperature test is performed for standard drying mode, the most frequently used mode for moisture content analysis.



Temperature
The test is performed for a preset temperature.



Tolerance
Maximum permissible deviation for a drying process.



Calibration kit number
Serial number of a control thermometer.

Time interval for test of both, stability and drying temperature accuracy, is merely 8-minute long!

Reports and statistics

Report
on drying process

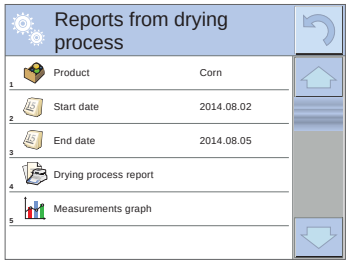
RADWAG moisture analyzers allow the user to make self-configured reports. Analysis, summaries, etc. may be printed by means of any office printer (PCL).

The report comprises three sections: the header (A), the data area (B), and the footer (C). Each section can be freely configured by a user.

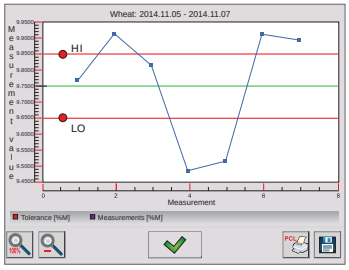


Drying
process statistics

Moisture content analysis performed for the same sample are used to determine the sample moisture content variation within a specified time interval (Trend). Trend graph is calculated automatically. Calculating moisture content variation is required wherever manufacturing process and control is performed in a permanent manner. The obtained data is used by systems controlling the manufacturing process. It helps to determine optimal moisture content for a particular sample, required for a finished product prior its packing.



In order to determine trend graph, open a database and specify reference value for sample humidity and permissible tolerance for humidity determination.



Statistics – trend for moisture content variation over time, calculated automatically for each product.

Drying	
Date	05.09.2014
Time	6:32:18
Operator	Admin
Product	Prod-01
Program	MAR-1
Drying profile	Standard
Drying profile parameters	90 °C
Finish mode	Manual
Start mass	0.674 g
0:00:30	
0:01:00	
0:01:30	
0:02:00	
0:02:30	
0:03:00	
Status	Completed
Drying time	0:03:00
End mass	0.499 g
Result	25.964% M

Example of a simple report on drying, generated by MA.R moisture analyzer.

Drying	
Start date	2014.10.28
Start time	11:34:44
Operator	Admin
Product	Corn
Drying mode	Corn-PRG01
Drying mode	Standard
Drying mode parameters	100 °C
Auto switch-off mode	Auto
Finish mode parameters	1 mg/60 s
Printout interval	0:00:30
Start mass	0.590 g
Date and time	2014.10.28 11:35:14
Drying time	0:00:30
Product	Corn
Current result	5.085% M
0:00:30	5.085% M
Humidity content	5.085% M
Dry mass content	94.915% D
Humid / Dry	5.357% R
Tare	0.007 g
Gross	0.567 g
Set temperature	100 °C
Current temperature	99 °C
Date and time	2014.10.28 11:35:44
Drying time	0:01:00
Current result	7.795% M
Date and time	2014.10.28 11:39:14
Drying time	0:04:30
Current result	14.237% M
Status	Completed
End date	2014.10.28
End time	11:39:22
Drying time	0:04:38
Operator	Admin
Product	Corn
End mass	0.506 g
Humidity content	14.237% M

Example of a complex report on drying, generated by MA.3Y moisture analyzer.

Databases: managing and editing

Databases
drying process ergonomics

Drying parameters such as temperature and auto switch-off are optimally selected for every single sample. Trying to remember the parameters for just a few samples requires considerable effort. It is more convenient to record the parameters in a database than attempting to learn them by heart.



Product database
contains any data relating to a sample:

- name and description,
- EAN code: searching a sample in a database by means of a scanner,
- target value (%): value used for automatic control of sample weight (bargraph) and for determining moisture content variation over time (trend),
- Min, Max: value used for automatic control of sample weight (bargraph),
- tolerance: value used for determining moisture content variation over time (trend),
- drying program.



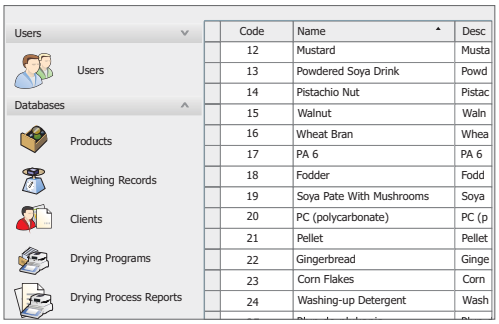


Drying programs database
contains any data relating to a drying process:

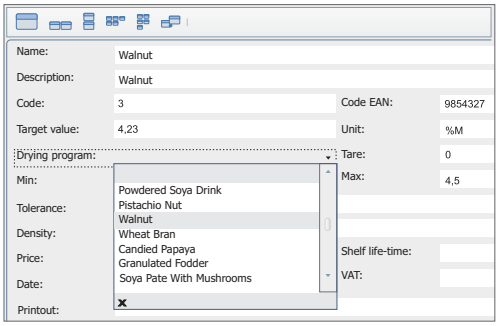
- name, code,
- drying mode, drying temperature,
- auto switch-off (auto / time-defined / user-defined),
- start mass control (none / optional / essential),
- equipment intended for a sample (methodology),
- instruction on sample preparation for a drying process (methodology),
- required sample size (methodology).

Database
editor

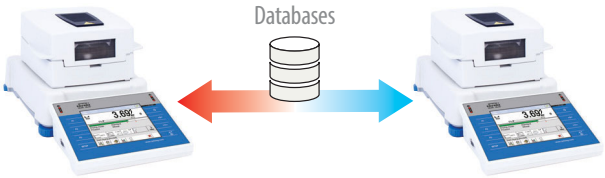
Database Editor PC software is designed to support users dealing with a vast number of samples. Clear structure of the program ensures quickness when it comes to specifying drying parameters and other information relating to a sample. Data is transferred from the software to a moisture analyzer by means of Ethernet (3Y) or RS 232 (3Y, R).



Available databases: Products, Weighing Records, Clients, Drying Programs, Drying Process Records, Ambient Conditions, Packaging, Warehouses, Printouts, Universal Variables.



Detailed information concerning the product.



Export / import of databases between moisture analyzers.

E2R results analysis performed online

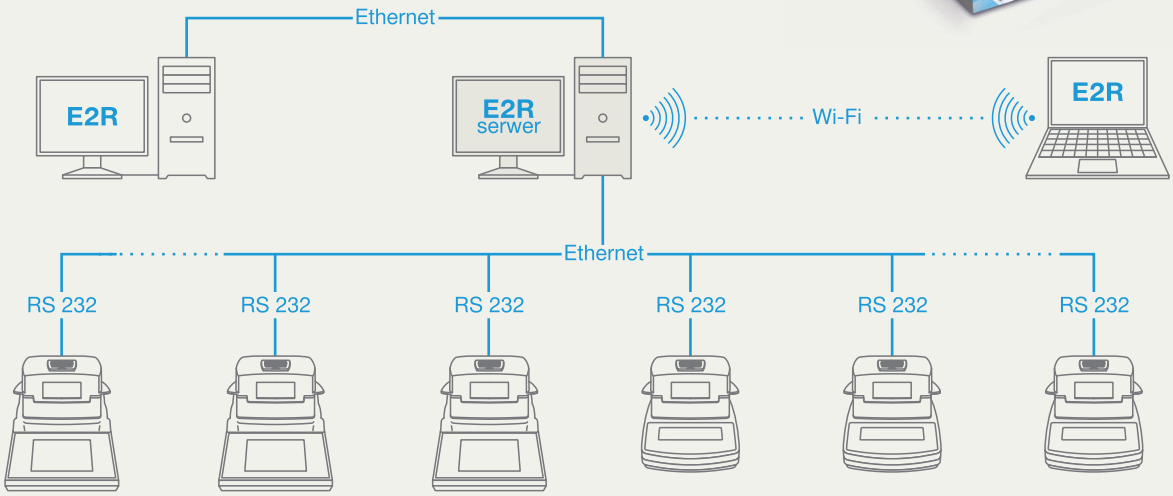
Databases

drying proceses ergonomics

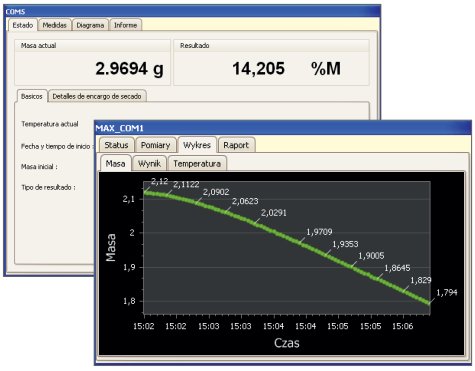


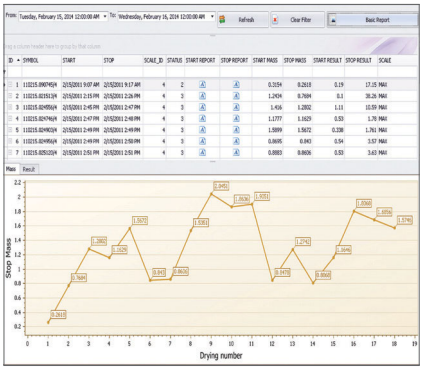
Production processes for which moisture content of a particular sample is a crucial parameter, require quick reaction. This may be carried out using so called weighing networks comprising MA.3Y and MA.R moisture analyzers. Each drying process is monitored on-line regardless of workstations location.

E2R Moisture Analyzer PC software is designed to record measurements performed by means of RADWAG moisture analyzers cooperating in a network, using RS 232 and Ethernet interfaces for connection. The software enables monitoring and reporting of collected measurements.



Software functions: on-line monitoring of moisture analyzer operation, possibility of configuring reports and graphs, analysis of data collected from many drying workstations, data protection.





E2R Moisture Analyzer is a module of integrated system for managing E2R weighing processes.
E2R System comprises various programs ensuring continuous control of balances and their databases together with both, complete managing of the manufacturing process and the process optimization.

Intended use and application

Area
of use

Moisture content analysis and dry mass measurement of a particular product are both crucial for various branches of industry and science. Vast area of use and diversity of analyzed samples structure requires individual approach to different substances.



Dairy industry

Samples:
cheese, buttermilk, yoghurt, powdered milk, etc.

Samples are dried directly on a weighing pan or by means of glass fiber filters or quartz sand (increasing surface of evaporation).



Fruit and vegetable industry

Samples:
dried vegetables, fruits and mushroom, nuts etc.

Samples shall be cut into smaller pieces (the analyzed samples cannot be too thick).



Food industry

Samples:
sugar, flour, pasta, spices, gelatin, etc.

Thin layer of semi-liquid samples shall be distributed on a weighing pan (quartz sand or glass fiber filters may be used). Other kinds of samples shall be crushed.



Sugar industry

Samples:
emulsion, gel and lotions used for cleaning, paints, film, graphite, etc.

Thin layer of semi-liquid samples shall be distributed on a weighing pan (quartz sand or glass fiber filters may be used). Other kinds of samples shall be crushed).



Agricultural industry

Samples:
grain, seeds, hay, biomass, etc.

Grain needs to be crushed prior being subjected to drying.

PC
Software

RADWAG PC software supports moisture analyzers expanding their functionality.



PW Win

Balance and computer cooperation, display of measurements and statistics.



Database Editor

Databases support for 3Y balances and PUE 7 and PUE HY terminals.



RAD Key

Readout of balance data by means of defined Hot Key.



E2R Moisture Analyzers

Record of weighments carried out by moisture analyzers cooperating in a network.

Additional
equipment

- Anti-vibration weighing tables,
- Disposable weighing pans,
- Thermal and dot matrix printers,
- Barcode scanners (for 3Y series),
- Control thermometer,
- Water vapor permeability set.

Complete offer is to be found on www.radwag.com website.

Technical information





	MA 60.3Y	MA 200.3Y	MA 50/1.R	MA 50.R	MA 110.R	MA 210.R
Metrologically important parameters						
Max load [Max]	60 g	200 g	50 g	50 g	110 g	210 g
Readability [d]	0,1 mg	1 mg	0,1 mg	1 mg	1 mg	1 mg
Tare range	-60 mg	-200 mg	-50 mg	-50 mg	-110 mg	-210 mg
Max sample weight	60 g	200 g	50 g	50 g	110 g	210 g
Drying temeperature range	max 160 °C	max 160 °C	max 160 °C	max 160 °C	max 160 °C	max 160 °C
Moisture readout accuracy	0,0001 %	0,001 %	0,0001 %	0,001 %	0,001 %	0,001 %
Moisture content repeatability for ~ 2g heavy samples	+/-0,05%	+/-0,05%	+/-0,05%	+/-0,05%	+/-0,05%	+/-0,05%
Moisture content repeatability for ~ 10g heavy samples	+/-0,01%	+/-0,01%	+/-0,01%	+/-0,01%	+/-0,01%	+/-0,01%
Design						
Display	5,7" colour touch screen	5,7" colour touch screen	LCD (backlit)	LCD (backlit)	LCD (backlit)	LCD (backlit)
Keyboard	8 buttons	8 buttons	14 buttons	14 buttons	14 buttons	14 buttons
Heating element	IR emitter	IR emitter	IR emitter	IR emitter	IR emitter	IR emitter
Features						
Databases	1 GB (database of samples and programs)		6 databases (users, products, weighing records, tares, drying programs, reports)			
Method for drying	4 drying modes		4 drying modes			
Auto switch-off options	4 options		4 options			
Touch-free operation	programmable sensors		–			
Additional functions	sample identification, drying process graph		sample identification			
Communication interface						
USB	USB 2.0×2	USB 2.0×2	USB A, USB B	USB A, USB B	USB A, USB B	USB A, USB B
RS 232	RS 232	RS 232	RS 232	RS 232	RS 232	RS 232
Wi-Fi	YES	YES	YES (option)	YES (option)	YES (option)	YES (option)
Ethernet	10/100 Mbit	10/100 Mbit	–	–	–	–
Inputs / Outputs	In×4 / Out×4	In×4 / Out×4	–	–	–	–
Electrical parameters						
Power supply	230V 50Hz AC	230V 50Hz AC	230V 50Hz AC	230V 50Hz AC	230V 50Hz AC	230V 50Hz AC
Power consumption	420 W	420 W	405 W	405 W	405 W	405 W
Power of a heating device	400 W	400 W	400 W	400 W	400 W	400 W
Ambient conditions						
Working temperature	+10 - +40 °C	+10 - +40 °C	+10 - +40 °C	+10 - +40 °C	+10 - +40 °C	+10 - +40 °C
Physical characteristics						
Weighing pan size	ø 90, h = 8 mm	ø 90, h = 8 mm	ø 90, h = 8 mm	ø 90, h = 8 mm	ø 90, h = 8 mm	ø 90, h = 8 mm
Overall dimensions	250×436×190 mm	250×436×190 mm	206×333×190 mm	206×333×190 mm	206×333×190 mm	206×333×190 mm
Net weight	6 kg	6 kg	4,9 kg	4,9 kg	4,9 kg	4,9 kg
Packaging size	595×395×420 mm	595×395×420 mm	470×380×336 mm	470×380×336 mm	470×380×336 mm	470×380×336 mm
Gross weight	10 kg	10 kg	6,4 kg	6,4 kg	6,4 kg	6,4 kg



Features:



Touchscreen display



Databases



Portable terminal



Automatic level indicator



Proximity sensors



Interfaces: USB, Wi-Fi, Ethernet, IN/OUT and RS 232



Profiles



Media player

Function:

- Mass measurement
- Drying samples
- %M Moisture content analysis
- %D Dry mass calculation
- Drying modes
- END Auto switch-off modes
- Drying process visualization
- GLP Procedures
- Water vapor permeability
- 250°C Increased temperature (option)

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