



Moisture Analyzers



PMV 50 PLUS

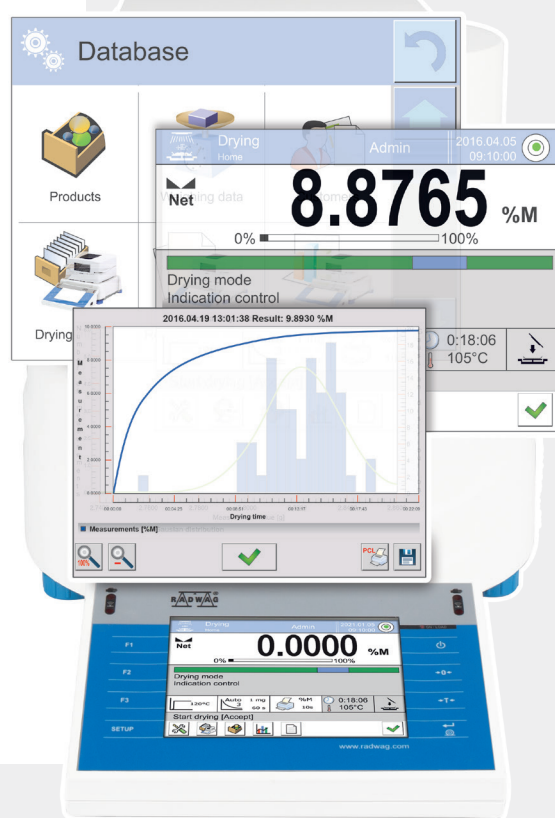
Microwave Moisture Analyzer

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

- 5.7" touch screen display
- Interactive menu
- Wi-Fi
- Control and adjustment system for a drying chamber (GMP)
- Compliance with regulations (GLP System)
- Databases (products, weighings, customers, drying programs, drying processes reports, control Wand statistics for drying processes reports)
- Dynamic control of sample weight (bar graph)
- Drying parameters optimisation (Test)
- Drying process visualisation (%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)

Home screen

- 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 bar graph
- G** Bar graph for sample weight control
- H** Configurable area for supplementary information
- I** Drying mode / temperature selection
- J** Auto switch-off option
- 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)



Plus



- 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.



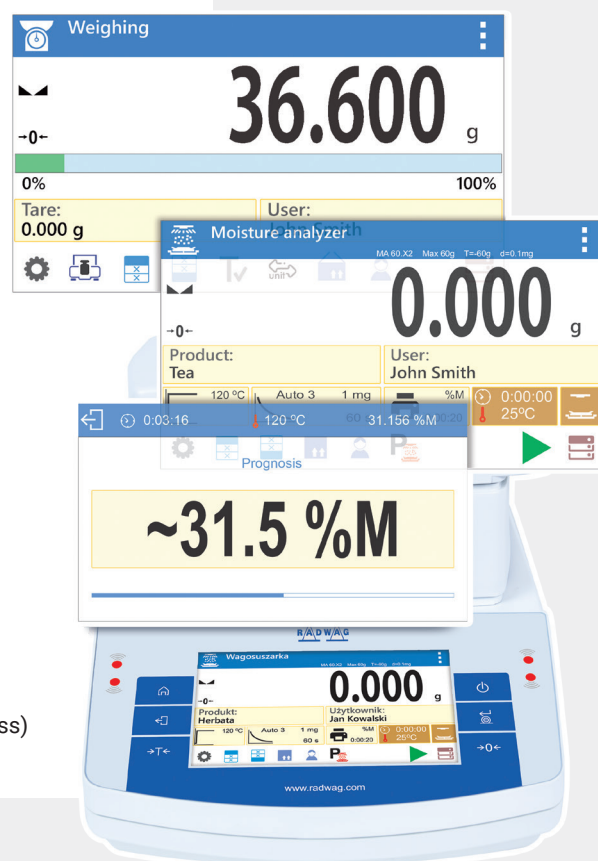
Moisture Analyzers of X2 Series

Professional design assuring the highest quality of drying process and maximum comfort of operation.

- 5.7" colour touch screen
- Free customization of menu elements
- Wi-Fi
- Control and adjustment system for a drying chamber (GMP)
- Compliance with regulations (GLP System)
- Databases (products, customers, users, packaging, drying programs, drying reports)
- Dynamic control of sample weight (bar graph)
- Drying parameters optimisation (test)
- Drying process visualisation
- Statistics (trend of sample humidity over time)
- Printouts, reports (standard PCL)
- Multilingual menu
- Wide spectrum of applications (industry, laboratories, universities, research and development institutes)

Home screen

- A** Displaying home screen
- B** Exit (return to the previous screen)
- C** Tare button
- D** Display shutdown
- E** Enter/Print button
- F** Zero button
- G** Status bar (working mode, moisture analyzer metrological data)
- H** Area with drying/weighing result
- I** Information panel
- J** Quick access key triggering functions and settings
- K** Current working mode settings
- L** Proximity sensors
- M** Drying mode / temperature selection
- N** Drying process automatic shutdown
- O** Printout interval
- P** Temperature and analysis time
- R** Area defining the drying chamber (Opened / Closed / Drying Process)





- Clear information arrangement.
- Uncomplicated and intuitive operation as a result of free customization of the menu.
- Automatically opened and closed drying chamber.



Moisture Analyzers of R Series

Advanced technology for a drying process and moisture content analysis!

- LCD display
- Cascading menu
- Wi-Fi
- Control and adjustment system for a drying chamber (GMP)
- Compliance with regulations (GLP System)
- Databases (users, products, programs, tares)
- Drying parameters optimisation (Test)
- Drying process visualisation (%M, %R, %D, graph)
- Printouts, reports (standard PCL)
- Multilingual menu
- Wide spectrum of applications (industry, laboratories, universities, research and development institutes)

Home screen

- A** Displaying home screen
- B** Exit (return to the previous screen)
- C** Tare button
- D** Display shutdown
- E** Enter/Print button
- F** Zero button
- G** Status bar (working mode, moisture analyzer metrological data)
- H** Area with drying/weighing result
- I** Information panel
- J** Quick access key triggering functions and settings
- K** Current working mode settings
- L** Proximity sensors





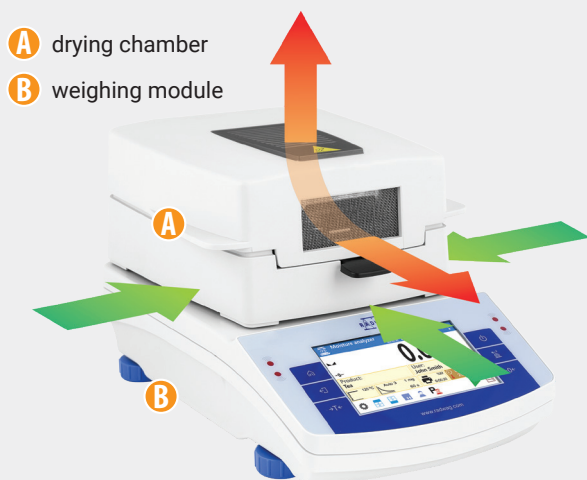
- Compact size and design.
- Easy and intuitive operation.
- Direct access to reports and product databases.
- Ease of data exchange between devices.
- Versatility of applications in various workstations.



Design and Construction

Measurements 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. Module stabilisation is obtained using special algorithm controlling halogen lamp operation.



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.



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. **RADWAG-designed 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.**

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.**

Heat Source Types and Intended Use

IRS Halogen

Intended for:
powder, semi-liquids, liquids.

IRM Emitter

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

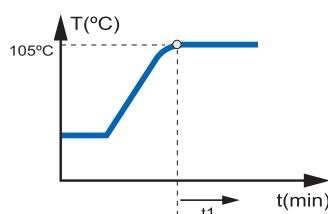
IRL Emitter

Intended for:
bodies of thick consistence and for solids.

Microwave Emitter

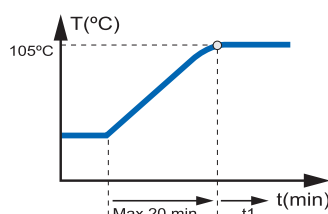
Intended for:
drying of samples containing significant amount of moisture (up to 100%)

Methods for Obtaining the Preset Temperature



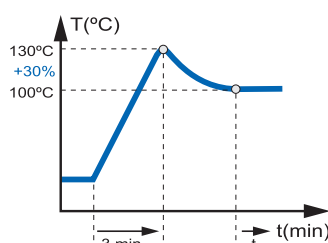
Standard Mode

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



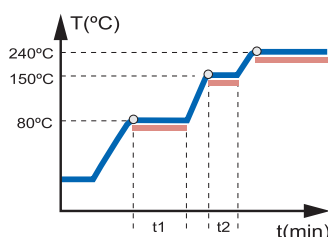
Mild Mode

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. In case of overadjustment 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 and Processes

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 (standardised method).



Solid bodies
- light sample,
- requires grinding



Samples of low humidity
- heavy sample
(10 - 15 g)



Liquids
- increasing active
surface of evaporation is
recommended

Sample Structure Transformation

Unfavorable physical processes, affecting 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.



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.

Automatic Control of Sample Weight

Obtaining optimal results for a drying process depends 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)

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

Demonstrative printout of TEST function.

Methods of Analysis Completion

TEST function analyses weight variation for a particular sample, occurring during the drying process. There are 5 different options for automatic shutdown. 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 automatic shutdown possibilities there are time-defined, manual and user-defined options, the latest one being the best adjusted to a particular sample characteristics.

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

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.



Reports and Statistics

Report on Drying Process

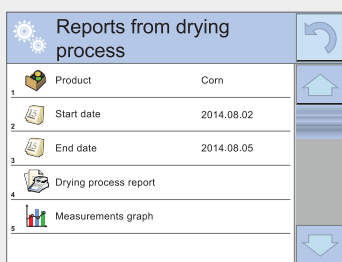
RADWAG moisture analyzers allow the user to make self-configured reports. Analysis, summaries, etc. may be printed by means of any office printer (PCL).

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.

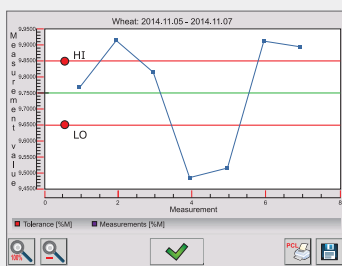
Drying Process Statistics

Moisture content analyses 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.

A

B

C

Drying	
Date	05.01.2021
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 drying report, generated by MA R moisture analyzer.

A

B

C

Drying	
Start date	2021.01.28
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	2021.01.28 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	2021.01.28 11:35:44
Drying time	0:01:00
Current result	7.795% M
Date and time	2021.01.28 11:39:14
Drying time	0:04:30
Current result	14.237% M
Status	Completed
End date	2021.01.28
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 drying report, generated by PMV 50 PLUS moisture analyzer.

Databases Managing and Editing

Databases Drying Process Ergonomics

Drying parameters such as temperature and automatic shutdown 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 (bar graph) and for determining moisture content variation over time (trend),
- Min, Max: value used for automatic control of sample weight (bar graph),
- 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,
- automatic shutdown (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 () or RS 232 (, R).

Users	Code	Name	Desc
Users	12	Mustard	Musta
	13	Powdered Soya Drink	Powd
	14	Pistachio Nut	Pistac
Databases	15	Walnut	Waln
Products	16	Wheat Bran	Whea
	17	PA 6	PA 6
Weighing Records	18	Fodder	Fodd
Clients	19	Soya Pate With Mushrooms	Soya
Drying Programs	20	PC (polycarbonate)	PC (p
Drying Process Reports	21	Pellet	Pellet
	22	Gingerbread	Ginge
	23	Corn Flakes	Corn
	24	Washing-up Detergent	Wash

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

Name:	Walnut		
Description:	Walnut		
Code:	3	Code EAN:	9854327
Target value:	4,23	Unit:	%M
Drying program:		Tare:	0
Min:		Max:	4,5
Tolerance:			
Density:			
Price:			
Date:			
Printout:			

Detailed information concerning the product.



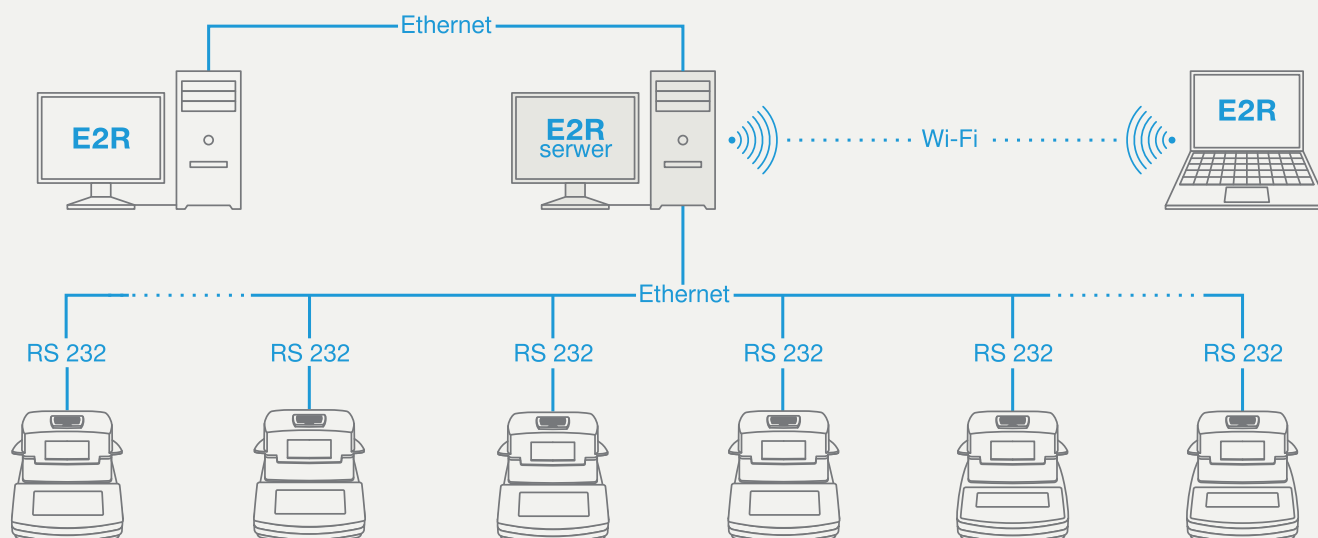
Export / import of databases moisture analyzers

E2R Results Analysis

Databases Drying Processes 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 PMV 50 PLUS, MA X2 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.

PC Software

RADWAG PC software supports moisture analyzers expanding their functionality.

R-Lab

Scales preview, weighings graphs and statistics graphs.

Database Editor

Readout, databases editing and record of computer stored databases on balance.

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,
- Control thermometer,
- Water vapor permeability set.

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



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 optimisation.

Intended Use and Applications

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 require 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 silica 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 (silica sand or glass fiber filters may be used). Other kinds of samples shall be crushed.



Chemical 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 (Silica 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 drying.

Technical Specification



PMV 50 PLUS



MA 50/1.X2.A
MA 50/1.IC.X2.A*









MA 50.X2.A
MA 50.IC.X2.A*



MA 110.X2.A
MA 110.IC.X2.A*

Maximum capacity [Max]	50 g	50 g	50 g	110 g
Readability [d]	0.1 mg	0.1 mg	1 mg	1 mg
Tare range	-50 g	-50 g	-50 g	-110 g
Maximum sample weight	50 g	50 g	50 g	110 g
Moisture readout accuracy	0.0001 %	0.0001 %	0.001 %	0.001 %
Moisture content repeatability for ~ 2g sample.	0.05%	0.05 %	0.05 %	0.05 %
Moisture content repeatability for ~ 10g sample.	0.01 %	0.01 %	0.01 %	0.01 %
Adjustment	external	external (MA X2.A), internal (MA X2.IC.A)	external (MA X2.A), internal (MA X2.IC.A)	external (MA X2.A), internal (MA X2.IC.A)
Drying temperature range	–	max 160°C, max 250°C (option)	max 160°C, max 250°C (option)	max 160°C, max 250°C (option)
Heating element	microwave emitter	IR emitter, halogen (option), metal heater (option)	IR emitter, halogen (option), metal heater (option)	IR emitter, halogen (option), metal heater (option)
Power of heating element	max 800 W	450 W	450 W	450 W
Drying mode	standard, quick, step, mild	standard, quick, step, mild	standard, quick, step, mild	standard, quick, step, mild
Drying shutdown options	manual, automatic, time-defined, user-defined	manual, automatic, time-defined, user-defined	manual, automatic, time-defined, user-defined	manual, automatic, time-defined, user-defined
Touch-free operation	programmable sensors	programmable sensors	programmable sensors	programmable sensors
Automatically opened drying chamber	–	YES	YES	YES
Additional functions	control of sample weight before drying process	control of sample weight before drying process	control of sample weight before drying process	control of sample weight before drying process
Operating temperature	+10°C - + 40°C	+10°C - + 40°C	+10°C - + 40°C	+10°C - + 40°C
Weighing pan dimensions	ø90 mm, h = 8 mm	ø90 mm, h = 8 mm	ø90 mm, h = 8 mm	ø90 mm, h = 8 mm
Display	5" capacitive colour touchscreen	5" capacitive colour touchscreen	5" capacitive colour touchscreen	5" capacitive colour touchscreen
Communication interfaces	2×USB-A, RS 232, Ethernet, W-Fi®, 4×IN/OUT	USB-A, USB-B, RS 232, Ethernet, Wi-Fi®	USB-A, USB-B, RS 232, Ethernet, Wi-Fi®	USB-A, USB-B, RS 232, Ethernet, Wi-Fi®

					
MA 200/1.X2.A MA 200/1.IC.X2.A*	MA 210.X2.A MA 210.IC.X2.A*	MA 50/1.R	MA 50.R	MA 110.R	MA 210.R
200 g	210 g	50 g	50 g	110 g	210 g
0,1 mg	1 mg	0.1 mg	1 mg	1 mg	1 mg
-200 g	-210 g	-50 g	-50 g	-110 g	-210 g
200 g	210 g	50 g	50 g	110 g	210 g
0.001 %	0.001 %	0.0001 %	0.001 %	0.001 %	0.001 %
0.05 %	0.05 %	0.05 %	0.05 %	0.05 %	0.05 %
0.01 %	0.01 %	0.01 %	0.01 %	0.01 %	0.01 %
external (MA X2.A), internal (MA X2.IC.A)	external (MA X2.A), internal (MA X2.IC.A)	external	external	external	external
max 160°C, max 250°C (option)	max 160°C, max 250°C (option)	max 160°C, max 250°C (option)	max 160°C, max 250°C (option)	max 160°C, max 250°C (option)	max 160°C, max 250°C (option)
IR emitter, halogen (option), metal heater (option)	IR emitter, halogen (option), metal heater (option)	IR emitter, halogen (option), metal heater (option)	IR emitter, halogen (option), metal heater (option)	IR emitter, halogen (option), metal heater (option)	IR emitter, halogen (option), metal heater (option)
450 W	450 W	450 W	450 W	450 W	450 W
standard, quick, step, mild	standard, quick, step, mild	standard, quick, step, mild	standard, quick, step, mild	standard, quick, step, mild	standard, quick, step, mild
manual, automatic, time-defined, user-defined	manual, automatic, time-defined, user-defined	manual, automatic, time-defined, user-defined	manual, automatic, time-defined, user-defined	manual, automatic, time-defined, user-defined	manual, automatic, time-defined, user-defined
programmable sensors	programmable sensors	–	–	–	–
YES	YES	–	–	–	–
control of sample weight before drying process	control of sample weight before drying process	sample identification	sample identification	sample identification	sample identification
+10°C - + 40°C	+10°C - + 40°C	+10°C - + 40°C	+10°C - + 40°C	+10°C - + 40°C	+10°C - + 40°C
ø90 mm, h = 8 mm	ø90 mm, h = 8 mm	ø90 mm, h = 8 mm	ø90 mm, h = 8 mm	ø90 mm, h = 8 mm	ø90 mm, h = 8 mm
5" capacitive colour touchscreen	5" capacitive colour touchscreen	LCD (backlit)	LCD (backlit)	LCD (backlit)	LCD (backlit)
USB-A, USB-B, RS 232, Ethernet, Wi-Fi®	USB-A, USB-B, RS 232, Ethernet, Wi-Fi®	USB-A, USB-B, RS 232, Wi-Fi®	USB-A, USB-B, RS 232, Wi-Fi®	USB-A, USB-B, RS 232, Wi-Fi®	USB-A, USB-B, RS 232, Wi-Fi®

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