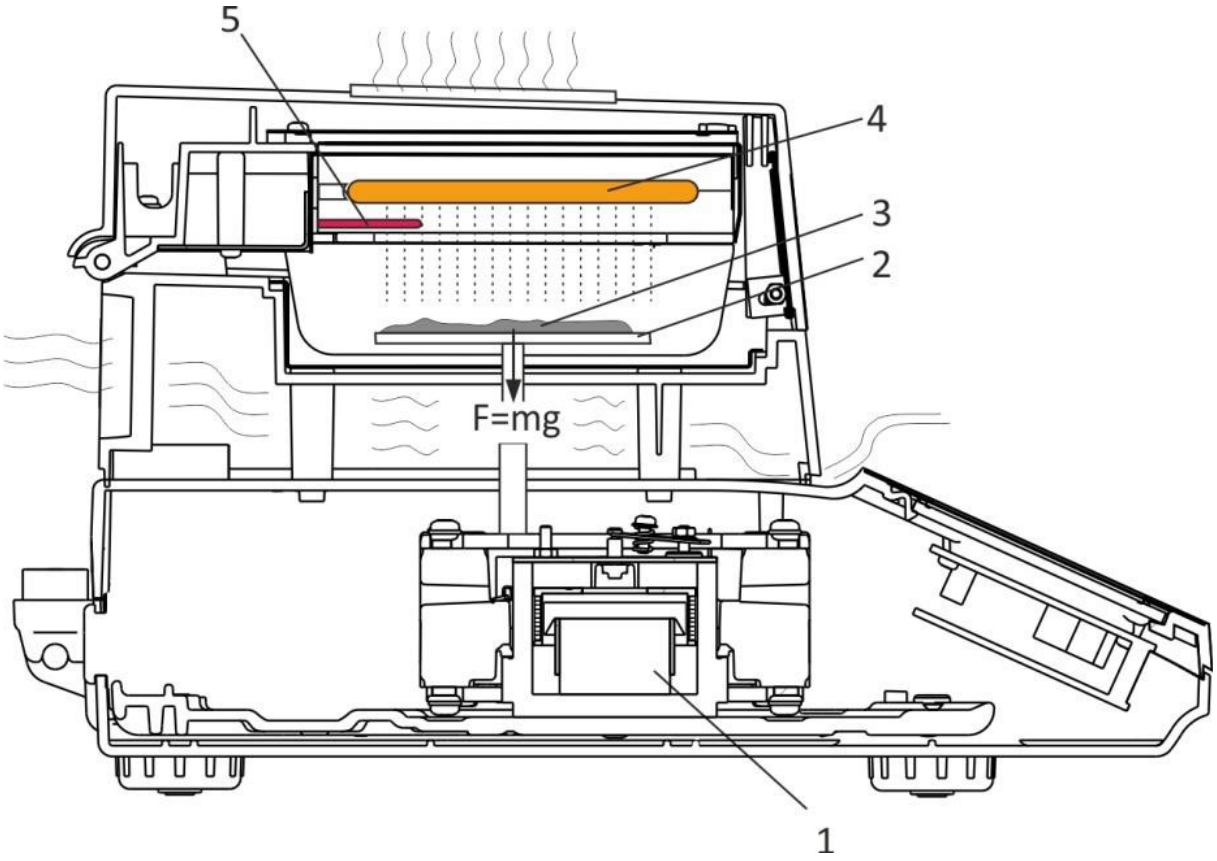
Operation description – MA X2 moisture analyzers

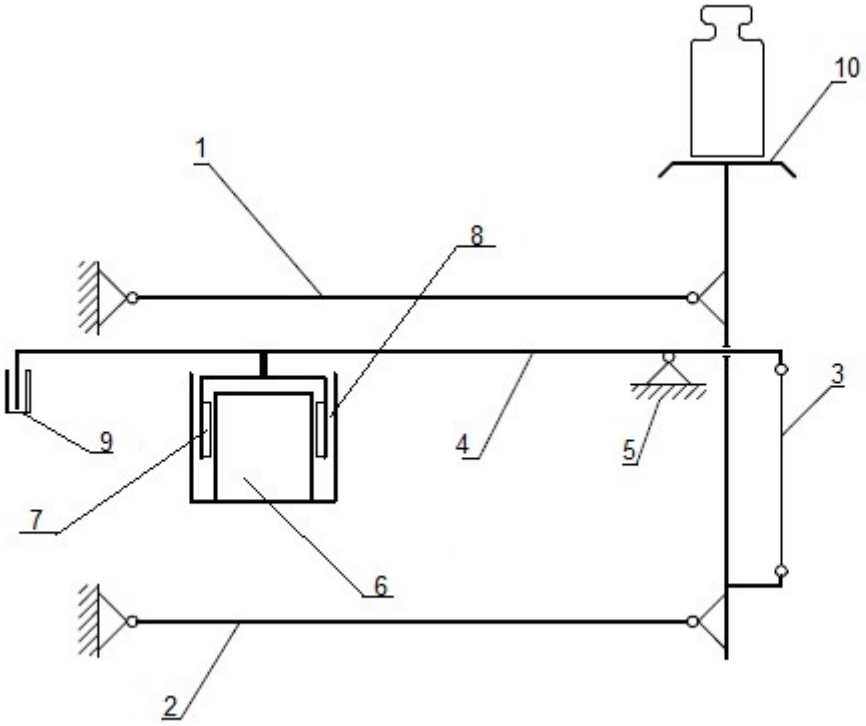
MA X2 moisture analyzers comprise a precision balance and a drying chamber surrounding a weighing pan joined together. High resolution weighing module is designed to provide quick and precise measurement of a particular sample weight, independently from its thermal condition. Module stabilisation is obtained using special algorithm controlling halogen lamp or infrared lamp operation.



The general rule of operation is to measure the mass of evaporated water from a sample 3 placed on a weighing pan 4 during heating it by a heating element 4 (halogen or infrared lamp). The whole process is controlled by a digital system using the thermometer 5 and changes in mass measured by the electromagnetic weighing cell 5.
Precise measurement of analysed product mass is guaranteed due to an electromagnetic weighing cell 1.
Measurement of the product mass is realized in accordance with the following equation:
F= mg
m – product mass,
g – on-site gravitational acceleration

Product mass change during heating is analyzed by data processing systems operating in accordance with a unique algorithm. The increase of product temperature aiming to isolate and determine water contained within product structure takes place in the drying chamber. Inside of the chamber there is a weighing pan 2, permanently fixed to the weighing cell 1. In the course of production the moisture analyzer is calibrated using mass standards, traceability is accounted for. This allows to link the gravitational force with the 1 kilogram mass standard. Due to the above, upon placing the sample 3 on the weighing pan 2 it is possible to present the gravitational force (F = mg) on a moisture analyzer display as a weighing result expressed in gram.
Increase of product 3 temperature is brought about with use of a precisely controlled heat source 4, built into the top part of the drying chamber.

Weighing principle



1, 2 – parallel guides
3 - vertical elastic element
4 – leverage system
5 – fulcrum
6 – permanent magnet
7 – air coil
8 – air gap
9 – position sensor
10 – load receptor

The operating principle of MA X moisture analyzers consist in electromagnetic compensation of the force of gravity applied to the load receptor 10. Generally the rule of operation is to keep the whole unit in equilibrium by generating an adequate current Ic that flows through air

coil 7. If a load is applied to the weighing pan, it generates a force of gravity related to the mass of the object on the load receptor 10. The leverage system 4 to which the air coil 7 and position sensor 9 are attached changes position so that the unit becomes unbalanced. Electronics detect the position sensor imbalance and reacts by changing the current Ic. In other words, said force causes a deviation of the system from equilibrium, the deviation being transferred by the mechanical system to the coil placed in a magnetic field of a permanent magnet 6 placed within the actuator. The air coil 8 can move freely in the air gap 8 according to leverage system 4 movements. The weighing mechanism in moisture analyzers MA X is hybridic, made of many parts linked by screws.

The position of the coil in the field of the solenoid actuator is detected by the position sensor 9. Due to the change in signal from the position sensor 9, the value of the current Ic flowing in the coil also changes, with this operation the mass measurement system regains its initial equilibrium with another Ic value.

The precise measuring resistor converts the coil current into voltage. The measured value of the voltage is transferred to an A/D converter which supplies the digital value of the measurement signal and transfers it to a microprocessor. The digital signal related to measured mass is then filtered (software). Owing to filtering, demanded resolution is provided. Thus prepared measurement signal is corrected by factors accounting for changes occurring within mass measuring system, which changes are a result of temperature variation. Next, in order to get accurate linear relation between measured load and measurement signal value, the signal is subjected to so called linearity correction. At the end the measurement signal is scaled using adjustment coefficient, this is to provide weighing result, displayed on the screen. The weighing result is considered to be stable when it varies less than specified by stability criterion value described below. All operations mentioned here are performed by embedded software. The weighing result is displayed on the LCD display. The weighing results can be saved in the internal memory or passed to other devices via interfaces. One of those interfaces is wireless. FCC certified module is applied to connect the device to an external WiFi network.

Description of grounding

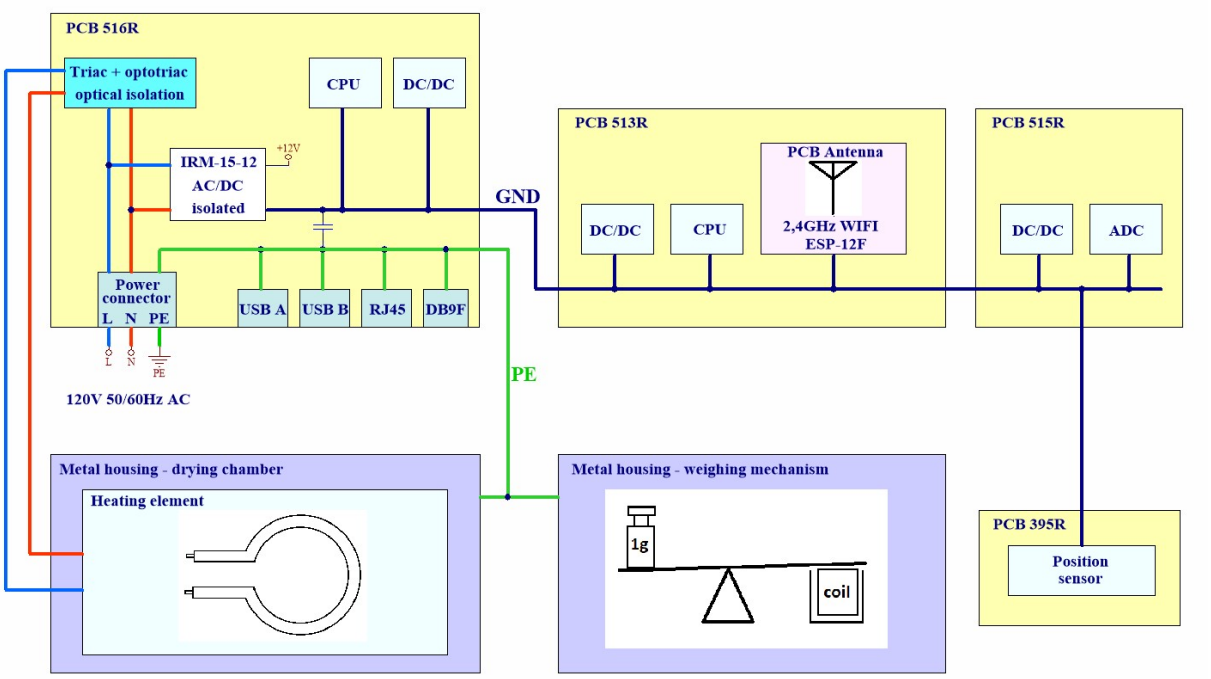


Fig 1. Models without internal calibration

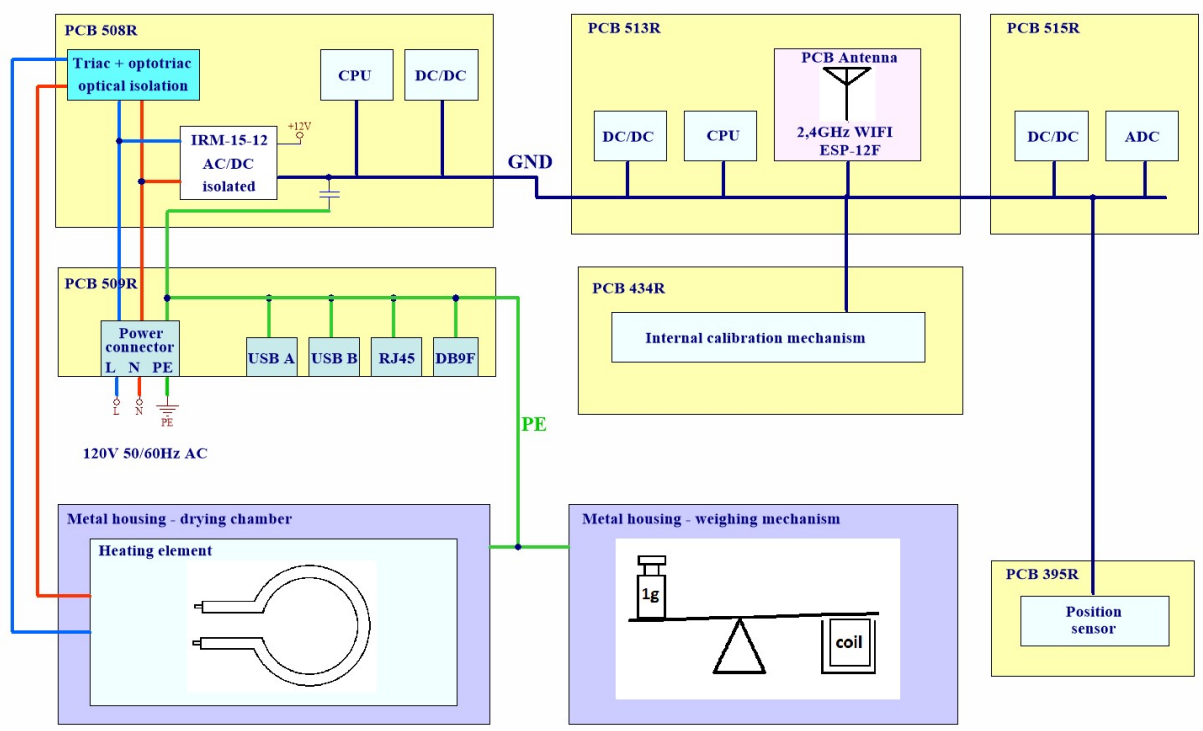


Fig 2. Models with internal calibration

The device is supplied from the mains: 100 -120V AC 50 / 60Hz.
The device is connected to the mains via a 3-core cable with a PE protective conductor. On the 516R or 508R power supply board, the mains voltage is converted to 12V DC using the IRM-15-12 isolating AC / DC converter. In case of internal calibration models the mains voltage is 120 V AC is applied to 509R PCB and further directed to 508R PCB without changes. The voltage is lowered to the desired values by DC / DC converters to suit the

components on the 513R motherboard, 515R converter board and 395R position sensor board. Additionally, in case of models with internal calibration, the DC voltage is passed to 434R PCB responsible for controlling the internal calibration process.

All interface connector housings are connected to PE potential. All metal housing elements that the user has access to are connected to the PE potential.

12V DC voltage goes to the 513R motherboard. Then the voltage is re-processed to power the individual elements: processor, lcd, wifi module etc.

Description of anthenna
The anthenna for the third party FCC certified WiFi module is made as a PCB track on the modules PCB. The further description of the module registered with FCC ID: 2AHMR-ESP12F can be found on the FCC website:
FCC ID Search | Federal Communications Commission