

Application of microwave in-line moisture meters MR112K13K in the mining industry.



Microwave conveyor moisture meters are widely used in the mining industry, as they allow continuous and real-time monitoring of the moisture content of ore, coal, concentrates, and other bulk materials directly on the conveyor belt.

Main objectives of application:

1. Product quality control

Maintaining stable moisture content of ore and concentrates.

Compliance with the requirements of metallurgical enterprises and processing plants.

2. Optimization of technological processes

Regulation of water supply in crushing, screening and beneficiation plants.

Control of drying or filtration processes.

Reducing energy costs during processing.

3. Automation and monitoring

Moisture meters are integrated into the enterprise's automated process control system and allow for the construction of comprehensive moisture management systems.

Provides an alarm when parameters go beyond acceptable limits.

Advantages of microwave moisture meters

- Continuous operation mode (unlike laboratory samples).
- High accuracy even with changes in the granulometric composition and color of the material.
- Non-contact measurement method – sensors are not worn out by abrasive materials.
- Resistance to dust and vibration, which is important for mines and quarries.
- Ability to work with large flows and high conveyor productivity.

Application examples

- At beneficiation plants – control of ore moisture before crushing and flotation.
- Control of operation of centrifuges and filters after flotation.
- In coal mines – determination of coal moisture content to calculate calorific value and cost.
- During transportation and storage – preventing freezing and formation of cakes in winter.
- At metallurgical plants – control of the moisture content of concentrates before agglomeration or roasting.

Operating principle

Physical basis

The microwave method is based on the fact that water strongly affects the dielectric properties of the material.

When an electromagnetic wave passes through a flow of ore or coal, the following changes: speed of propagation,

phase,

signal amplitude.

The higher the moisture content, the more noticeable these changes are.

Measuring circuit

A microwave emitter and receiver are installed on the conveyor

The wave passes through a layer of material, and the device records the change in the signal.

The moisture meter calculates the mass fraction of moisture in real time.

Calibration

To take into account the characteristics of a particular ore (fraction, mineralogy, waste rock content), preliminary calibration is carried out using laboratory data.

After this, the device can operate automatically without constant intervention from staff.

Advantages of the method

Continuity and online control

Unlike sampling and laboratory analysis, results are provided continuously, as the material moves along the conveyor.

Contactless

The sensors do not come into direct contact with abrasive ore or coal → minimal wear and high reliability.

Resistance to mining conditions

The devices operate in high dust conditions, vibrations, and temperature changes.

They do not depend on the color and granulometric composition of the material (which limits, for example, optical methods).

Economic efficiency

Energy costs for drying and transportation are reduced .

Losses during storage and shipping are reduced.

Fines for non-compliance with product moisture content are eliminated.

Integration into automated process control systems

Modern moisture meters have interfaces for transmitting data to the enterprise management system.

You can automatically regulate the water supply, the operation of drying drums or filters

Microwave conveyor moisture meters thus provide **reliable, accurate, and cost-effective** moisture control in mining environments where conventional laboratory methods are too slow and labor-intensive, infrared moisture meters measure only the surface layer, and radioisotope methods are too complex to operate.

Our offer for the mining industry is the MR112K13K conveyor flow moisture meter.

Using the MICRORADAR112K13K moisture meters, you can monitor the operation of dewatering centrifuges, filters, and drying units, record and view equipment performance data over any period of time, monitor the moisture content of shipped products, and prevent defective shipments.

The moisture meter's easy installation, setup, and adjustment will be hassle-free for maintenance personnel. Connecting the moisture meter to your existing plant control systems will allow you to always monitor the moisture situation throughout all your processes and promptly resolve any issues that arise.

Non-contact microwave amplitude-phase moisture meter of two-sided type **MICRORADAR112K13K** It is designed to measure the moisture content of ores and concentrates with classes from 0 to 150 mm and thickness 100- 300 mm. on conveyor belts. The moisture meter can operate in conjunction with a conveyor scale or be equipped with an ultrasonic level meter that measures the thickness of the material layer.



How does this work

The moisture meter operates by measuring the interaction parameters of microwave energy with a wet material. The amplitude and phase of the signal transmitted through the material, the measured thickness of the material on the belt, or the load signal from a conveyor scale are used in the algorithm, the moisture content is calculated.



The MR112K13K moisture meters consist of microwave sensors, an ultrasonic level meter, a microwave module and a processing unit.

The moisture meter sensors are mounted above and below the conveyor belt with material, as shown in the figures.





To level the layer in front of the sensors, a leveler is installed - a very simple device made from a conveyor belt, as shown in the figures.



The microwave module is housed in a metal cabinet with IP66 protection rating.

The device provides automatic correction of measurement results when the temperature of the material changes, has a current output and a serial communication channel with a computer RS -485 using the MODBUS protocol .

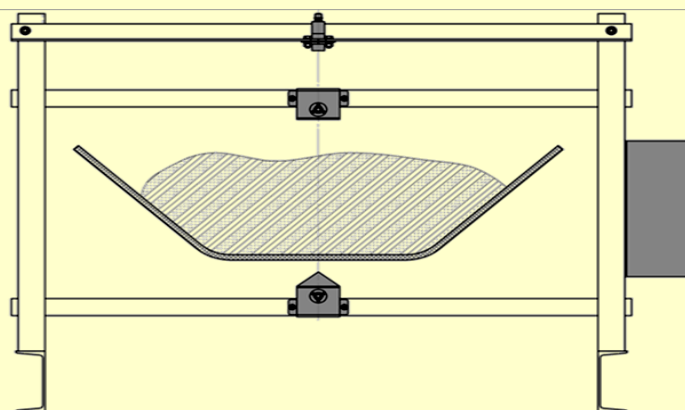
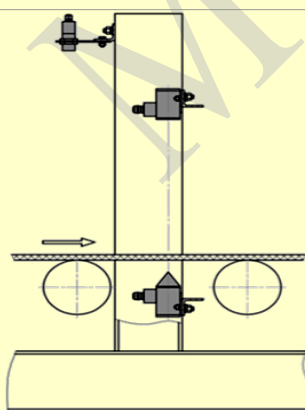
The sensor signal is fed to the processing unit, which collects all necessary parameters (amplitude-phase characteristics of the microwave signal, level meter and temperature sensor signals) and calculates moisture. The measured value is displayed on the microprocessor unit's indicator panel, converted into 4-20 mA and 0-5 V analog outputs , and transmitted to the computer via the RS485 channel using modern communication protocols.

Easy calibration and maintenance is ensured by a clear and user-friendly interface.

The device may be supplied with a remote display unit and software for collecting and displaying real-time data, allowing you to record, monitor, store, and print moisture data for a selected period. Modern communication solutions allow for easy integration with an industrial control system.

The accuracy of moisture measurement is from 0.15% to 1% abs . depending on the moisture range, taking into account the sampling error and the error in measuring moisture by a standard method, such as drying in a drying cabinet.

The figure schematically shows the installation of moisture meter sensors on a conveyor belt.



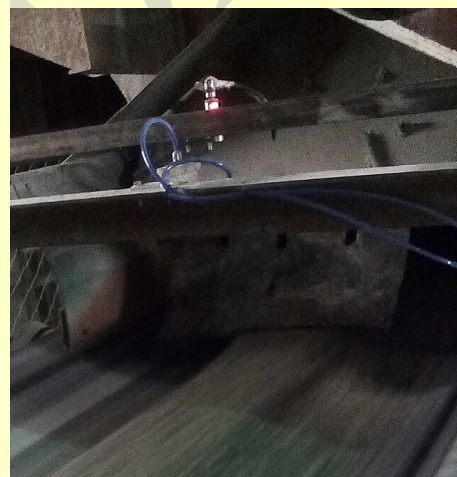
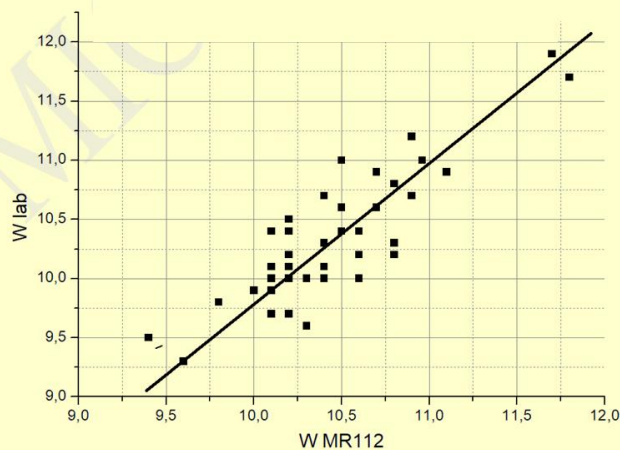
Main technical parameters

Parameter	Parameter characteristic
Range of measured moisture , %	from 2 to 50
Basic relative error, %	no more than 5
Temperature of controlled material, ° C	from +5 to +95
Execution of block housings	IP66

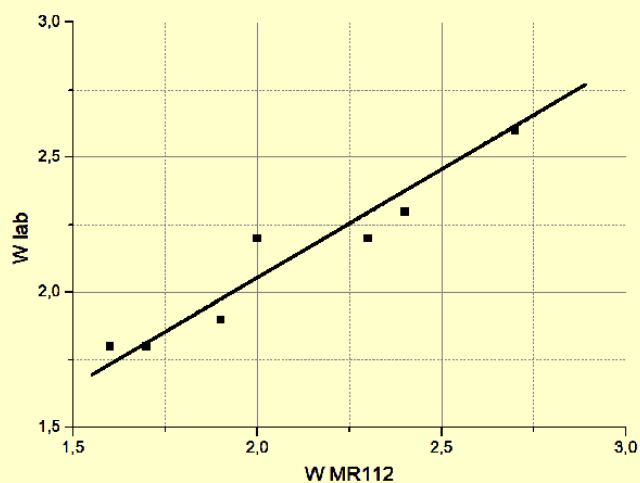
Experience of use on different materials.

Over the past few years, more than fifty MR112K13K moisture meters have been installed and are being successfully used for a wide variety of materials, from sand to fine coal ore. Some of the results are presented below.

1. Installation for loading apatite-nepheline concentrate after centrifuges.



2. Installation on apatite ore belt.



3. Installation on a conveyor of wet aluminum oxide (hydrate) after centrifuges.

The material is extremely wet, up to 20%, as can be seen in the photograph. The average measurement error for moisture is approximately 1% abs .



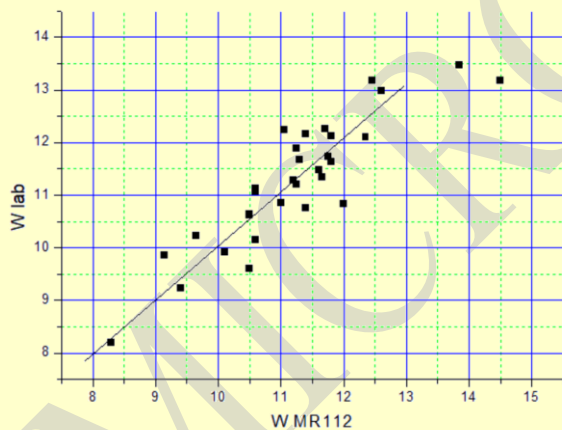
4. 2021 Installation of coal concentrate with a class of 0-25 mm on a conveyor belt after dehydration in centrifuges.

Moisture range 6-11%. Simple average measurement error of moisture 0.45%. abs .

The installation of the first MR112K13K moisture meter is shown. The factory subsequently purchased 11 more of these devices.



5. 2025, Africa. Installation of an MR112K13K moisture meter at an alumina production plant.



6. 2023. Installation of a modified MR12K13K moisture meter on a rotating frame. One of the gold mining enterprises.

Moisture range 6-18%. Simple average measurement error of moisture 0.65%. abs .



The MR112K13K moisture meter was developed and launched in 2017, and has been continuously updated and improved since then. Reliability, excellent metrological performance, and ease of maintenance have ensured this moisture meter's continued popularity over the years. Our specialists are always ready to supervise installation and setup of the moisture meter or provide maximum assistance to your specialists remotely if your engineers choose to install it themselves. Free technical support is provided for the entire life of the moisture meter (10 years), and repairs are available for any moisture meter, regardless of its manufacturing date.

We look forward to long-term and successful cooperation.

Compliance with EU directives:

- Electromagnetic Compatibility Directive (EMC) Directive 89/336/ EEC)
- Low Voltage Directive (The low voltage 93/68/ EEC)

The radiation density level of the microwave generator is no more than 0.5 mW/cm^2 ' which does not exceed the limit established for non-ionizing radiation by the international standard OSHA 1910.97 (10 mW/cm^2), due to which no special safety measures are required