



MICRORADAR

Laboratory and on-line microwave moisture meters

MICRORADAR-SERVICE LTD

<https://www.microradar.com>

ANALYZERS MICRORADAR112C13M and MICRORADAR112K13M. MEASUREMENT OF MOISTURE, DENSITY AND CONCENTRATION OF AQUEOUS SOLUTIONS, SLUDGE AND SUSPENSIONS.

Microwave analyzers MR112C13M and MR112K13M are designed to measure moisture, density, and dry matter concentration in the construction, coal, mining, chemical, and other industries, in any aqueous transparent and opaque liquids, suspensions, pastes, and sludges.

The use of MICRORADAR densitometers allows

- *Effectively manage the density of sand and clay slurries in the production of building materials*
- *Reliably measure and control the density of pulp after wet grinding mills, optimize the performance of ball mills, hydrocyclones, classifiers and flotation devices in the processing of ore materials*
- *Reliably measure and control sludge density in wastewater treatment processes*

MR112K13M and MR112S13M



- Ideal for measuring density (or dry matter content) in trays, pipes of different diameters, with flow, pressure and temperature parameters changing over time.
- Connected to the technological process without the use of bypasses
- Can measure the density of both clay and abrasive media
- Measurement accuracy ranges from 0.1% to 1% for density, concentration, and moisture, depending on the range and measurement conditions, excluding sampling error and measurement error using the standard method. Verification is performed by the

company's services.

- The measurement range is from the yield point to pure water.
- Via the RS 485 communication line and MODBUS protocol, they can be easily integrated into existing process control systems.
- They are an alternative to expensive and unsafe radioisotope density meters, which require additional costs associated with as with the need to obtain special permits for the use of radioisotopes at the enterprise, the presence of radioisotope laboratories for servicing instruments, as well as costs associated with ensuring life safety at the enterprise.
They work where refractometers cannot.

How does this work

The MICRORADAR112 series of density meters uses the principle of measuring the phase shift of microwave radio waves to determine the density (concentration, moisture) of a medium. The phase difference of the radio wave is determined solely by the volume permittivity of the material and is independent of its color, consistency, particle size distribution, impurities, and measurement conditions (flow rate, pressure, etc.). The permittivity of water is 80, the permittivity of dry substances is 3-4, and the permittivity and density of pulp are linearly dependent on the dry substance content of water, enabling continuous density (moisture or concentration) measurement in real time. The absence of optical or moving parts and components ensures high reliability and minimal maintenance requirements.

The MR112 series analyzers consist of microwave density sensors, a microwave module and a processing unit.

Sensors:

MR112K13M – for pipes with a diameter of up to 80 mm.

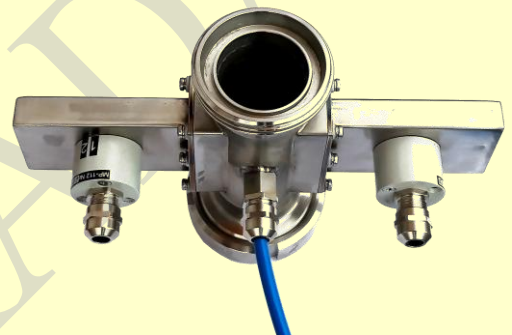
Supplied assembled, installed on standard flanges.

Made of stainless steel, antenna windows are made of corundum ceramics.

For sticky environments, polyurethane protection with a hardness of at least 98 units is used.

It has a limitation on the conductivity of the measured medium: 15 mS/cm with a diameter 250 mm and 40 mS/cm with a diameter 75 mm.

Dust and moisture protection – IP66.

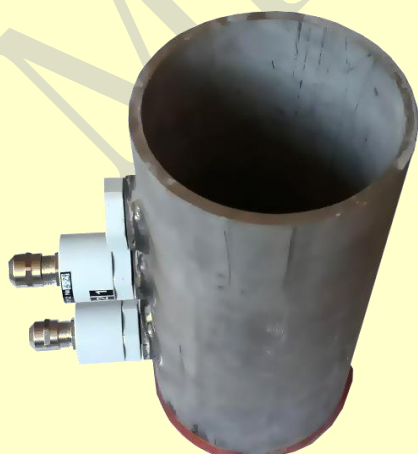


MR112C13M – for tray pulp pipelines, large-diameter pipes (more than 80 mm) and tanks.

Made of stainless steel. To prevent sticking and abrasion, the sensor antennas are protected by a polyurethane coating with a hardness of at least 98 units or corundum ceramics (78% aluminum oxide).

It has a limitation on the conductivity of the measured medium of 40 mS/cm.

Dust and moisture protection – IP66.



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 the computer RS -485.

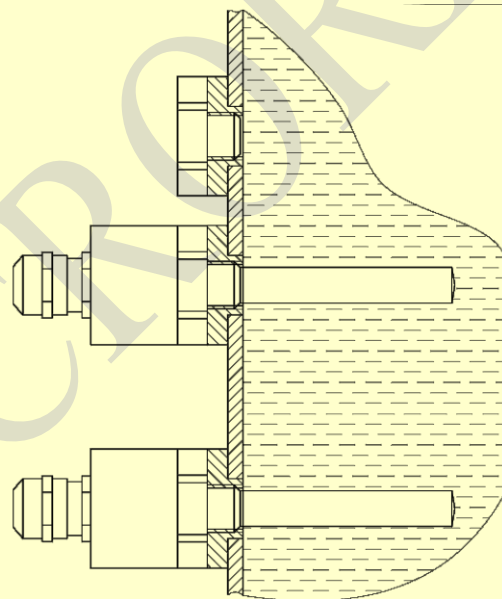
The sensor signal is sent to the microprocessor control and monitoring unit, where density calculations are performed. The measured value (density, moisture, or concentration) is displayed on the microprocessor unit's indicator panel, converted into 4-20 mA and 0-5 V analog outputs , and transmitted 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, which can be installed in any convenient location, and a program for collecting and displaying real-time data, allowing for recording, monitoring, storing, and printing density and concentration data for a selected period of time. Modern communication solutions allow

for easy integration with the production control system.

The figure shows a schematic diagram of the sensor installation.



Main technical parameters

Parameter	Parameter characteristic
Range of measured density, kg /m ³	from 1000 to 3000
Range of measured concentration, %	from 0 to 85
Dry solids content range per liter g /liter	0-1500
Basic absolute error for dry samples in the range of 0-200 g/l, no more than , g/liter	5
Basic absolute error for dry samples in the range of 200-500 g/l, no more than , g/liter	10
Basic absolute error for dry samples in the range of 500-1500 g/l, no more than , g/liter	15
Basic relative error in concentration, %	no more than 0.5
Basic absolute error in density, kg/ m ³ .	no more than 10
Instrumental relative error , %	0.01
Temperature of controlled material, ° C	from +0 to +95
Pipe diameter, mm . for MR112K13M	50-150
Permissible maximum conductivity of the material, mS/ cm MR112K13M	10-40, depending on the pipe diameter.
Permissible maximum conductivity of the material, mS/ cm MR112C113M	40
Current output standard (selectable), mA	0...5; 0...20; 4...20
Current output load capacity, Ohm	no more than 500
Output voltage range	0.5...2.5
Maximum switching current of relay output, A	1.0
Time to establish operating mode, minutes	no more than 20
Opening hours	continuous
Supply voltage, V	~ 90-260 or constant =24 ±3
Power consumption, V •A	no more than 50
Overall dimensions , mm	130x130x75
Weight of the BI, kg	no more than 1
RS485 protocol	MODBUS



Operation of a densitometer at a silicate products plant.

The obtained standard deviation of 0.00347 g/cm³ shows the possibility of using the MR112C13M01 densitometer for measuring the density of sand slurry in the range of 1.65-1.75 g/cm³ with an error of no more than 0.01 g/cm³.

Microwave Density Meters on the Market Today.

and concentration meters available on the world market today : Toshiba LQ 500 (Japan), VALMET TS (USA) and MICRORADAR112 (Belarus). The table shows the main characteristics of the devices.

Parameter	Toshiba LQ 500	VALMET TS	MICRORADAR112
Dry matter concentration range, %	0-50	0-40	0-75
Instrumental error, %	0.01	0.01	0.01
Basic error,% abs .	No data	No data	0.5
Material temperature	0-100	0-100	0-100
Material conductivity, mS/ cm	0-20	0-40	0-40
Communication with a computer	No	RS-232	RS-485
Cable length between the sensor and the electronic unit	10 m	10 m	25 m
The presence of protruding parts in the pipe	No	Yes	No
Method	Change in permittivity	Change in permittivity	Change in permittivity
Temperature and conductivity correction	Yes	Yes	Yes
Nutrition	90-260 V	90-260 V	90-260 V , 24 V

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/cm² ' which does not exceed the limit established for non-ionizing radiation by the international standard OSHA 1910.97 (10 mW/cm²), due to which no special safety measures are required