POLON-IZOT

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Online meters: density, concentration, concentration, temperature and flow

Density, concentration, temperature and flow meters are used for non-contact, continuous measurement of liquids in pipelines or tanks with the measurement space completely filled. To measure the density of liquids, the phenomenon of partial absorption of a beam of ionising radiation by the medium under test is used. The measure of the density of the liquid is the degree of absorption of the radiation. After passing through the test medium, the beam falls on a detector that converts the radiation changes into ionisation current. A change in the density, concentration and concentration of the substance being measured causes a change in the detector current, which is sent to the microprocessor controller of the monitoring and control CPU. According to the programme, the controller interprets the changes in the input signal and provides the density/concentration measurement results digitally on the digital display and in current and analogue outputs. The digital/analogue output signals can be used to control valves or pumps that regulate the density and concentration levels of the medium in the tank.

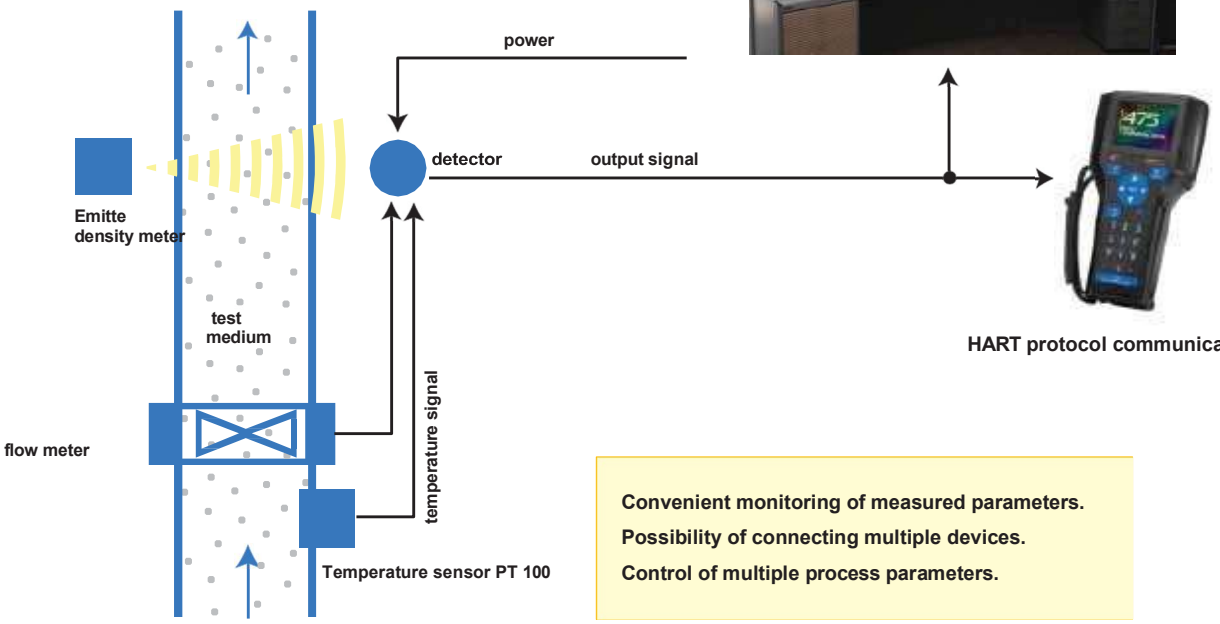
Applications

measurement of concentrations of acids, bases, salt solutions and suspensions; monitoring of crystallisation and polymerisation; measurement of solids in suspensions, flue gases; measurement of volumetric density of powders.

Features

- Measure density, concentration, temperature and flow of acids, bases, salt solutions and other media;
- the measurement result is shown on the digital display and the analogue and digital outputs of the meter;
- continuous operation adapted to the prevailing industrial conditions;
- automatic recording and archiving of results;
- automatic temperature correction;
- protocols: MODBUS RTU, HART.

Control and monitoring centre



HART protocol communicator

Convenient monitoring of measured parameters.
Possibility of connecting multiple devices.
Control of multiple process parameters.

Method of Measurement

The emitted ionising radiation is absorbed when passing through the test material. The level of absorption depends on the length of the optical path covered by the radiation in the substance and on the parameters of the substance under examination - density, concentration, chemical composition, temperature. A fixed distance between the emitter and the detector allows the measured parameters to be measured as a function of the absorption of radiation in the material under investigation.

Measurement system

The measurement system consists of a radiation emitter**, e.g. an X-ray** tube or source, a tube mounting kit, a detector and control panel, as well as a unit for processing the resulting measurement. The whole is enclosed in a single housing. The control panel is located next to the meter or, for example, in the plant control room.

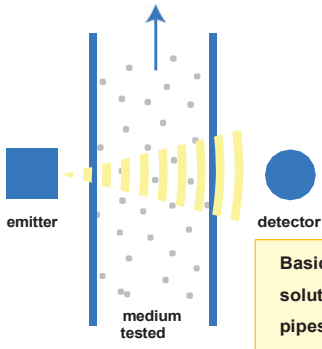
Installation

Installation of the device does not interfere with the structure of the ducts or pipes through which the measured substance flows, so no production stoppage is required. Both the emitter and detector can be mounted on the pipe using clamps. It is also possible to mount the device at different angles, e.g. 90°, 45° and 30°. If the diameter of the cable is small, an S- or U-shaped section of cable can be used to increase the measurement accuracy. Temperature changes can be compensated for by a temperature sensor or by an external current signal.

Measurement of density and flow rate

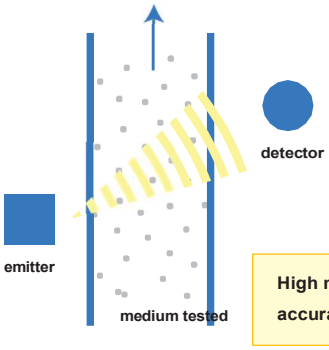
Measuring mass flow rate requires information on volume flow and density. With liquids, a flow meter can be used. The current signal can be directly processed by the detector. The same measurement principle can be used to measure the flux of suspensions with pneumatic conveying.

1) Measurement at 90°



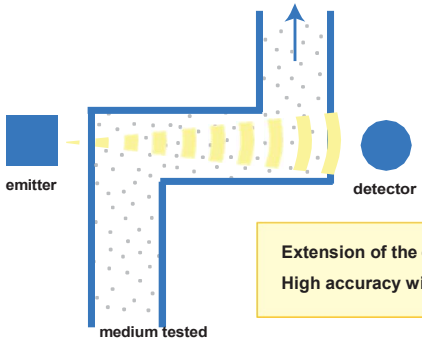
Basic solution. The perfect solution for large diameter pipes.
Easy to install.

2) Measurement at an angle of 45° or 30°



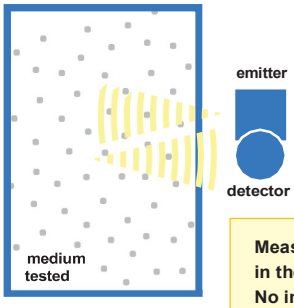
High measurement accuracy. Easy installation.

3) Measurement at small pipe diameters S- or U-shaped section of pipe



Extension of the optical path.
High accuracy with small pipe diameters.

4) Measurement in the tank



Measurement directly in the tank.
No interference in the construction of the tank

Device design

Each instrument is tailored to the specific needs and requirements of the user. To achieve this, it is necessary to study under which conditions and with which substances the detector is to work. This approach guarantees safety, maximum accuracy of the instrument with minimal source activity.

In order to shorten the design phase, we ask that when sending your enquiry you complete the questionnaire found on our website www.polonizot.pl.

Parameters to be determined during the design phase

- measurands
- measuring range
- accuracy required
- product temperature range
- external pipe dimensions, wall thickness and insulation
- For suspensions: solid density, liquid density, minimum/maximum density
- For liquids: measuring range in $^{g/cm3}$, minimum/maximum concentration, chemical formula (if possible)
- ambient temperature and humidity range
- type of device input/output signals
- type of communication protocol

Radiation detector

The detector can be based on a high-performance radiation counter, the magnitude of which is a function of the measured e.g. density of the fluid flowing through the pipe. The radiation causes photoflashes. The number of flashes is proportional to the intensity of the radiation. The crystal is 'observed' by a photocell which, together with electronics, converts the flashes into an electrical signal. Compared to other detection technologies (e.g. ionisation chambers), this method out:

- high sensitivity to gamma radiation;
- low required emitter activity;
- higher resistance to temperature variations;
- longer service life.

The high resistance to temperature changes is further optimised in the electronic loop. This loop ensures excellent parameter stability even for small measuring ranges. Other long-term deviations caused, for example, by sensor ageing, are also compensated for.

Emitter shield

All radiation sources in industrial installations are carefully enclosed in stainless steel containers often lined with materials with high radiation absorption, e.g. lead liners. These must comply with safety regulations including, for example, PAA.

The use of **X-ray tubes** as a radiation source is preferable due to the shielding, and does not require restrictions as with radioactive sources.

The shield separates the radiation source from the environment including the working substance. Typically, the isotope Cs-137 is used as the radioactive source, although Co-60 or Am-241 can also be used. The emitters are built into the shield, containing an aperture that opens when the radiation stream is directed towards the detector. The shielding is adjusted to the required emitter activity, so users are never exposed to high levels of radiation. No contamination of the substance being measured is possible. Specialised shielding is used depending on individual needs, e.g. for measurements in tanks.

Technical data

MEASURING RANGE	
density	Measuring ranges and accuracies tailored to specific needs
concentration	
temperature	
flow	
OPERATING PARAMETERS	
power supply	95 to 250 VAC, 50 to 60 Hz, 15VA
storage temperature	-40 to +60oC
operating temperature	-40 to +60oC
INPUT, OUTPUT SIGNALS	
communication protocol	MODBUS RTU, option: HART
4 two-state outputs	load ≈ 24 V, 1A
2 analogue outputs	0÷ 10 V, I_{max}= 10 mA / 4÷ 20 mA, R= 0.5 kΩ
serial interface	RS485/ RS232/ RS422/ ETHERNET
ELECTRONICS	
CPU	automatic recording and archiving of results; automatic temperature correction; continuous operation adapted to the prevailing industrial conditions.
EQUIPMENT	
standard	measuring probe; microprocessor controller; cabling; documentation (DTR, operating instructions, guarantee card, declaration of conformity); transport, installation, commissioning of equipment and operator training.
options	use of the meter in explosive areas; use of the meter in anti-explosive areas; controller and head with dust and splash protection for protection level IP-64.

POLON - IZOT sp. z o.o. is the continuation of POLON Zjednoczone Zakłady Urządzeń Jądrowych, a company founded in 1956. We can therefore boast over 50 years of technical achievements. Our mission is to manufacture equipment based on our own technical solutions, on/off line industrial and laboratory apparatus, measuring devices, technological process control systems. We cooperate closely with the Central Laboratory of Radiation Protection, the Institute of Chemistry and Nuclear Technology, the National Centre for Nuclear Research and the Institute of Physics of the University of Warsaw.

POLON-IZOT Sp. z o. o. holds a licence from the Radiation Protection Department of the State Atomic Energy Agency, authorising it to install, operate, maintain and manufacture isotope measurement and control instruments and XRF spectrometers.

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