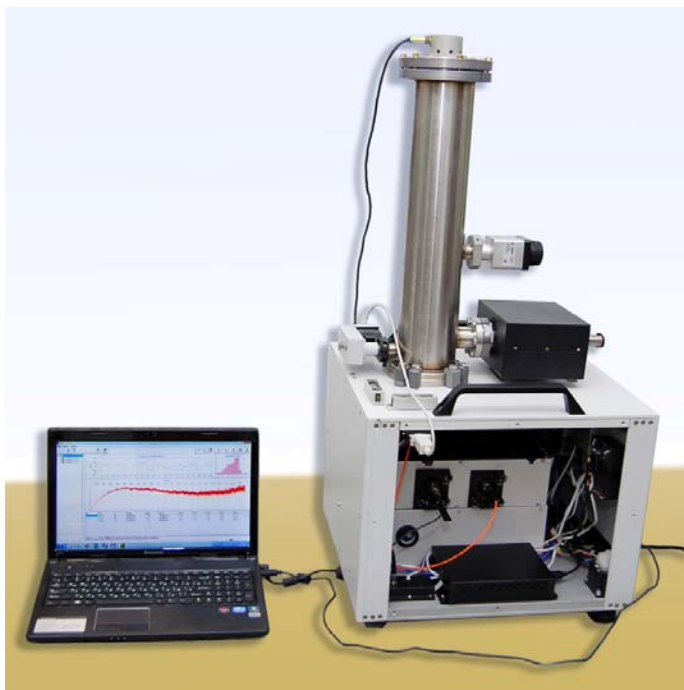




**INSTITUTE OF AUTOMATION AND ELECTROMETRY
OF THE SIBERIAN BRANCH OF THE RUSSIAN ACADEMY OF SCIENCES
(IA&E SB RAS)**

BALLISTIC ABSOLUTE GRAVIMETER GABL-PM FOR FIELD OPERATION

The operation principle of a ballistic gravimeter is based on measuring the path of a free-falling body in vacuum. This principle allows the use of natural (and most accurate) standards of length and time. The movement of the falling body is measured by the interferometric method; a measure of length is the wavelength of the laser. As the lighting system the interferometer uses a length standard on the basis of solid state Nd: YAG laser stabilized on iodine with the operating wavelength of 532 nm. The signals of precision rubidium frequency standard are used as a measure of the time intervals. Devices based on the absolute measurement method feature the absence of zero drift, what allows measurements unbound from the reference gravimetric network. Devices of this type are not produced in Russia.



Gravimeter «GABL-PM»

Technical Specifications

1. The rms uncertainty of measurement of the absolute acceleration value of gravity, μGal , max	3
2. Residual uncertainty in measuring the acceleration of gravity, μGal , max	5
3. The number of samples in a single falling test mass, min	5000
4. The duration of one measurement cycle, s, max	8,5
5. Power consumption, W, max	250
6. Gravimeter weight, kg, max	60

Technical and Economic Advantages

As shown by regular international verification of absolute gravimeters (ICAG) held every four years at the International Bureau of Weights and Measures (BIPM, Sevres, France), stationary ballistic gravimeters (GABL-G, FG-5, IMGIC) are well proven at laboratory operation. However, the applied geophysical research faces the acute problem of creating a field device for operating in harsh environments. Devices of this type are not produced in Russia.

Gravimeter GABL-PM features small size, high reliability, independent power supplies and ease of use while maintaining high metrological characteristics. Creating a high-precision instrument

GABL-PM with improved performance in the future will increase the efficiency of gravimetric and geodetic survey in the country.

Application Areas

High-precision determination of the absolute value of gravity acceleration is needed to solve a number of problems of geodesy, geophysics and cosmonautics:

- creation of fundamental astronomical and geodetic network (FAGS) points, the state fundamental gravity network (GFGS) points, standard gravimetric and geodynamic polygons and field gravimetric points of the 1st class;
- creation of a highly efficient system of geodetic support and further development of a global navigation satellite system GLONASS on the territory of the Russian Federation;
- conduct forecasting and prospecting in order to select informative geological and geophysical characteristics, search for prospective oil and gas structures, including in the permafrost;
- study of changes in the physical conditions at the exploited deposits of oil and gas occurring during the pumping of oil and gas;
- the solution of problems in geodynamics, in particular in the study of the deep structure of the crust and in the search for precursors of strong earthquakes;
- trajectory adjustment for missiles, space satellites and spacecrafts.

Development Stage:

A small series of GABL-PM devices is finalized and released.

All gravimeter components were tested remotely with a laptop computer attached via USB-cable and with an additional computer over wireless network. According to the measurement results, the instrumental standard error of measuring the absolute gravity acceleration by the gravimeters does not exceed $\pm 5 \cdot 10^{-8} \text{ m/s}^2$ (5 μGal).

Patent protection:

RF utility patent number #99194 "Laser ballistic gravimeter".

An application for a RF patent (the applicants: IAE SB RAS and GraviCo Ltd.) "The method of setting a laser beam vertical in a ballistic gravimeter and the device for its realization."

Commercial offers:

Contract-based manufacturing, supply and technical support for the gravimeters GABL-PM.

The estimated cost of ~ 9,000,000 rubles.