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# Deformation vacuum gauge

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**Deformation vacuum gauges** are direct pressure measuring instruments. The principle of operation of deformation vacuum gauges is based on the deformation of flexible structural elements of the transducer owing to pressure difference. The main advantage of deformation instruments is that the pressure readings are independent of the gas type. This feature is particularly important in view of the increasing number of applications of ion-plasma technological processes that occur at pressures of a few Torr.

Tensoresistive deformation vacuum gauges use a change in the resistance of tensoresistors upon a deformation of the silicon membrane and operate in a range of 1–1000 Torr.

Significant disadvantages of the existing tensoresistive vacuum gauges are the strong dependence of the pressure measurement error on the ambient temperature and low sensitivity, which limits their use in processes that occur at pressures below 1 Torr.

**Method to increase the pressure measurement accuracy**

To improve the accuracy of low pressure measurements, a VD-10 tensoresistive vacuum gauge sample has been developed and constructed; the gauge includes a measuring unit and a transducer, the sensitive element of which is a silicon crystal in the middle part of which a thin membrane with tensoresistors placed on the outer surface is formed.

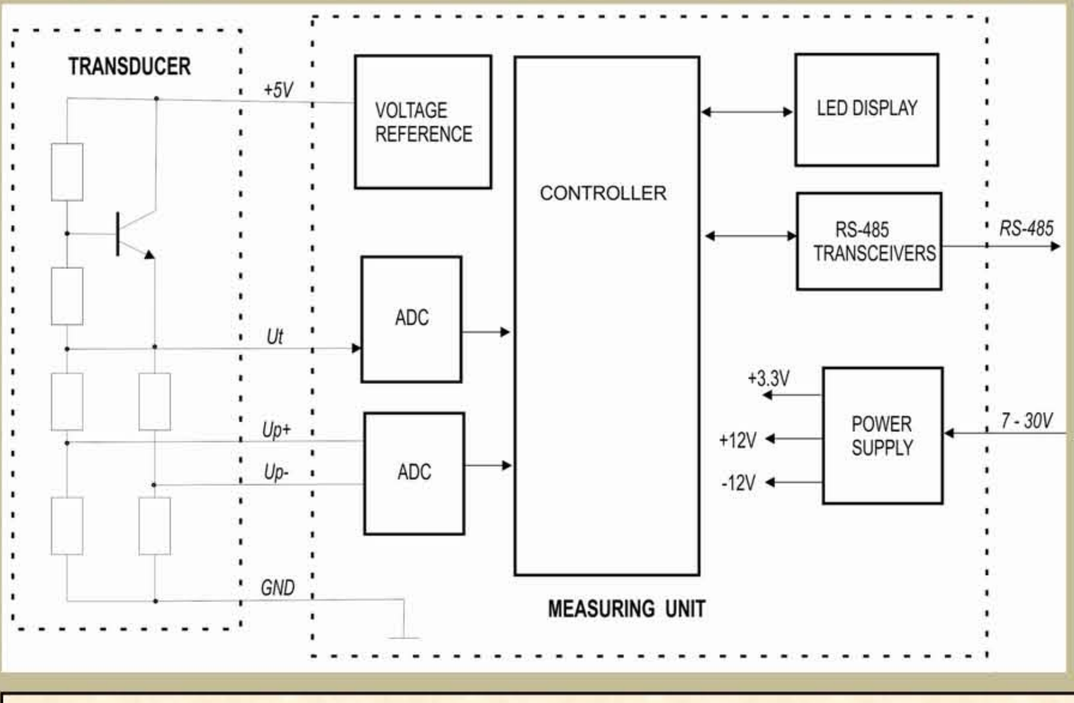
To decrease the dependence on the ambient temperature, a circuit consisting of a transistor and resistors is formed on the crystal; the circuit provides power to the bridge circuit with a temperature-dependent voltage to compensate for the drift. In addition, temperature fluctuations are recorded by the measuring unit for additional software correction.

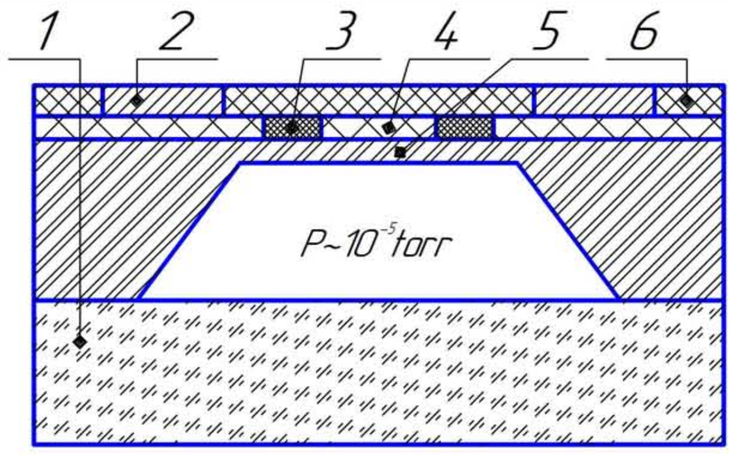
**Advantages of the proposed deformation vacuum gauge**

A decrease in the membrane thickness has made it possible to increase the sensitivity of the transducer and, accordingly, expand the range of measured pressures to 5 × 10–2 Torr.

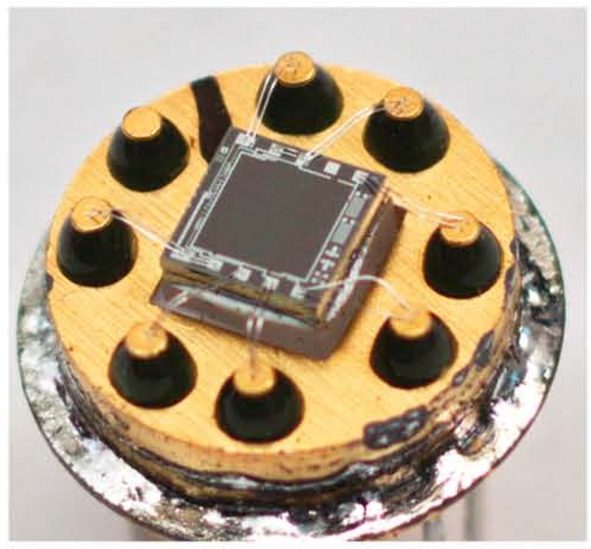
Compensation for the effect of change in the ambient temperature reduces the pressure measurement error from 0.3% to 0.1% Full Scale.

The use of modern analog-to-digital electronics, along with a high-performance microcontroller, in the electronic unit has made it possible to provide the stability of maintaining the electrical modes of the transducer and a high accuracy of measurements of the output parameters of the transducer.




*1 – Glass*
*2 – Contact pads*
*3 – Diffusion tensoresistors*
*4 – Silicon oxide*
*5 – Silicon membrane*
*6 – Passivating oxide*



Sensitive element of the transducer

## TECHNICAL DATA

- Measurement range 5 × 10–2 – 1000 Torr
- Accuracy ±0.1% full scale
- Power consumption 1 W
- Interface RS-485
- Resolution 0.01 Torr
- Dimension 60x35x135 mm

## ADVANTAGES

- *Wide range of measured pressures*
- *High accuracy and reproducibility of measurement*
- *Small size and low power consumption*
- *Any position of the gauge*
- *Traducer temperature compensation*
- *Wide range of supply voltages (7 – 30V)*

## References

**DECISION on registration of industrial designs «Vacuumetru» Nr. f 2019 0041 2019.05.23 Date of publication: 2019.09.30**