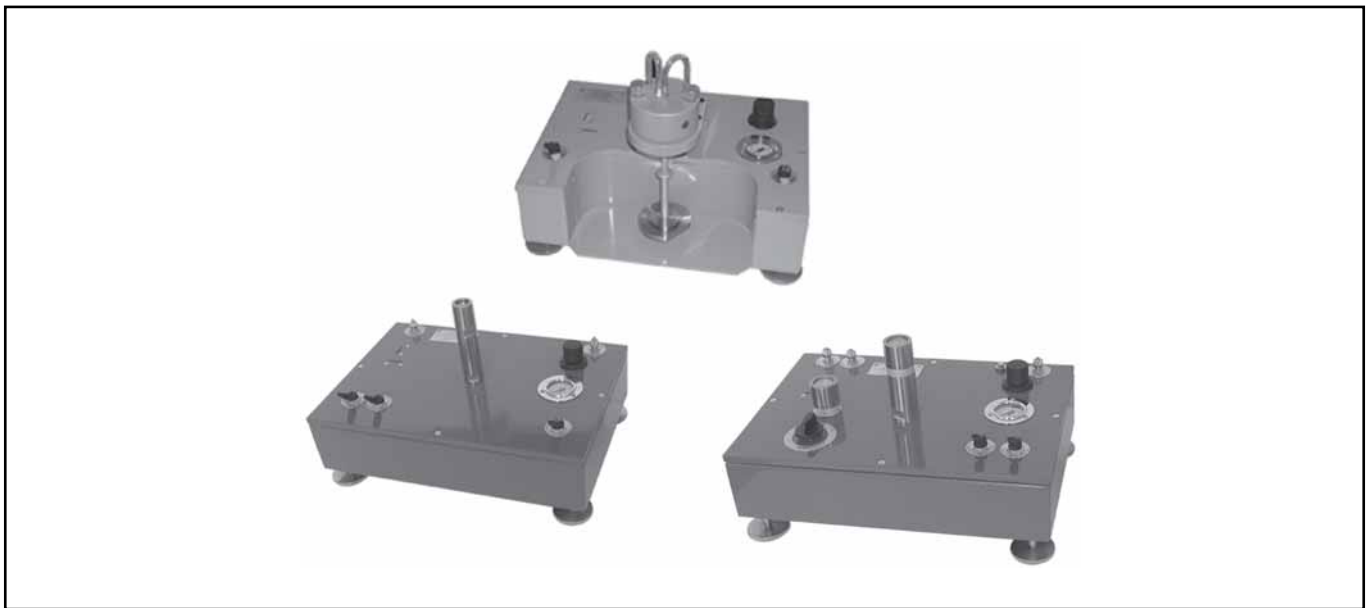


## Metran-500 Vozdukh Series Pneumatic Pressure Calibrators



- **Operating fluid**  
air
- **Ranges**
  - gage pressure  
0.005...1000 kPa;
  - differential pressure relative to bearing  
pressure 300 Pa  
0.005...25 kPa
- **Accuracy Class**  
0.01; 0.015; 0.02
- **Life time**  
8 years minimum

Metran-500 Vozdukh Series Pneumatic Pressure Calibrators are designed for precise reproduction of gage pressure and vacuum units.

These instruments are used as reference standards for verification, calibration, adjustment and graduation:

- precision pressure, vacuum and gage-vacuum transmitters of type 3051C, 3051S, EJA, Metran and other pressure instruments;
- standard pressure gages, calibrators and other reference standards.

Main advantages:

- wide range of pressure reproduction;
- capability of low gage pressure reproduction;
- high accuracy of pressure reproduction over the entire range;
- automatic pressure reproduction after loading.

### DESIGN AND OPERATING PRINCIPLE

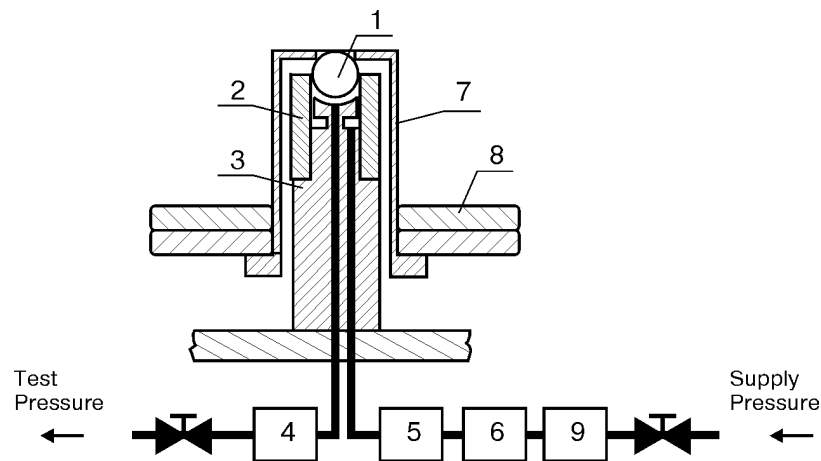


Fig. 1. Design and Operating Principle.

A force to pressure converter is the main element of the device. It represents a pneumatic interthrottle chamber consisting of variable and constant throttles (Fig.1). The variable throttle is formed by a spherical (or conical) piston 1 and nozzle 2, and the constant one is made in the form of circular slot clearance between nozzle 2 and housing 3. The two volumes 4 and 5 operate as dynamic auto-oscillation dampers, and the two-cascade regulator 6 automatically controls air flow and pressure, provides precise reproduction of test pressure values ( $P$ ) at change of force generated by mass of the piston, the receptacle 7 and weights 8.

The pressure control assembly of supply air 9 (consists of a regulator valve and a pressure gage) provides adjustment and control of calibrator's supply air pressure.

The operating principle of the calibrator is based on the dynamic interaction of the piston and the airflow: force  $mg$  generated by mass of the piston 1, the receptacle (hitch) 7 and weights 8 is transformed into air pressure  $P$ , which is supplied from calibrator's outlet into the device under test, in so doing the piston is self-centralized in the nozzle and self-balanced.

### PRESSURE GENERATION SYSTEM

#### Metran-505 Vozdukh Pressure Calibrator

Pistons, i.e. conical rotation bodies, mass of which is adjusted with regard to nonlinear characteristic of the effective area and the value of specified acceleration  $g$  (Fig.2) are the main elements for pressure generation. To decrease the piston mass and generate low pressures, the pistons are made in the form of trapezoidal cones, and not a ball.

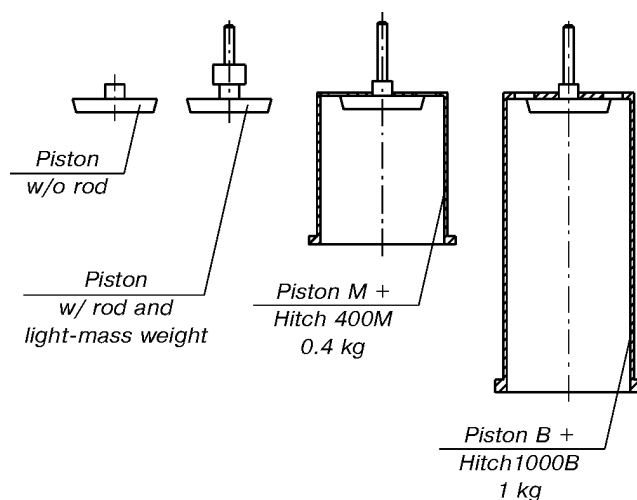


Fig.2. Metran-505 Vozdukh Pistons and Hitches.

#### Metran-504 Vozdukh, Metran-506 Vozdukh Pressure Calibrators

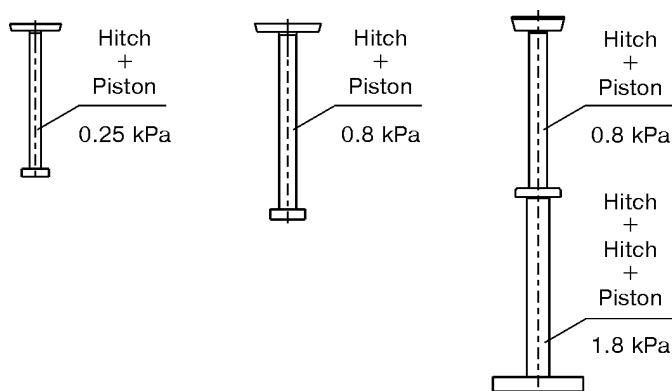
The piston, which is a pyroceram ball, is the main element for pressure generation in these calibrators. The hitch 7 (Fig.1) is placed on this piston. Calibrators have only a large hitch, which together with the piston provides reproduction of initial pressure value.

#### Metran-503 Vozdukh Vacuum Controller

The vacuum reproduction system of Metran-503 Vozdukh Vacuum Controller is similar to the pressure reproduction system of Metran-505 Vozdukh Pressure Calibrator, i.e. cone pistons with hitches are used as the basis.

The controller is supplied with three hitches (Fig.3), which together with pistons provides pressure 0.25, 0.8 and 1.8 kPa, and a set of weights.

Weights with rating from 0.05 to 1 kPa and a hitch with rating 0.25 kPa provide generation of pressures in the range from 0.25 to 2.5 kPa. Weights with rating from 0.1 to 20 kPa and hitches with rating 0.8 kPa and 1.8 kPa provide generation of pressures in the range from 0.8 to 63 kPa.



**Fig.3. Pistons and Hitches of Metran-503 Vozdukh Calibrator.**

A set of pistons, weights and hitches, which is supplied **for all models**, is called a weight set and provides the required discreteness for transmitter verification. Additional sets of pistons and weights are also available (refer to Additional Equipment).

### SPECIFICATIONS

#### RANGES AND DISCRETENESS OF PRESSURE SETTING

Table 2

Version	Range of Pressure Setting, kPa	Discreteness of Pressure Setting, Pa
Metran-505 Vozdukh-I	0.005...25 (with Support Block); 0.02...25 (with Support Block disconnected)	With Support Block: 5 At Support Block disconnected: from 10 to 20 (in the range up to 300 Pa) 5 (in the range over 300 Pa)
Metran-505 Vozdukh-II	0.02...25	from 10 to 20 (in the range up to 300 Pa) 5 (in the range over 300 Pa)
Metran-504 Vozdukh	4...400	250
Metran-506 Vozdukh*	10...1000	
Metran 503-Vozdukh	minus 0.25...minus 63	50 (in the range 0.25...2.5 kPa); 100 (in the range 0.8...63 kPa)

**Support Block** - a block of bearing pressure.

\* Launch of Metran-506 Vozdukh Calibrator is III quarter of 2006.

At transfer of test pressure through pneumatic line with internal diameter 4 mm, length up to 1.5 m and at capacity of the closed volume 0.1 l maximum at the end of the line, the settling time of test pressure is no more than 30 sec (for Metran-504 Vozdukh, Metran-506 Vozdukh and Metran-503 Vozdukh) or no more than 20 sec (for Metran-505 Vozdukh).

### ACCURACY

Table 3

Version	Range of Pressure Setting, kPa	Limits of Accuracy		
		Accuracy Class 0.015	Accuracy Class 0.02	Accuracy Class 0.05
Metran-505 Vozdukh-I	0.005...0.4	±0.10 Pa	±0.12 Pa	-
	0.4...2	±0.025%Pr	±0.03%Pr	-
	2...25	±0.015%Pr	±0.02%Pr	-
Metran-505 Vozdukh-II	0.02...0.4	±0.10 Pa	±0.12 Pa	-
	0.4...2	±0.025%Pr	±0.03%Pr	-
	2...25	±0.015%Pr	±0.02%Pr	-
Metran-504 Vozdukh	4...400	0.015%Pr	0.02%Pr	-
Metran-506 Vozdukh	10...1000			-
Metran-503 Vozdukh	Up to minus 4	-	±(0.4+0.0001Ptest)Pa	±2 Pa
	Over minus 4	-	±0.02%Pr	±0.05%Pr

**Ptest** - the value of pressure reproduced by Metran-503 Vozdukh Controller;

**Pr** - the rated value of pressure reproduced by calibrators/controller.

## POWER SUPPLY AND GENERAL DATA

Table 4

Version	Metran-505 Vozdukh-I	Metran-505 Vozdukh-II	Metran-504 Vozdukh	Metran-506 Vozdukh	Metran-503 Vozdukh
Pressure of supply air, kPa	300-400		600-700	1400-1600	900-1000
Flow of supply air*, max, l/min	6		8		90
Weight, max, kg	13.5**	11*	9**		10**

\* Power supply of calibrators/controllers is carried out by compressed air of contamination class 1 from an external source. To provide the required contamination class of supply air it is recommended to use Metran-500 Vozdukh Series calibrator/controller complete with an air-preparation unit.

\*\* Mass of models Metran-505 Vozdukh, Metran 504 Vozdukh, Metran-503 Vozdukh without a set of weights. Mass of weight set, maximum: 4.5 kg (Metran-505 Vozdukh), 8.5 kg (Metran-504 Vozdukh), 5.5 kg (Metran-503 Vozdukh), 10.5 kg (Metran-506 Vozdukh).

## UNIQUE FEATURES OF DESIGN AND APPLICATION

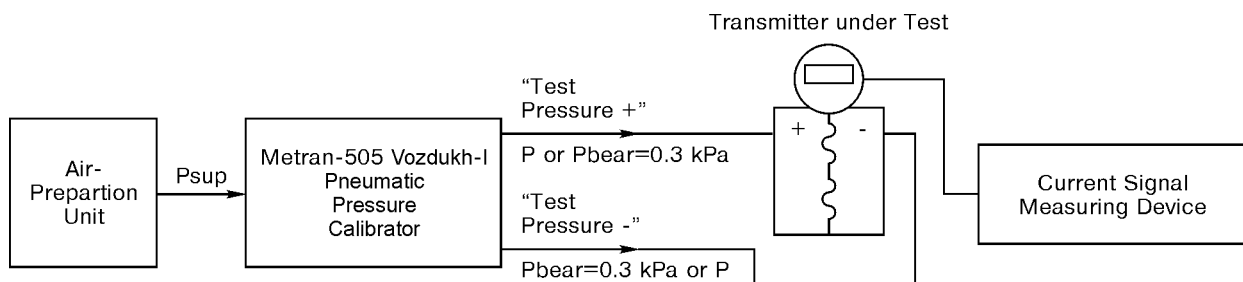
## METRAN-505 VOZDUKH PRESSURE CALIBRATOR

Metran-505 Vozdukh has an air control valve providing the switching of gage pressure supply out of calibrator's outlet into "+" (positive) and/or "-" (negative) volumes of the transmitter under test (e.g., DIV/DV transmitter).

Metran-505 Vozdukh Calibrator has two versions:

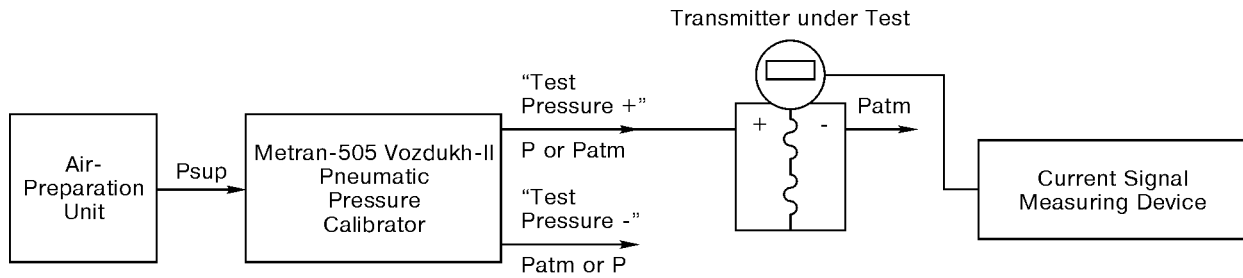
**Version I (Metran-505 Vozdukh-I)** - a pressure calibrator with a block of bearing pressure (Support Block). Metran-505 Vozdukh-I Calibrator provides reproduction of gage pressure relative to bearing pressure 300 Pa within the range 0.005...25 kPa. The Calibrator and the Support Block are in the housing. It is recommended to switch on the Support Block of Metran-505 Vozdukh-I Calibrator at verification of low-limit differential pressure transmitters, as well as low-limit pressure, vacuum and gage-vacuum transmitters, design of which makes pressure supply into both transmitter's volumes possible.

The Support Block generates gage pressure 300 Pa ( $P_{bear}$ ). The piston with the rod, which provide generation of pressure  $P_{test}=P_{bear}=300$  Pa on calibrator's outlet, is placed in calibrator's nozzle 2. The output value, i.e. 0 or 4 mA, depending on transmitter's output range, is set with the "zero" adjuster of the transmitter under test. Then one should place the weights with marking of rated pressure value (hereinafter - rating) 5, 10, 20, 20 and 50 Pa, which create the required differential pressure ( $P-P_{bear}$ ) up to 100 Pa at transmitter's outlet, on the piston with the rod. Such system provides the required discreteness of pressure setting (5 Pa) and enables it to reduce the effect of atmospheric pressure fluctuations during verification of low-limit transmitters. Small and large hitches are used at generating differential pressure over 100 Pa (refer to description of pressure generation system). It is recommended to switch the Support Block off at verification of transmitters with a range over 4 kPa, in doing so the operation of Metran-505 Vozdukh-I Calibrator is similar to the operation of Metran-505 Vozdukh-II Calibrator.



**Fig.4. Metran-505 Vozdukh-I Calibrator Wiring Diagram at Verification of Differential Pressure, Pressure and Gage-Vacuum Transmitters with the Support Block.**

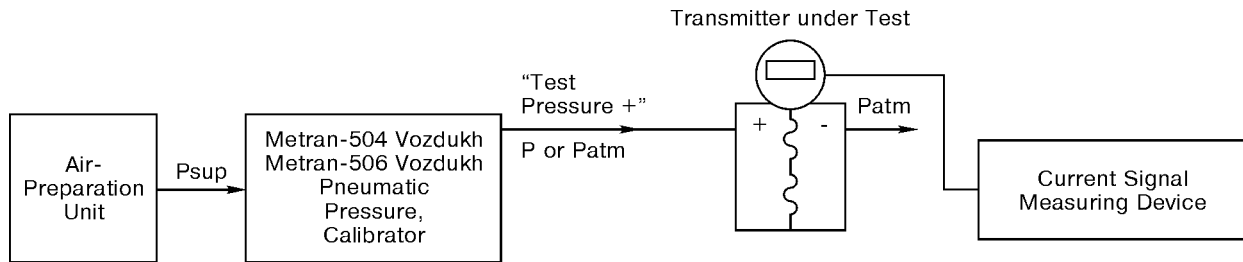
**Version II (Metran-505 Vozdukh-II)** - Pressure Calibrator without the Support Block. Metran-505 Vozdukh-II Calibrator provides reproduction of gage pressure relative to atmospheric pressure within the range 0.02...25 kPa.



**Fig.5. Metran-505 Vozdukh-II/Metran-505 Vozdukh-I Calibrators Wiring Diagram (with disconnected Support Block) at Verification of Pressure and Differential Pressure Transmitters.**

**METRAN-504 VOZDUKH, METRAN-506 VOZDUKH PRESSURE CALIBRATORS**

Metran-504 Vozdukh Calibrator provides reproduction of gage pressure relative to atmospheric pressure within the range 4...400 kPa, Metran-506 Vozdukh Calibrator within the range 10...1000 kPa.



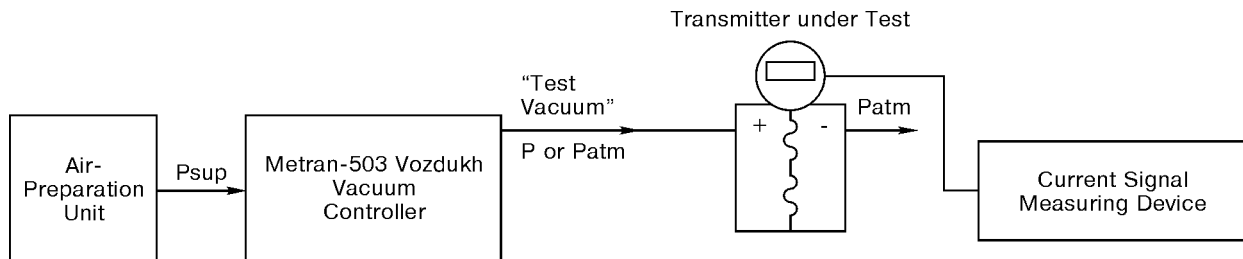
**Fig.6. Metran-504 Vozdukh/Metran-506 Vozdukh Calibrator Wiring Diagram at Verification of Pressure and Differential Pressure Transmitters.**

**METRAN-503 VOZDUKH VACUUM CONTROLLER**

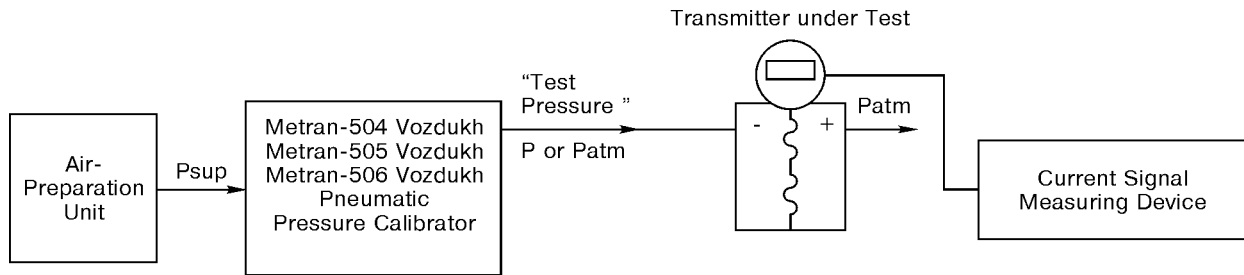
Metran-503-Vozdukh Controller provides reproduction of vacuum within the range 0.25...63 kPa. Its operation is similar to operation of Metran-505 Vozdukh Calibrator, but direction of airflow is opposite. The ejector, an additional unit, is used for generation of vacuum.

Supply pressure 800 kPa is applied into the ejector of classical type, where negative pressure 80-90 kPa is generated, and which is the power supply of the two-cascade regulator. Conical pistons with hitches are used for vacuum generation (refer to description of pressure generation system).

Note: As per "Verification Procedure of Metran Series Pressure Transmitters" MI4212-012-2001, it is permissible to set the value of a measurable quantity by applying the proper value of gage pressure from the opposite side of the transmitter sensor, during verification of vacuum and gage-vacuum transmitters, if it is designed in the transmitter (Fig.8). The design of all Metran Series pressure and gage-vacuum transmitters, except for models 2210, 2220, 2310, 2320, 2350, 2351 of Metran-22 and models 1350, 1351, 4950 of Metran-100, makes the above verification for this transmitters possible.



**Fig.7. Metran-503 Vozdukh Controller Wiring Diagram at Verification of Vacuum and Gage-Vacuum Transmitters.**



**Fig.8. Metran-504 Vozdukh/Metran-505 Vozdukh/Metran-506 Vozdukh Wiring Diagram at Verification of Vacuum and Gage-Vacuum Transmitters.**

### OPERATION CONDITIONS

Operating range of ambient temperatures is from 15 to 35°C, relative humidity is from 30 to 80%, and barometric pressure is 84 to 106.7 kPa.

### WARRANTY

Warranty is 18 months from the date of commissioning, but no more than 24 months from the date of its shipment from the manufacturer.

### MAINTENANCE

Metran IG performs the following types of work:

#### 1. Preventive maintenance:

- cleaning;
- leak test and performance check;
- determination of metrological characteristics;
- verification in Chelyabinsk Center for Standardization and Metrology.

#### 2. Medium maintenance or complex repair.

#### 3. Re-adjustment:

- change of pressure units;
- manufacture of a weight set with other units of measurement;
- change of weight masses for another value of local acceleration due to gravity.

#### 4. Verification in Chelyabinsk Center for Standardization and Metrology.

### DELIVERY SET

The delivery set includes:

- Calibrator/Controller	1 unit
- Set of Weights	1 unit
- Air Check Fixture	1 unit
- Air hose for connection of the transmitter under test to the calibrator/controller with coupling nut M10x1	1 unit*
- Set of reducing sleeves M10/M10*, M10/M20, M10/ K1/2, M10/ K1/4 for connection of transmitters under test	1 unit
- Product Data Sheet, Operation Manual	1 copy
- Verification Certificate	1 copy

\* 2 units - for Metran-505 Vozdukh-I Calibrator.

### VERIFICATION

Interval is once per year.

Verification may be carried out at the manufacturer or in Gosstandard territorial offices.

### ADDITIONAL EQUIPMENT

The following equipment is available by special order:

1. Air-Preparation Unit.
2. Power supply system for Metran-500 Vozdukh pressure calibrators/controller. The system consists of a mobile compressor, an air-preparation unit and a connector tube.
3. Set of weights and pistons calibrated in pressure units, which differ from pressure units of weights included in calibrator/controller delivery set.
4. Additional weight set for Metran-505 Vozdukh, Metran-504 Vozdukh Calibrators, Metran-503-Vozdukh Controller\*.
5. Additional reducing sleeves for connection of transmitters under test with different threads to an air hose of Metran-500 Vozdukh Calibrators/Controller.

### Description of Additional Set of Weights and Pistons

Special sets of weights and pistons designed for verification of transmitters by metering skid verification procedures may be manufactured for verification of pressure transmitters installed in energy metering skids. For example, a set of weights and pistons is manufactured for 3051S transmitters with upper range limit 63 kPa, which is designed for verification of these transmitters in points 9, 25, 64, 81, 100% of range. The set of weights and pistons for verification of HYPERFLOW transmitters is also available.

In addition, for instrument making companies producing pressure transmitters or other pressure instruments and companies with large pressure instruments stock, it is recommended to order an additional set of pistons and weights. This set provides verification of pressure transmitters and other devices in calibration points in accordance with their verification procedures with a minimum of combinations for changing pistons and weights, which provides a higher level of productivity for calibration specialists (such sets are used for manufacturing of Metran Series transmitters at Metran IG).

## ORDERING INFORMATION

Metran-505 Vozdukh - II - 0.015 - Pa, mmH<sub>2</sub>O - 9.8155 m/s<sup>2</sup> - TU ...

1                      2                      3                      4                      5                      6

1. Model of Pneumatic Pressure Calibrator (Metran-504 Vozdukh, Metran-505 Vozdukh or Metran-506 Vozdukh) or Vacuum Controller (Metran-503 Vozdukh).
2. Version (for Metran-505 Vozdukh Calibrators only).
3. Accuracy Class.
4. Pressure unit (Pa, kgf/cm<sup>2</sup> or other). If it is necessary to order several sets of weights calibrated in different pressure units, it is required to specify pressure units of these sets, which are divided by commas, in the order line.
5. Acceleration of gravity, for which weights are to be calibrated (specified accurate to four decimal places)\*.
6. Designation of specification (Table 4).

\* If acceleration of gravity is not specified, a controller is supplied for standard acceleration of gravity (9.80665 m/s<sup>2</sup>).

Notes:

1. Additional equipment as per items 1, 2, 4, 5 (if necessary) is specified in the order for a calibrator on a separate line, as per item 3 in a line of an order in accordance with calibrator designation in the ordering information.
2. To order an additional set of calibrator's weights with range or discreteness, which differs from the standard one, it is required to specify measurement ranges of devices under test and calibration points in % of upper range limit.

## DIMENSIONAL DRAWINGS

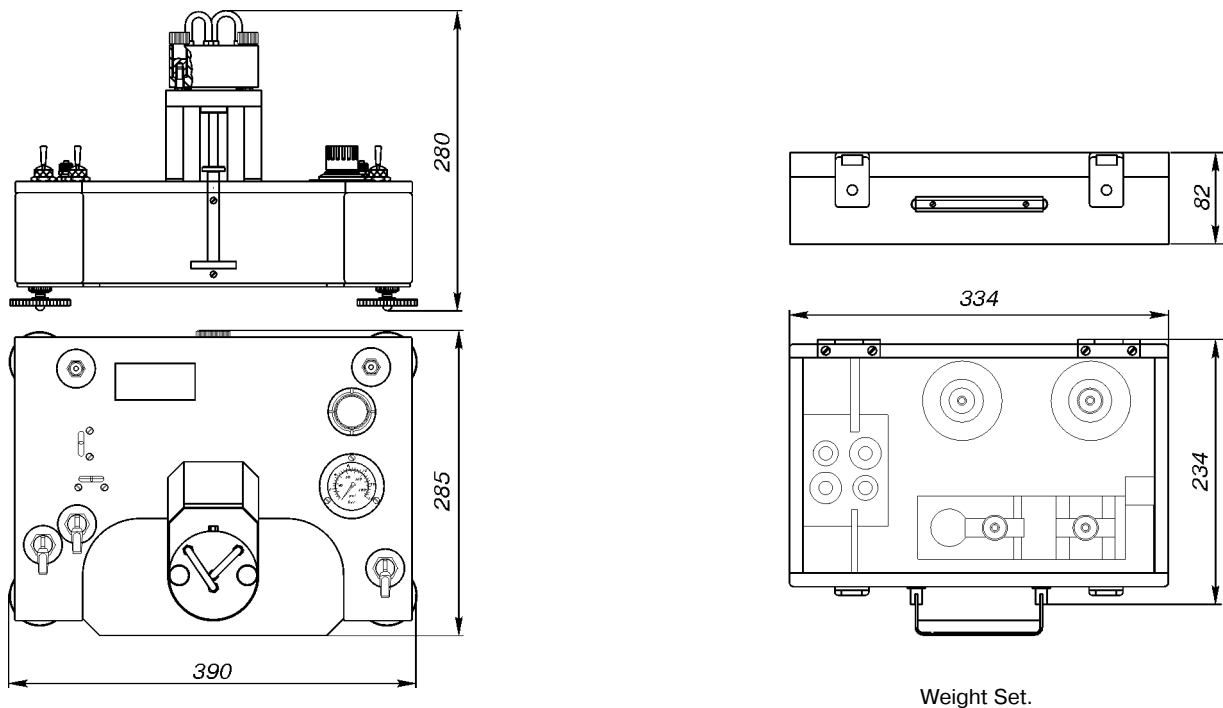
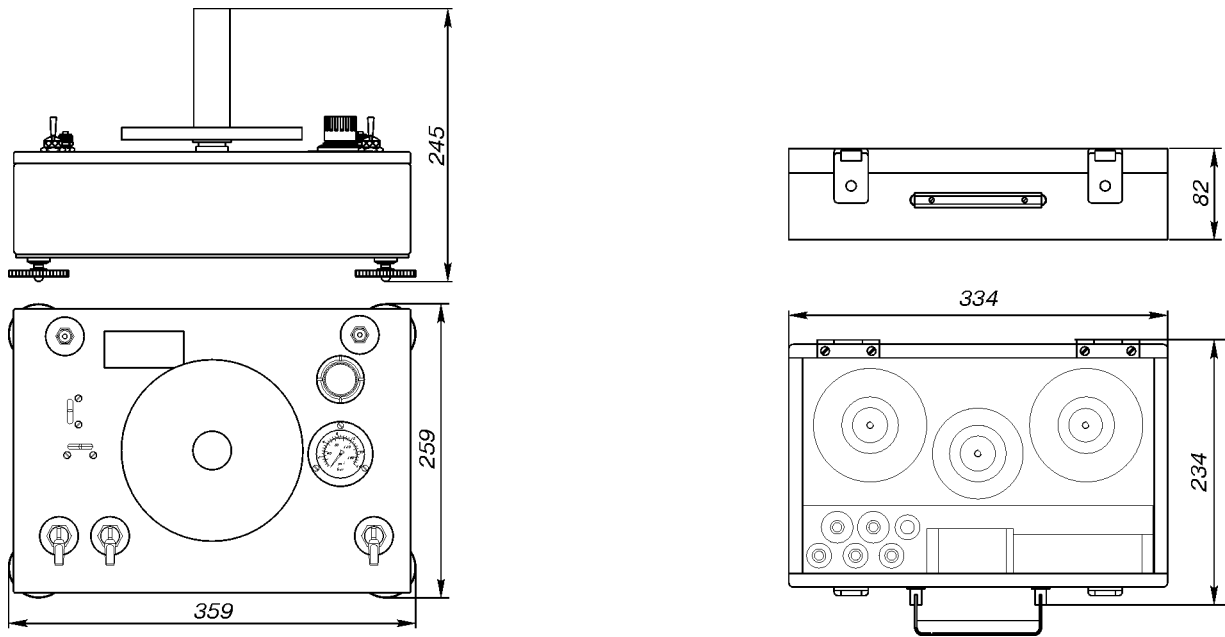
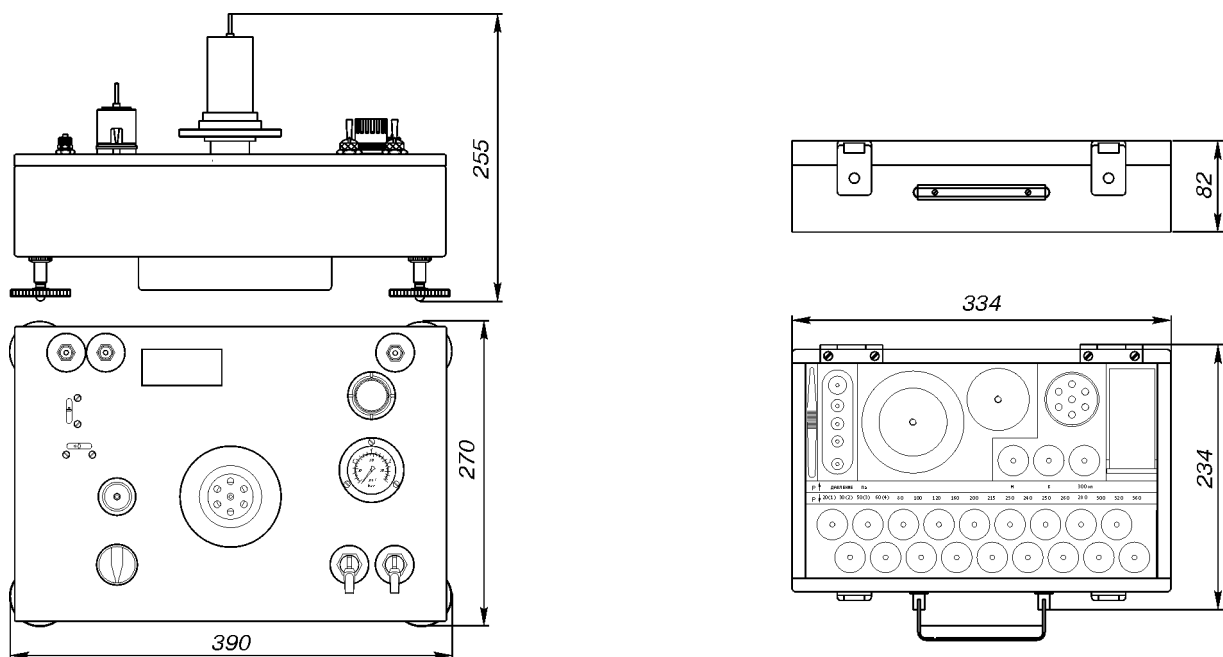


Fig.9. Metran-503 Vozdukh Vacuum Controller.



Weight Set.

**Fig. 10. Metran-504 Vozdukh, Metran-506 Vozdukh Pneumatic Pressure Calibrators**



Weight Set.

**Fig. 11. Metran-505 Vozdukh Pneumatic Pressure Calibrator**