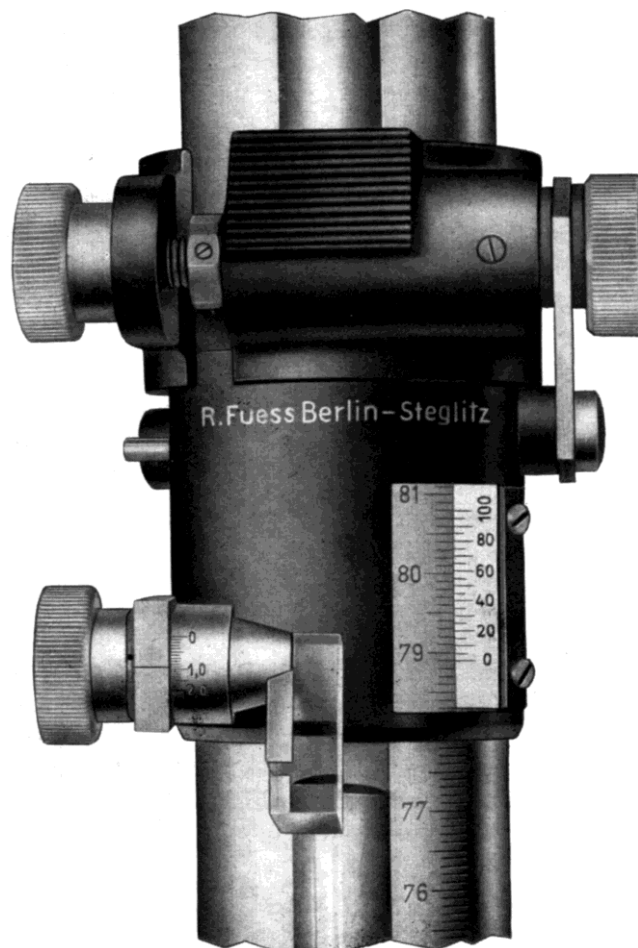


111,0 E

## MERCURY (Hg) - BAROMETER



### Overview of the barometers

No.	Type	Measuring range in hPa	Inner diameter of measuring tube	Accuracy of reading in hPa
2k	Standard Barometer	865 ... 1090	14	0.05
20k	Control Barometer	55 ... 1090	11	0.05
11a9	Station Barometer	800 ... 1070	9	0.1
11b9	Station Barometer	580 ... 1025	9	0.1
11i	Test Barometer	55 ... 1090	8	0.1

## Standard Barometer 2k

The Standard Barometer 2k excels by the following advantages:

At any time, the degree of vacuum and the conformity of the two sights can be checked by the barometer itself without the aid of a reference instrument therefore the characterisation as absolute instrument.

Moreover, it is dependent on the quality of the filled-in mercury. A possible small loss of mercury does not effect the level of the mercury column.

One account of its high accuracy of measurement the Standard Barometer is used for all applications which demand an exact determination of the atmospheric pressure.

Virtually it represents a two - legged cistern-barometer whose both short and long leg dip into a mercury-filled cistern with leather bottom (combination cistern and siphon barometer). The long leg is closed at the top and forms the Torricelli-Tube with the vacuum chamber. The atmospheric pressure acts on the mercury column in the open short leg. Two sights sliding along the casing tube in combination with a precision graduation serve for reading of the barometric pressure. The difference in height of the upper and lower mercury level represents an equivalent for the atmospheric pressure. (Fig. 1 and 2)

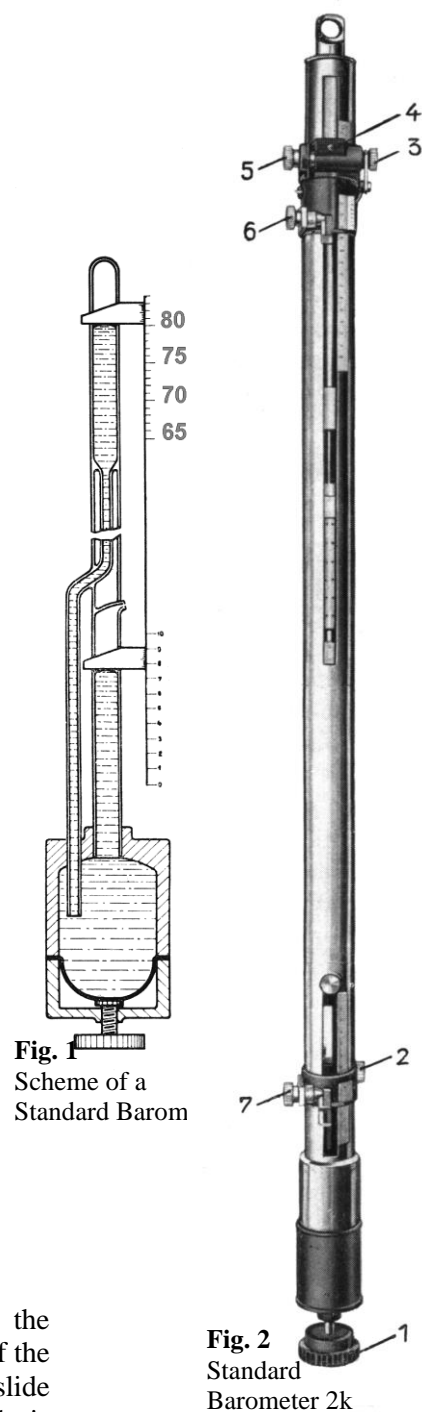
The variation of the atmospheric pressure causes a change in height of the mercury columns in both legs. By means of the fine-adjusting screw below the cistern volume and consequently the level of both mercury menisci can be varied very sensitively.

In this way the zero level variations - the variations of the lower mercury level in the open leg - are eliminated before the reading. A further advantage is the applicability of the Argo-Metod vacuum test, in which case the chamber volume in the long leg can be changed at choice.

Before each reading two adjustments are necessary. By means of the adjusting screw first the two mercury columns are raised until the peak of the lower meniscus coincides with the lower sight edge of the vernier slide which is adjusted to the fixed scale zero. Then the upper vernier slide is adjusted to the upper meniscus by means of the fine control and finally the rough barometric pressure is read at the vernier (frontispiece). After suitable corrections the true atmospheric pressure is obtained (see instruction K 111-6E).

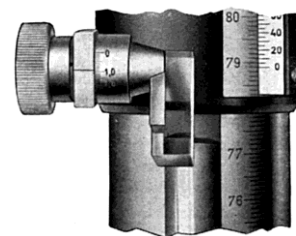
By the raise of both menisci during the measuring procedure and due to the equality of the diameters of the legs a uniform curvature of both menisci is achieved so that capillary corrections are usually not necessary.

For checking the degree of vacuum the reading can be repeated with a different position of the menisci according to the method of Argo. In this case the barometric pressure is obtained by the difference of reading of the position of the upper and lower sight. Different results indicate an imperfect vacuum which can be analytically eliminated according to the observed difference (see instruction 2k-2E)



For checking the parallelism of both sight planes one sight can be moved into the position of the other. In this case both readings should yield the same result.

The lower sight (zero mark sight) consists of a ring to be clamped by the screw 2. It is provided with division marks for adjustment to the scale zero. The upper sight with the vernier is connected with the clamping ring 4 by two toggle joints. The clamping ring can be moved by hand and clamped by means of the screw 5. By turning the adjusting knob 3 the sight together with the vernier is sensitively moved relative to the clamping ring by an eccentric fine adjustment (after Prof. Kleinschmidt). The fine adjustment by means of an eccentric increases the accuracy of adjustment, as the sight can be moved quickly up and down. That is desirable to avoid a temperature increase by the body temperature.



**Fig. 3** Device after Kleinschmidt for measuring the height of the meniscus for No. 2k and 20k

Each slide is provided with a device (Fig. 2: 6 resp. 7) to measure the height of the meniscus, consisting of a plane parallel, rotating glass plate covering half the meniscus (Fig. 3). The lower margin of the meniscus is observed through the glass plate. The glass plate is turned until the margin appears at the same height as the meniscus peak lying beside it, owing to the refraction of light. The height of the meniscus can then be read from the micrometer knob.

The barometer has a hPa graduation. The units of atmospheric pressure and the referring inscriptions on the barometer scale correspond to the international standards as defined by the WMO:

“True hPa at 0° C and 980.665 cm/sec<sup>2</sup>”

Moreover, it is equipped with an additional thermometer for the determination of temperature of the instrument, measuring range -10 to +50° C. Each barometer is delivered together with instructions and correction tables in order to make allowance for temperature, acceleration due to gravity and capillary depression.

## Summary:

### Standard Barometer 2k

Measuring range: 865 ... 1090 hPa (650 ... 820 mm Hg on special request)

Available for local altitudes up to 1000 m over mean sea level

Inner diameter of measuring tube: 14 mm

Graduation of scale: 1/1 hPa

Accuracy of reading: 0.05 hPa

Measuring range of the additional thermometer: -10 to +50 °C, 1/1 °C graduation

### Accessory free of charge:

Transport case, dimensions 1200 x 125 x 100 mm

Upper and lower support

Instruction 2k-2E and instruction K111-6E, part A and B

Weight including accessory: appr. 9.7 kg

### Spare parts:

**5a** Spare tube filled with mercury, in stuffed transport case

**5ac** Spare tube filled with mercury, complete with conus and cistern in stuffed transport case (to be used for instruments till serial No. K7019)

**B17 T091** Spare thermometer, measuring range: -10 to +50 °C.

## Control Barometer 20k (Fig. 4)

This instrument differs from the Standard Barometer 2k mainly by an extended measuring range, according to its application as calibration instrument. Like the upper sight of No. 2k, both upper and lower sight of No. 20k are equally equipped with eccentric fine adjustment, vernier and device for measuring the meniscus height.

For frequently used calibration equipments it has proved advantageous to apply the more handy Test Barometer 11i. The Control Barometer 20k is then only used to occasionally check the former.

### Summary

#### Control Barometer 20k

Measuring range: 55 ... 1090 hPa (40 ... 820 mm Hg on special request)

Available among others for calibration of altimeters up to 20 km

Inner diameter of measuring tube: 11 mm

Graduation of scale: 1/1 hPa

Accuracy of reading: 0.05 hPa

Measuring range of the additional thermometer: -10 to +50° C, 1/1° C graduation

#### Accessory free of charge:

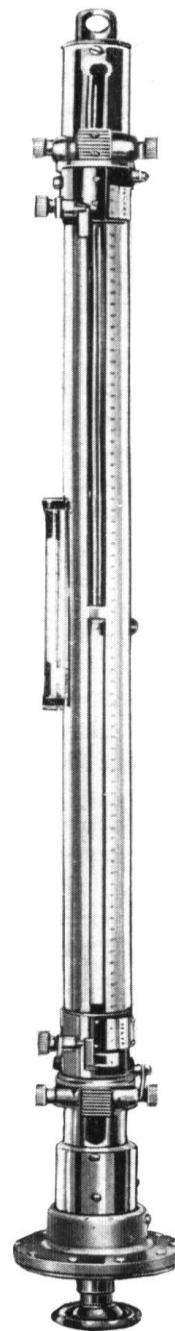
Transport case, dimensions: 1220 x 145 x 140 mm,

Upper and lower support,

Instruction 2k-2E and instruction K111-6E, part A and B

#### Spare parts:

- |                 |   |
|-----------------|---|
| <b>20b</b>      | Spare tube filled with mercury in stuffed transport case  |
| <b>20bc</b>     | Spare tube filled with mercury, complete with conus and cistern in stuffed transport case (to be used for instruments till year of construction 2008) |
| <b>B17 T091</b> | Spare additional thermometer, measuring range: -10 to +50 °C.   |



**Fig. 4**  
Control Barometer 20K

## Station Barometer 11a9 and 11b9 (Fig. 5 and 6)

These barometers are single-leg cistern barometers and therefore easily to adjust and for quickly reading, as only one sight has to be observed. In these barometers the quantity of mercury is balanced in such a way that capillary correction is not necessary. They are used at meteorological stations, aviation weather stations, test plants, technical and scientific laboratories, also as test and calibration instruments. The lower open end of the measuring tube dips into the mercury cistern, and the atmospheric pressure acts on the mercury surface in the cistern.

The zero point of the scale of the casing tube coincides with that height of the mercury surface which would result if the atmospheric pressure in the cistern would be zero. The lowering of the cistern level with increasing pressure is taken into account in the graduation. Therefore, these instruments are also called “barometers with reduced graduation.”

For reading one adjusts the sight to the upper meniscus by turning the lateral knurled knob only. Afterwards the barometric pressure can be read from the scale by means of the vernier (Fig. 6). The vernier is adjusted by rack and pinion.

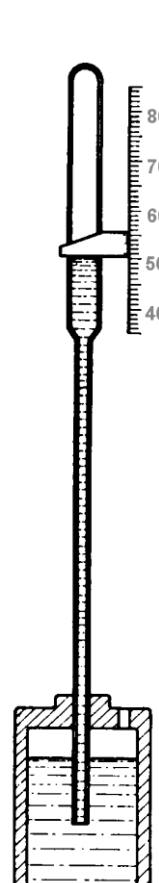
The barometers are graduated in hPa. The units of atmospheric pressure and the referring inscriptions on the barometer scales correspond to the international standards as defined by the WMO:

$$\text{“True hPa at } 0\text{ }^{\circ}\text{C and } 980.665\text{ cm/sec}^2\text{”}$$

The measuring principle implies a dependence of the indication upon the filled-in quantity of mercury so that any loss of mercury must strictly be avoided. Contrary to the Standard Barometers it is not possible to take into account the influence of air that might have penetrated.

To prevent the penetration of air into the vacuum chamber an air trap is provided in the lower part of the tube. Possibly rising air bubbles are held back in the widening.

In the Station Barometer 11a9 and 11b9 the quantity of mercury is balanced in such a way that the barometer coincides with the Standard Barometer at a temperature of 0°C.



**Fig. 5**  
Scheme of a  
Station Barometer



**Fig. 6**  
Station Barometer  
11a9

## Summary

### Station Barometer 11a9

Measuring range: 800 ... 1070 hPa  
Available for local altitudes up to 1500 m over mean sea level  
Inner diameter of measuring tube: 9 mm  
Graduation of scale: 1/1 hPa  
Accuracy of reading: 0.1 hPa  
Measuring range of the additional thermometer: -15 to +50 °C, 1/1 °C graduation

### Accessory free of charge

Transport case, dimensions 975 x 110 x 110 mm  
Hanger, special wrench  
Instruction 11a9-1E and instruction K111-6E, part A and B  
Weight including accessory: appr. 5.9 kg

### Spare parts

**B31 UG08A VP** Spare measuring tube, filled with mercury, with screw cap, in protective box  
**B31 T085A** Spare glass shield tube  
**B31 T081** Spare additional thermometer, measuring range: -15 to +50 °C

### Station Barometer 11b9

as No. 11a9, however with  
Measuring range: 580 ... 1025 hPa  
Available for local altitudes up to 4000 m over mean sea level  
Weight: appr. 6 kg  
Inner diameter of measuring tube: 9 mm  
Graduation of scale: 1/1 hPa  
Accuracy of reading:  $\pm 0.1$  hPa  
Measuring range of the additional thermometer: -15 to +50 °C, 1/1 °C graduation

Further technical details and accessory free of charge as No. 11a9

### Spare parts

**B31 UG08B VP** Spare measuring tube, filled with mercury, with screw cap, in protective box  
**B31 T085B** Spare glass shield tube  
**B31 T081** Spare additional thermometer, measuring range: -15 to +50 °C.

## Test Barometer 11i

This instrument is designed in the same manner as the Station Barometer No. 11a9. It has, however, an expanded measuring range so that it is mainly used for the calibration of aneroid barometers, barographs, altimeters, pressure gauges etc.

Here the Torricelli-Tube has the same cross section over the whole length. Therefore, the cistern has also been extended as to be able to receive the increased quantity of mercury of the measuring tube. The cistern is mercurytight and airtight since at low pressures considerable negative pressures relative to the outside pressure may occur. A closed sleeve serves for the connection with a receiver or a test chamber respectively.

The adjusting sight with its vernier is mounted on a slide which operates with friction on the casing tube. In addition, this site can be adjusted sensitively to the mercury meniscus by a worm thread. For frequent calibrations at certain pressure stages "short vernier slides" without fine adjustment can be delivered; they can be adjusted to fixed calibration values in steps of 35 hPa respectively.

The barometer is graduated in hPa. In these Test Barometers the quantity of mercury is balanced in such a way that the barometer coincides with the Standard Barometer at a temperature of 20 °C.

## Summary

### Test Barometer

Measuring range: 55 ... 1090 hPa  
Available among others for calibration of altimeters up to 20 km  
Inner diameter of measuring tube: 8 mm  
Graduation of scale: 1/1 hPa  
Accuracy of reading: 0.1 hPa  
Measuring range of the additional thermometer: -20 to +50 °C, 1/1 °C graduation

### Accessory free of charge:

Transport case, dimensions: 1050 x 105 x 105 mm  
Upper and lower support, special wrench  
Instruction 11a9-1E and instruction K 111-6E, part A and B  
Weight including accessory: appr. 6.4 kg

### Supplement accessory

**11n** Short vernier slide

### Spare parts

**11s** Spare measuring tube, filled with mercury, with screw cap, in protective box  
**B23 T028** Spare thermometer, measuring range -20 to +50 °C

**DR. ALFRED MÜLLER**  
**METEOROLOGISCHE INSTRUMENTE KG**  
Chausseestraße 39 / 42c  
D-15712 Königs Wusterhausen

**Tel.:** +49 3375 9025-32  
**FAX:** +49 3375 9025-36  
**e-mail:** info@meteomueller.de  
**www.rfuess-mueller.de**