

Pressure balance – compact version

Model CPB3000



WIKA data sheet CT 31.05

Applications

- Primary standard for defining the pressure scale in a range up to 1,000 bar (hydraulic)
- Reference instrument for the test, adjustment and calibration of pressure measuring instruments in factories and calibration laboratories
- Self-contained, complete system also suitable for on-site measurements/calibrations

Special features

- Total uncertainty of measurement down to 0.025 % of reading
- Factory calibration certificate as standard, traceable to National Standards, DKD/DAkkS calibration certificate available as an option
- High long-term stability with a recommended recalibration cycle of 5 years
- Masses manufactured from stainless steel and aluminium, local gravity adjustment possible at no additional charge
- Compact dimensions

Description

Proven primary standard

Pressure balances are the most accurate instruments for the calibration of electronic or mechanical pressure measuring instruments. The direct measurement of pressure, ($P = F/A$) and the use of high-quality materials, result in small measurement uncertainties and an excellent long-term stability of five years (Recommendation in accordance with the German Calibration Service DKD/DAkkS).

For these reasons pressure balances have already been used in the calibration laboratories of industry, national institutes and research laboratories for many years.

Self-contained operation

Due to the integrated pressure generation and the purely mechanical measuring principle, the CPB3000 is ideally suited to on-site use as well as service and maintenance purposes.

Basic principle

Pressure is defined as the quotient of force and area. Corre-



Pressure balance model CPB3000

spondingly, the core of the CPB3000 is a very precisely-manufactured piston cylinder system, which is loaded with masses in order to generate the individual test points. The weight applied is proportional to the desired pressure and accomplished by using optimally graduated weights. These weights are manufactured to standard gravity (9.80665 m/s^2) although, for fixed location usage, they can be adjusted to a customer specified local gravity.

Easy functioning

The pressure is set via an integrated, finely-adjustable, precision spindle pump. As soon as the measuring system reaches equilibrium, there is a balance of forces between pressure and mass applied. The excellent quality of the system ensures that this pressure remains stable over several minutes, so that the device under test can be calibrated or time-consuming adjustments can be carried out without any problems.

Compact instrument design

In addition, the CPB3000 sets itself apart through its compact size, the clearly arranged control elements and the space saving storage of the weight discs, directly on top of the instrument's base-plate.

The built-in spindle pump, is very easy to operate, even at very high pressures, and features a threaded spindle which only runs within the pump body. There is, therefore, no adverse bending moment acting on the spindle when it is fully open, and, particularly for field use, this also has the advantage that the dimensions of this instrument will not change as the spindle is turned during operation.

Scope of supply

- Instrument base with dust cover
- Spindle pump for pressure generation/fine adjustment
- Quick connection of test devices
- Piston cylinder system with bell jar
- Basic mass-set stored on the instrument base
- Mass-set extension in carrying case (only for measuring ranges to 1,000 bar and 14,500 psi)
- Mass-set manufactured to standard gravity (9.80665 m/s^2)
- Operating fluid (0.5 litre)
- Operating instructions in German and English
- Factory calibration certificate

Options

- Mass-set manufactured to local gravity
- Test connection for gauges exceeding NS 160
- DKD/DAkkS calibration certificate



Pressure balance model CPB3000 with test device

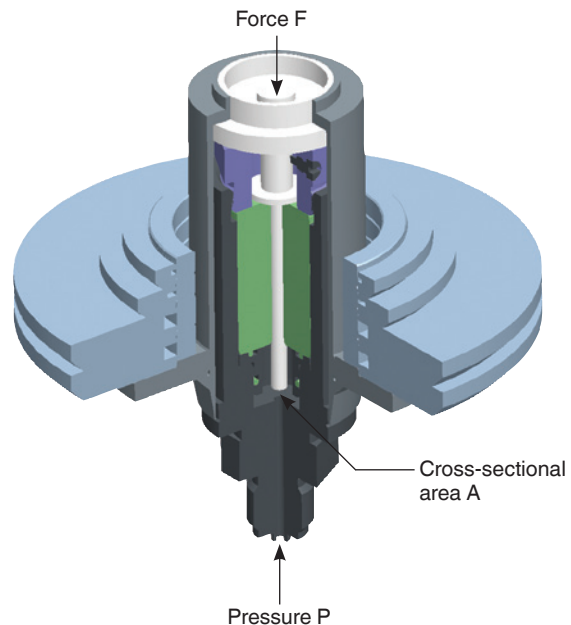
Piston cylinder system

Both the piston and cylinder are manufactured from Tungsten Carbide. Compared to other materials Tungsten Carbide has very small pressure and thermal expansion coefficients, which results in a very good linearity of the effective cross-sectional area of the piston and a high measurement accuracy.

Piston and cylinder are very well protected, in a solid stainless steel housing, against contact, impacts or contamination from outside. In addition, overpressure protection is integrated, which prevents the piston from being forced out vertically and avoids damage to the piston cylinder system in the event of weight removal under pressure.

The weight discs are stacked on a bell jar which is fitted to the piston skirt. Due to the construction of the bell jar, the centre of gravity for the stacked weights is very low, which minimises both the side thrust on the piston cylinder system and the friction. For relatively low starting pressures, a lighter aluminium plate can be used instead of the bell jar.

The overall design of the piston/cylinder unit and the very precise manufacturing of both the piston and the cylinder ensure excellent operating characteristics with a long free-rotation time, low sink rates and a very high long-term stability. Therefore the recommended recalibration interval is 5 years.



Piston cylinder system

Tables of masses

The following tables show the number of weights per measuring range, within a weight set, with their nominal mass values and the resulting nominal pressures.

Should you not operate the device under reference conditions (ambient temperature 20 °C, air pressure 1013 mbar, relative humidity 40 %), corrections must be considered, if necessary.

These weights are manufactured to standard gravity (9.80665 m/s²) although for fixed location usage they can be adjusted to a customer specified local gravity.

Measuring range [bar]	0.2 ... 60		1 ... 250		2 ... 600		2 ... 1,000	
	pieces	Nominal pressure per piece in bar	pieces	Nominal pressure per piece in bar	pieces	Nominal pressure per piece in bar	pieces	Nominal pressure per piece in bar
Piston	1	0.2	1	1	1	2	1	2
Bell jar	1	1.6	1	8	1	16	1	16
Aluminium plate	1	0.1	1	0.5	1	1	1	1
Masses 4 kg	6	8	6	40	6	80	11	80
Masses 2 kg	2	4	2	20	2	40	2	40
Masses 1 kg	1	2	1	10	1	20	1	20
Masses 0.5 kg	1	1	1	5	1	10	1	10
Masses 0.2 kg	1	0.4	1	2	1	4	1	4
Masses 0.1 kg	1	0.2	1	1	1	2	1	2
Masses 0.05 kg	1	0.1	1	0.5	1	1	1	1

Measuring range [psi]	2.9 ... 1,000		14.5 ... 5,000		29 ... 10,000		29 ... 14,500	
	pieces	Nominal pressure per piece in psi	pieces	Nominal pressure per piece in psi	pieces	Nominal pressure per piece in psi	pieces	Nominal pressure per piece in psi
Piston	1	2.9	1	14.5	1	29	1	29
Bell jar	1	23.1	1	115.5	1	231	1	231
Aluminium plate	1	1.1	1	5.5	1	11	1	11
Masses 3.5 kg	9	100	9	500	9	1,000	14	1,000
Masses 1.4 kg	1	40	1	200	1	400	1	400
Masses 1 kg	1	30	1	150	1	300	1	300
Masses 0.7 kg	2	20	2	100	2	200	2	200
Masses 0.35 kg	1	10	1	50	1	100	1	100
Masses 0.175 kg	1	5	1	25	1	50	1	50
Masses 0.14 kg	1	4	1	20	1	40	1	40
Masses 0.07 kg	1	2	1	10	1	20	1	20

Specifications

Model CPB3000

Measuring range	bar ¹⁾	0.2 ... 60	1 ... 250	2 ... 600	2 ... 1,000
Required weights	kg	30	25	30	50
Smallest step	bar ²⁾	0.1	0.5	1	1
Nominal cross-sectional area of the piston	cm ²	0.5	0.1	0.05	0.05
Measuring range	psi ¹⁾	2.9 ... 1,000	14.5 ... 5,000	29 ... 10,000	29 ... 14,500
Required weights	kg	34	34	34	50
Smallest step	psi ²⁾	2	10	20	20
Nominal cross-sectional area of the piston	cm ²	0.5	0.1	0.05	0.05
Accuracy ³⁾	% of reading	0.025 ⁴⁾			
Pressure transmission medium	hydraulic	Operating fluid (0.5 litre is included in delivery), other mediums on request			
Oil reservoir	cm ³	110			
Connection of the piston cylinder system		G ½ B male thread			
Connection for the test specimen		Quick connector G ½ B female thread as standard, freely rotating, changeable, (for other threaded inserts, see accessories)			
Material					
■ Piston		Tungsten Carbide			
■ Cylinder		Tungsten Carbide			
■ Mass-set		Stainless steel 1.4305 and Aluminium, non-magnetic			
Spindle pump					
■ Swept volume per revolution	cm ³	approx. 0.1			
■ Overall swept volume	cm ³	approx. 3.9			
Required moment at					
■ 250 bar	Nm	2.0			
■ 500 bar	Nm	4.0			
■ 1000 bar	Nm	8.0			
Operating temperature	°C	18 ... 28			
Weight					
■ Instrument base (without weight pieces)	kg	11.7			
■ Piston cylinder system	kg	1.5			
■ BAR basic mass-set incl. bell jar	kg	30.8			
■ BAR mass-set extension incl. carrying case (only for 1,000 bar)	kg	24.0			
■ PSI basic mass-set incl. bell jar	kg	37.0			
■ PSI mass-set extension incl. carrying case (only for 15,000 psi)	kg	21.5			
Dimensions					
■ Instrument base	mm	365 (W) x 483 (D) x 294 (H), for details see technical drawing			
■ Carrying case for mass-set extension	mm	215 (W) x 310 (D) x 310 (H)			
Calibration		Factory calibration certificate (optional: DKD calibration certificate)			

1) Theoretical starting value; corresponds to the pressure value generated by the piston (by its own weight). To optimise the operating characteristics more weights should be loaded.

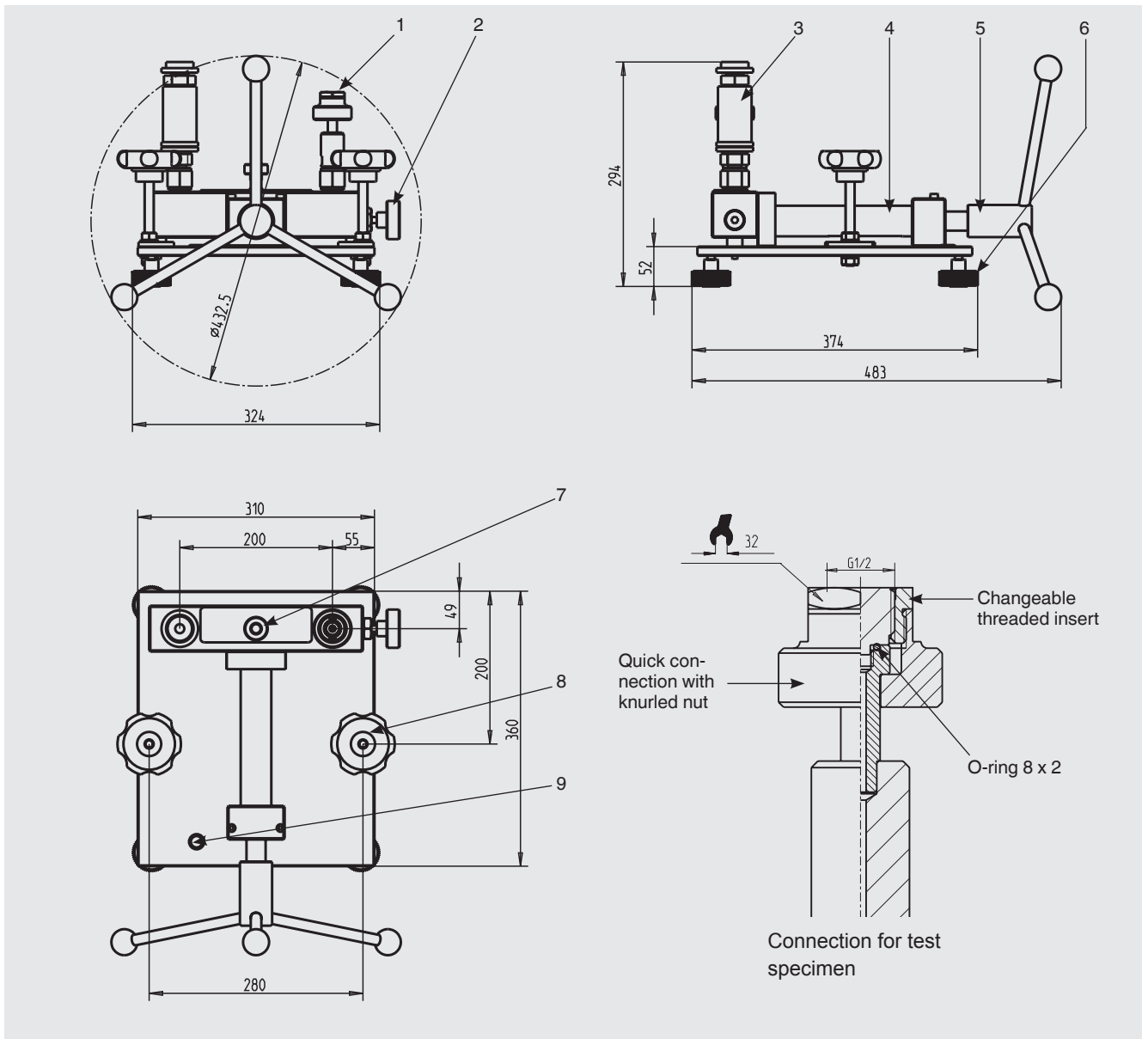
2) The lowest pressure change value that is reached based on the standard weight set. A fine weight set is also available for lower values.

3) The accuracy is in reference to the measurement value, from 10 % of the measurement range. A fixed error is considered in the lower area in reference to 10 % of the area.

4) Measurement uncertainty assuming reference conditions (room temperature 20 °C, air pressure 1013 mbar, relative humidity 40 %). Corrections may be required for use without CalibratorUnit.

Dimensions in mm

(without weight pieces)



- (1) Connection for the test specimen G ½ female, changeable
- (2) Shut-off valve for test connection
- (3) Piston cylinder system
- (4) Spindle pump
- (5) Removable star handle with spring-loaded thrust pad

- (6) Rotating base
- (7) Reservoir with shut-off valve
- (8) Storage of weight pieces
- (9) Water level

Accessories

Set of trim-masses

The weights included in the standard scope of delivery are ideally suited for everyday use. If you would like to generate intermediate values, however, we recommend using a set of Class F1 trim-masses, with the following weights:

1 x 50 g / 2 x 20 g / 1 x 10 g / 1 x 5 g / 2 x 2 g / 1 x 1 g /
 1 x 500 mg / 2 x 200 mg / 1 x 100 mg / 1 x 50 mg /
 2 x 20 mg / 1 x 10 mg / 1 x 5 mg / 2 x 2 mg / 1 x 1 mg



Set of trim-masses

Set of adapters for quick connector

As a standard, the pressure balance is equipped with a quick connector for connecting the test item. For this purpose, various threaded adapters, which can be easily exchanged, are available:

- Set of adapters: G ¼, G ⅜, ½ NPT, ¼ NPT and M20 x 1.5
- Set of adapters NPT: ⅛ NPT, ¼ NPT, ⅜ NPT and ½ NPT

Additionally the sets of adapters include spare O-rings as well as a spanner, flats 32 and flats 14, for exchanging the adapters.

Other threaded inserts are available on request.



Set of adapters

Test item connections

With the test connection included in the standard scope of delivery test gauges up to NS 160 mm, and with lower mount connection can be mounted. For larger instruments or gauges with back mount connection the following adapters with quick connection are available:

- Test connection for gauges up to NS 250 mm
- Angle connection 90°, for test specimens with back mounting connection

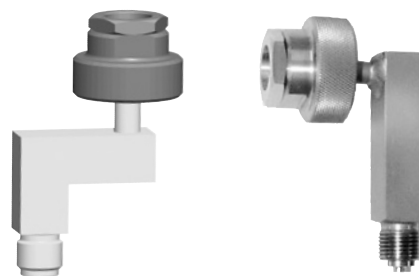


Fig. left: Test connection for gauges up to NS 250
 Fig. right: Angle connection 90°

Description / Features	Order no.
Trim-masses (1 mg up to 50 g), class F1	7093874
Adapter for test item connection for gauges up to NS 250	11279614
Set of adapters for quick-connector, in a case with threaded inserts G ¼, G ⅜, ½ NPT, ¼ NPT and M20 x 1.5 for fitting to the knurled nut of the test item connection.	2036941
Set of "NPT" adapters for quick-connector in a case with threaded inserts ⅛ NPT, ¼ NPT, ⅜ NPT and ½ NPT for fitting to the knurled nut of the test item connection	12563626
Angle connection 90°, for test specimens with back mounting connection	1564838
Set of O-rings consisting of 10 spare sealings for each pressure connection of the CPB3000	12822311
Operating fluid for CPB3000 up to 1,000 bar, 0.5 litre	2099954
Cleaning set for ConTect-systems, hydraulic version	12481425

Further pressure balances within our testing and calibration technology program

Pressure balance model CPB5000

Measuring ranges:

- pneumatic: -1 bar up to +100 bar resp.
-14 psi up to +1,500 psi
- hydraulic: 60 bar up to 1,000 bar resp.
1,000 psi up to 14,500 psi

Accuracy:

0.015 % of reading

0.008 % of reading (optional)

Specifications according to data sheet CT 31.01



Pressure balance model CPB5000

High-pressure pressure balance model CPB5000HP

Measuring ranges:

- hydraulic: 2,500 bar, 4,000 bar or 5,000 bar resp.
40,000 psi, 60,000 psi or 70,000 psi

Accuracy:

0.025 % of reading

0.02 % of reading (optional)

Specifications according to data sheet CT 31.51



High-pressure pressure balance model CPB5000HP

Differential pressure balance model CPB5000DP

Measuring ranges

(= static line pressure + differential pressure):

- pneumatic: 2 bar up to 100 bar resp.
30 psi up to 1,500 psi
- hydraulic: 60 bar up to 1,000 bar resp.
1,000 psi up to 14,500 psi

Accuracy:

0.015 % of reading

0.008 % of reading (optional)

Specifications according to data sheet CT 31.52



Differential pressure balance model CPB5000DP

CalibratorUnit model CPU5000

The CPU5000 CalibratorUnit is a compact tool for use with a pressure balance. Particularly when highly accurate measuring values with uncertainties of measurement of less than 0.025 % are required, complicated mathematic calculations and corrections are necessary. With the CPU5000 all critical ambient parameters can be registered and automatically corrected.

The basic CalibratorUnit package converts masses into the corresponding pressure value, or vice versa, it calculates the masses required for a specific pressure value by considering the local gravity on-site. The conversion can be carried out in all common pressure units.

The sensor package extension includes sensors to make an automatic registration of all critical parameters like room temperature, air pressure, relative humidity and piston temperature and a continual updating of the calculations possible.

Furthermore with the multimeter package a calibrator function for pressure transmitters can be integrated, so that a voltage can be supplied to the test item sensors and sensor signals can be measured without any additional devices. Besides the signal the automatically converted pressure value is also shown on the display.

By upgrading the CPU5000 with the extension for float position indication, the piston position can be measured contact-free and shown on the CalibratorUnit with high resolution.

Specifications according to data sheet CT 35.01.



CalibratorUnit model CPU5000

Order variants

CPU5000 Basis package (only processor)

- Calculation of the mass-loads
- Manual input of all parameters

Sensor package for measuring of:

- Ambient temperature
- Air pressure
- Air humidity
- Piston temperature

Multimeter package

- Power supply DC 24 V
- Measuring of output signal (V, mA) incl. conversion into pressure values

Piston position display

- Contact-free measuring of piston position

Products and services within our calibration technology program

- DKD/DAkkS calibration services for pressure
- Repair of calibration units of all makes
- Portable pressure measuring devices for test and calibration tasks
- Precision pressure measuring units and pressure controllers
- Primary standards for pressure
- Testing technology system solutions
- DKD/DAkkS calibration services for temperature
- Portable measuring devices and calibrators
- Dry well temperature calibrators
- Calibration baths and furnaces
- Precision thermometers
- Primary standards for temperature
- Consulting and seminars

The specifications given in this document represent the state of engineering at the time of publishing. We reserve the right to make modifications to the specifications and materials.



WIKAI Alexander Wiegand SE & Co. KG
Alexander-Wiegand-Straße 30
63911 Klingenberg/Germany
Tel. (+49) 9372/132-0
Fax (+49) 9372/132-406
E-mail info@wika.de
www.wika.de