

# Pressure balance

## Differential pressure version

### Model CPB5600DP



WIKA data sheet CT 31.56



for further approvals  
see page 7

### Applications

- Primary standard for the calibration of differential pressure measuring instruments under static pressure
- Reference instrument for factory and calibration laboratories for the testing, adjustment and calibration of pressure measuring instruments
- Complete, stand-alone system, also suitable for on-site use

### Special features

- Measuring ranges (= static pressure + differential pressure) up to 400 bar (5,000 psi) pneumatic, up to 1,600 bar (23,200 psi) hydraulic
- Total measurement uncertainty to 0.008 % of differential pressure plus 0.0001 % (1 ppm) of static pressure
- Factory calibration included as standard, traceable to national standards; with DKD/DAkkS calibration possible as an option
- High long-term stability with recommended recalibration interval every five years
- Masses manufactured from stainless steel and aluminium, can be adjusted to local gravity

### Description

#### Proven primary standard

Pressure balances (dead-weight testers) are the most accurate instruments available on the market for the calibration of electronic or mechanical pressure measuring instruments. The direct measurement of the pressure ( $p = F/A$ ), as well as the use of high-quality materials enable a very small measurement uncertainty, in conjunction with an excellent long-term stability.

The pressure balance (dead-weight tester) has therefore been used for years in factory and calibration laboratories in industry, national institutes and research laboratories.

#### Stand-alone operation

Due to its integrated pressure generation and the pure mechanical measuring principle, the model CPB5600DP is ideal for on-site use for maintenance and service.



Pressure balance for differential pressure, model CPB5600DP

#### Basic principle

Pressure is defined as the quotient of force and area. The core component of the CPB5600DP is therefore a very precisely manufactured piston-cylinder system, onto which a mass load is applied in order to generate the individual test points.

The mass load is proportional to the target pressure and this is achieved through optimally graduated masses. As standard, these masses are manufactured to the standard gravity ( $9.80665 \text{ m/s}^2$ ), though they can be adjusted to a specific location and also DKD/DAkkS calibrated.

## Easy operation

The pressure setting depends on the instrument design and is either done via an integrated pump or from external pressure supply via a metering valve. For fine adjustment, a very precisely controllable spindle pump is fitted, with a precision spindle running within it.

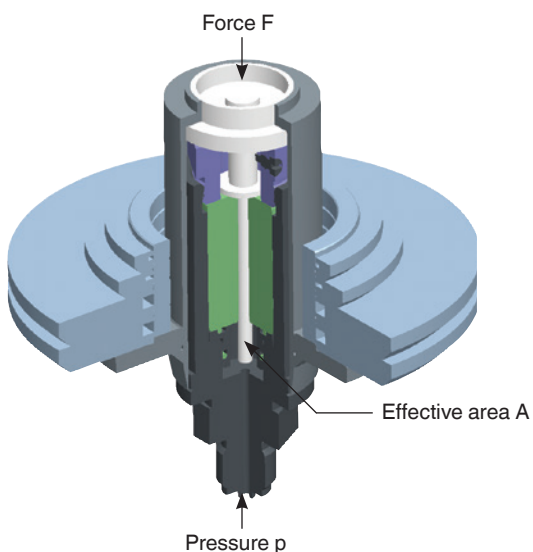
## The piston-cylinder system

Both the piston and cylinder are manufactured from tungsten carbide. This pairing of materials, in comparison to other materials, has very low pressure and temperature coefficients of expansion, which results in a very good linearity for the effective area of the piston and a very high accuracy.

Piston and cylinder are very well protected against contact, impacts or contamination from outside in a solid stainless-steel case. At the same time, 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 masses removal under pressure.

The masses are stacked on a mass carrier, which sits on the piston shaft. The construction of the mass carrier provides a very low centre of gravity for the stacked masses, 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 mass carrier.

The overall design of the piston-cylinder system and the very precise manufacturing of both the piston and the cylinder, ensures excellent operating characteristics with long free-rotation time and low sink rates. Thus a high long-term stability is ensured. Therefore, the recommended recalibration interval is two or five years depending on the conditions of use.



**Piston-cylinder system**

As soon as the measuring system reaches equilibrium, there is a balance of forces between the pressure and the masses. The excellent quality of the system ensures that this pressure remains stable over several minutes, so that the pressure value for comparative measurements can be read without any problems, or also so that more complex adjustments can be carried out on the test item.

## High-performance instrument range

The CPB5600DP instrument bases are available in the following four designs:

- Pneumatic base
  - up to max. 100 bar (1,500 psi)
  - with integrated pressure generation through priming pump and spindle pump
  - connection for external pressure supply
- Pneumatic base with integrated gas to oil separator
  - up to max. 400 bar (5,000 psi)
  - connection for external pressure supply
  - for use with hydraulic piston-cylinder systems with M30 x 2 connection
  - test items can be easily, dryly and cleanly calibrated with air
- Hydraulic base
  - up to max. 1,000 bar (14,500 psi)
  - with integrated pressure generation through priming pump and spindle pump
  - special designs available to 1,200 bar (17,400 psi)
- Hydraulic high-pressure base
  - up to max. 1,600 bar (23,200 psi)
  - with integrated pressure generation through priming pump and spindle pump
  - for use with hydraulic high-pressure piston-cylinder systems with M30 x 2 connection with sealing cone

The instruments include the components of two pressure balances in one case. For the calibration of differential pressure gauges under a static pressure, the two systems are separated by a by-pass valve.

One of the systems is used to generate the static pressure with the second system generating the differential pressure (incl. static pressure). It is recommended that one of the sets of fine increment masses is used for this (see accessories).

The instrument bases, pneumatic to 100 bar (1.450 psi) and hydraulic, are fitted with the patented ConTect quick-release mechanism. This enables a quick and safe replacement of the piston-cylinder system without any tools. The pneumatic instrument version with separator is fitted with a connection for the piston-cylinder system with M30 x 2 female thread and the hydraulic high-pressure base version is fitted with a M30 x 2 female thread with sealing cone.

The instrument bases are also available as individual instruments.

## Tables of masses

The following tables show the number of masses within a mass set with their nominal mass values and the resulting nominal pressures for the respective measuring ranges. Should the instrument not be operated under reference conditions (ambient temperature 20 °C (68 °F), atmospheric pressure 1,013 mbar (14.69 psi), relative humidity 40 %), the relevant corrections must be made, for example with the CPU6000 CalibratorUnit, see page 10.

The masses are manufactured, as standard, to the standard gravity (9.80665 m/s<sup>2</sup>) although they can be adjusted for any local gravity.

### Pneumatic models

Measuring range [bar]	0.03 ... 2		0.2 ... 10		0.4 ... 50		0.4 ... 100	
	Quantity	Nominal pressure per piece [bar]	Quantity	Nominal pressure per piece [bar]	Quantity	Nominal pressure per piece [bar]	Quantity	Nominal pressure per piece [bar]
Piston	1	0.03	1	0.2	1	0.4	1	0.4
Mass carrier	1	0.16	1	0.8	1	4	1	4
Piston plate	1	0.01	1	0.05	1	0.25	1	0.25
Masses 2 kg	-	-	-	-	-	-	5	10
Masses 1 kg	9	0.2	9	1	9	5	9	5
Masses 0.5 kg	1	0.1	1	0.5	1	2.5	1	2.5
Masses 0.2 kg	1	0.04	1	0.2	1	1	1	1
Masses 0.12 kg	1	0.024	1	0.12	1	0.6	1	0.6
Masses 0.1 kg	1	0.02	1	0.1	1	0.5	1	0.5
Masses 0.07 kg	1	0.014	1	0.07	1	0.35	1	0.35
Masses 0.05 kg	1	0.01	1	0.05	1	0.25	1	0.25

Measuring range [psi]	0.435... 30		2.9 ... 150		5.8 ... 500		5.8 ... 1,000		5.8 ... 1,500	
	Quantity	Nominal pressure per piece [psi]	Quantity	Nominal pressure per piece [psi]	Quantity	Nominal pressure per piece [psi]	Quantity	Nominal pressure per piece [psi]	Quantity	Nominal pressure per piece [psi]
Piston	1	0.435	1	2.9	1	5.8	1	5.8	1	5.8
Mass carrier	1	2.22	1	11.1	1	55.5	1	55.5	1	55.5
Piston plate	1	0.22	1	1.1	1	5.5	1	5.5	1	5.5
Masses 1.4 kg	5	4	5	20	-	-	5	100	8	100
Masses 1 kg	2	3	2	15	2	75	2	75	2	75
Masses 0.7 kg	4	2	4	10	4	50	4	50	9	50
Masses 0.35 kg	3	1	3	5	3	25	3	25	3	25
Masses 0.19 kg	1	0.548	1	2.74	1	13.7	1	13.7	1	13.7
Masses 0.14 kg	1	0.4	1	2	1	10	1	10	1	10
Masses 0.12 kg	1	0.345	1	1.725	1	8.625	1	8.625	1	8.625
Masses 0.07 kg	1	0.2	1	1	1	5	1	5	1	5

## Hydraulic models

Measuring range [bar]	0.2 ... 60		0.2 ... 100		1 ... 250		1 ... 400		2 ... 600		2 ... 1,000		25 ... 1,600	
	Quantity	Nominal pres- sure per piece [bar]	Quantity	Nominal pres- sure per piece [bar]	Quantity	Nominal pres- sure per piece [bar]	Quantity	Nominal pres- sure per piece [bar]	Quantity	Nominal pres- sure per piece [bar]	Quantity	Nominal pres- sure per piece [bar]	Quantity	Nominal pres- sure per piece [bar]
Piston	1	0.2	1	0.2	1	1	1	1	1	2	1	2	1	25
Mass carrier	1	1.6	1	1.6	1	8	1	8	1	16	1	16	-	-
Piston plate	1	0.1	1	0.1	1	0.5	1	0.5	1	1	1	1	-	-
Masses 4 kg	6	8	11	8	5	40	11	40	6	80	11	80	4	200
Masses 2 kg	2	4	2	4	2	20	2	20	2	40	2	40	8	100
Masses 1 kg	1	2	1	2	1	10	1	10	1	20	1	20	1	50
Masses 0.5 kg	1	1	1	1	1	5	1	5	1	10	1	10	2	25
Masses 0.2 kg	1	0.4	1	0.4	1	2	1	2	1	4	1	4	1	10
Masses 0.1 kg	1	0.2	1	0.2	1	1	1	1	1	2	1	2	1	5
Masses 0.05 kg	1	0.1	1	0.1	1	0.5	1	0.5	1	1	1	1	1	2.5

Measuring range [psi]	2.9 ... 1,000		14.5 ... 5,000		29 ... 10,000		29 ... 14,500		350 ... 23,200	
	Quantity	Nominal pres- sure per piece [psi]	Quantity	Nominal pres- sure per piece [psi]	Quantity	Nominal pres- sure per piece [psi]	Quantity	Nominal pres- sure per piece [psi]	Quantity	Nominal pres- sure per piece [psi]
Piston	1	2.9	1	14.5	1	29	1	29	1	350
Mass carrier	1	23.1	1	115.5	1	231	1	231	-	-
Piston plate	1	1.1	1	5.5	1	11	1	11	-	-
Masses 7 kg	-	-	-	-	-	-	-	-	2	5,000
Masses 3.5 kg	9	100	9	500	9	1,000	14	1,000	3	2,500
Masses 1.4 kg	1	40	1	200	1	400	1	400	6	1,000
Masses 1 kg	1	30	1	150	1	300	1	300	1	750
Masses 0.7 kg	2	20	2	100	2	200	2	200	2	500
Masses 0.35 kg	1	10	1	50	1	100	1	100	1	250
Masses 0.175 kg	1	5	1	25	1	50	1	50	-	-
Masses 0.14 kg	1	4	1	20	1	40	1	40	1	100
Masses 0.07 kg	1	2	1	10	1	20	1	20	1	50

# Specifications

## Model CPB5600DP

Piston-cylinder systems						
<b>Version</b>	pneumatic					
Measuring range <sup>1)</sup>	bar <sup>2)</sup>	0.03 ... 2	0.2 ... 10	0.4 ... 50	0.4 ... 100	
Required masses	kg	10	10	10	20	
Smallest step	bar <sup>3)</sup>	0.01	0.05	0.25	0.25	
Sensitivity <sup>4)</sup>	mbar	0.002	0.01	0.05	0.05	
Nominal effective area of the piston	cm <sup>2</sup>	5	1	0.2	0.2	
<b>Version</b>	pneumatic					
Measuring range <sup>1)</sup>	psi <sup>2)</sup>	0.435 ... 30	2.9 ... 150	5.8 ... 500	5.8 ... 1,000	5.8 ... 1,500
Required masses	kg	10	10	7	13	20
Smallest step	psi <sup>3)</sup>	0.2	1	5	5	5
Sensitivity <sup>4)</sup>	psi	0.00003	0.00015	0.00075	0.00075	0.00075
Nominal effective area of the piston	cm <sup>2</sup>	5	1	0.2	0.2	0.2
<b>Version</b>	hydraulic					
Measuring range <sup>1)</sup>	bar <sup>2)</sup>	0.2 ... 60	0.2 ... 100	1 ... 250	1 ... 400	2 ... 600
Required masses	kg	30	50	25	40	30
Smallest step	bar <sup>3)</sup>	0.1	0.1	0.5	0.5	1
Sensitivity <sup>4)</sup>	mbar	0.04	0.04	0.2	0.2	0.4
Nominal effective area of the piston	cm <sup>2</sup>	0.5	0.5	0.1	0.1	0.05
<b>Version</b>	hydraulic		hydraulic high pressure			
Measuring range <sup>1)</sup>	bar <sup>2)</sup>	2 ... 1,000	25 ... 1,600			
Required masses	kg	50	32			
Smallest step	bar <sup>3)</sup>	1	2.5			
Sensitivity <sup>4)</sup>	mbar	0.4	5			
Nominal effective area of the piston	cm <sup>2</sup>	0.05	0.02			
<b>Version</b>	hydraulic					hydraulic high pressure
Measuring range <sup>1)</sup>	psi <sup>2)</sup>	2.9 ... 1,000	14.5 ... 5,000	29 ... 10,000	29 ... 14,500	350 ... 23,200
Required masses	kg	34	34	34	50	33
Smallest step	psi <sup>3)</sup>	2	10	20	20	50
Sensitivity <sup>4)</sup>	psi	0.006	0.003	0.006	0.006	5
Nominal effective area of the piston	cm <sup>2</sup>	0.5	0.1	0.05	0.05	0.02
<b>Accuracies</b>						
Proportion of static pressure	0.0001 % of reading					
Proportion of differential pressure standard <sup>5) 6)</sup>	0.015 % of reading 0.025 % of reading at hydraulic high pressure					
Proportion of differential pressure premium <sup>5) 6)</sup>	0.008 % of reading 0.02 % of reading at hydraulic high pressure					
Lower limiting value of the measurement uncertainty	depending on the measuring range; corresponds to the sensitivity of the piston					

1) Measuring range = static pressure + differential pressure

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

3) The smallest pressure change value that can be achieved based on the standard mass set. To reduce this, a set of fine increment masses is also available.

4) The sensitivity is the threshold of the measuring system. It is the pressure value of the smallest mass load, which brings the piston-cylinder system clearly and reproducibly out of balance.

5) Measurement uncertainty assuming reference conditions (ambient temperature 20 °C (68 °F), atmospheric pressure 1,013 mbar (14.69 psi), relative humidity 40 %). For operation without a CalibratorUnit, corrections must be made if required.

6) The accuracy of the differential pressure is determined in accordance with the following calculation basis (see page 9).

## Piston-cylinder systems

### Material

Piston	Tungsten carbide hardened steel at hydraulic high pressure
Cylinder	Tungsten carbide
Mass set	1.4305 stainless steel and aluminium, non-magnetic

### Weight

Piston-cylinder system, pneumatic or hydraulic	1.5 kg / 5.7 kg / (3.3 lbs / 12.6 lbs) (incl. mass carrier and piston plate in optional storage case); 2 systems required
Piston-cylinder system, hydraulic high pressure	2.7 kg / 5.0 kg / (6.0 lbs / 11.0 lbs) (in optional storage case); 2 systems required
bar basic mass set, pneumatic (incl. 2 carrying cases)	32.4 kg (71.4 lbs)
bar extension mass set, pneumatic (incl. 2 carrying cases)	28.0 kg (61.7 lbs)
bar basic mass set, hydraulic (incl. 2 carrying cases)	72.0 kg (158.8 lbs)
bar extension mass set, hydraulic (incl. 2 carrying cases)	48.0 kg (105.8 lbs)
bar basic mass set, hydraulic high pressure (incl. 2 carrying cases)	48.0 kg (105.8 lbs)
bar extension mass set, hydraulic high pressure (incl. 2 carrying cases)	39.0 kg (86.0 lbs)
psi basic mass set, pneumatic (incl. 2 carrying cases)	25.0 kg (55.1 lbs)
psi extension mass set 1, pneumatic (incl. 2 carrying cases)	22.0 kg (48.5 lbs)
psi extension mass set 2, pneumatic (only for 1,500 psi) (incl. 2 carrying cases)	37.0 kg (81.6 lbs)
psi basic mass set, hydraulic (incl. 2 carrying cases)	84.0 kg (185.2 lbs)
psi extension mass set, hydraulic (incl. 2 carrying cases)	43.0 kg (94.8 lbs)
psi basic mass set, hydraulic high pressure (incl. 2 carrying cases)	96.5 kg (212.8 lbs)
psi extension mass set, hydraulic high pressure (incl. 2 carrying cases)	16.0 kg (35.3 lbs)

### Dimensions (W x D x H)

Carrying case for basic mass set	400 x 310 x 310 mm (15.8 x 12.2 x 12.2 in)
Carrying case for extension mass set	215 x 310 x 310 mm (8.5 x 12.2 x 12.2 in)
Storage case for the piston-cylinder system (optional)	300 x 265 x 205 mm (11.8 x 10.4 x 8.1 in)


## Base

### Base version

Pneumatic	up to max. 100 bar (1,500 psi); with priming pump, spindle pump and connection for external supply
Pneumatic, with separator	up to max. 400 bar (5,000 psi); for external supply with integrated gas to oil separator for use with hydraulic pistons with M30 x 2 connection
Hydraulic	up to max. 1,000 bar (14,500 psi); with internal pressure generation up to max. 1,200 bar (17,400 psi) on request
Hydraulic, high pressure	up to max. 1,600 bar (23,200 psi); with internal pressure generation

<b>Base</b>	
<b>Pressure transmission medium</b>	
Pneumatic	Clean, dry, non-corrosive gases (e.g. air or nitrogen)
Hydraulic	Operating fluid (1 litre is included in delivery), other media on request
Reservoir	250 cm <sup>3</sup>
<b>Connections</b>	
Connection for piston-cylinder system	ConTect quick connector on pneumatic and hydraulic base versions M30 x 2 female thread on pneumatic base version with separator M30 x 2 female thread with sealing cone on hydraulic high-pressure base version
Test item connection	2 pieces quick connector G ½ B female thread as standard, freely rotating, changeable; for further threaded inserts, see accessories
External pressure connection	6 mm SWAGELOK® threaded pipe connection; max. 110 % of the assigned measuring range; only with pneumatic base version and pneumatic version with separator
<b>Material</b>	
Piping in base	pneumatic: 1.4571 stainless steel, 3 x 1 mm hydraulic: 1.4404 stainless steel, 6 x 2 mm
<b>Weight</b>	
Pneumatic base	34.0 kg (75.0 lbs)
Pneumatic base with separator	32.0 kg (70.6 lbs)
Hydraulic base	38.5 kg (84.9 lbs)
Hydraulic high-pressure base	37.0 kg (81.6 lbs)
<b>Permissible ambient conditions</b>	
Operating temperature	18 ... 28 °C (64 ... 82 °F)
<b>Dimensions (W x D x H)</b>	
Base	800 x 375 x 265 mm (31.5 x 14.8 x 10.4 in), for details, see technical drawings

## Approvals

Logo	Description	Country
	<b>GOST</b> Metrology/measurement technology	Russia
-	<b>MTSCHS</b> Permission for commissioning	Kazakhstan

## Certificates

<b>Certificate</b>	
<b>Calibration</b>	Standard: factory calibration certificate Option: DKD/DAkkS calibration certificate
<b>Recommended recalibration interval</b>	2 to 5 years (dependent on conditions of use)

Approvals and certificates, see website

## Transport dimensions for complete instrument

The complete instrument, in its standard version and standard scope of delivery, consists of 2 packaging units.

- 1 wooden box with instrument base, dimensions 980 x 580 x 560 mm (38.6 x 22.8 x 22.1 in)
- 1 pallet with piston and mass sets, dimensions 1,200 x 800 x 500 mm (47.3 x 31.5 x 19.7 in)

The overall weight is dependent on the instrument version and measuring range.

	Weight	
	net	gross
<b>Wooden box</b>		
<b>Pneumatic base</b>	34.0 kg (75.0 lbs)	43.5 kg (95.9 lbs)
<b>Pneumatic base with separator</b>	32.0 kg (70.6 lbs)	41.5 kg (91.5 lbs)
<b>Hydraulic base</b>	38.5 kg (84.9 lbs)	48.0 kg (105.8 lbs)
<b>Hydraulic high-pressure base</b>	37.0 kg (81.6 lbs)	46.5 kg (102.5 lbs)

Pallet	Weight	
	net	gross
<b>Version in bar</b>		
<b>Pneumatic</b>		
2 bar / 10 bar / 50 bar	35.5 kg (78.3 lbs)	50.5 kg (111.4 lbs)
100 bar	63.5 kg (104.0 lbs)	78.5 kg (173.1 lbs)
<b>Hydraulic</b>		
60 bar / 250 bar / 600 bar	75.0 kg (165.4 lbs)	90.0 kg (198.5 lbs)
100 bar / 400 bar / 1,000 bar	123.0 kg (271.2 lbs)	138.0 kg (304.3 lbs)
1,600 bar	92.5 kg (204.0 lbs)	107.5 kg (237.0 lbs)

Pallet	Weight	
	net	gross
<b>Version in psi</b>		
<b>Pneumatic</b>		
30 psi / 150 psi / 1,000 psi	50.0 kg (110.3 lbs)	65.0 kg (143.3 lbs)
500 psi	28.0 kg (61.7 lbs)	43.0 kg (94.8 lbs)
1,500 psi	87.0 kg (191.8 lbs)	102.0 kg (224.9 lbs)
<b>Hydraulic</b>		
1,000 psi / 5,000 psi / 10,000 psi	87.0 kg (191.8 lbs)	102.0 kg (224.9 lbs)
14,500 psi	130.0 kg (286.7 lbs)	145.0 kg (326.3 lbs)
23,200 psi	118.0 kg (260.2 lbs)	133.0 kg (293.3 lbs)



## Calculation of the measurement uncertainty

The accuracy of the differential pressure is the quadratic sum of the percentage of static pressure  $u_{\text{stat}}$ . (normally distributed) and the percentage of the differential pressure value  $u_{\text{diff}}$ . (normally distributed). In this way, the minimum values of each of the individual components are taken into account. What is calculated is the expanded measurement uncertainty  $U$  ( $k = 2$ ), in which the measurand lies with a probability of 95 %.

The measurement uncertainty is calculated as per the following equation:

$$U = k * \sqrt{(u_{\text{stat.}} / 2)^2 + (u_{\text{diff.}} / 2)^2} \quad (k = 2 \text{ for } 95 \%)$$

### Example 1:

Measuring range of the piston-cylinder system: 10 bar  
 Accuracy of the piston-cylinder system: 0.015 %  
 Static pressure: 5 bar  
 Differential pressure measured value: 100 mbar

	Measurement uncertainty	Lower limiting value of the measurement uncertainty
Proportion of static pressure	0.0001 % of 5 bar = 0.005 mbar	<b>0.01 mbar</b>
Proportion of differential pressure	0.015 % of 100 mbar = <b>0.015 mbar</b>	0.01 mbar
Overall accuracy	$\pm 2 * \sqrt{(0.01 \text{ mbar}/2)^2 + (0.015 \text{ mbar}/2)^2} = 0.018 \text{ mbar}$ which corresponds to <b><math>\pm 0.018</math> %</b> of reading	

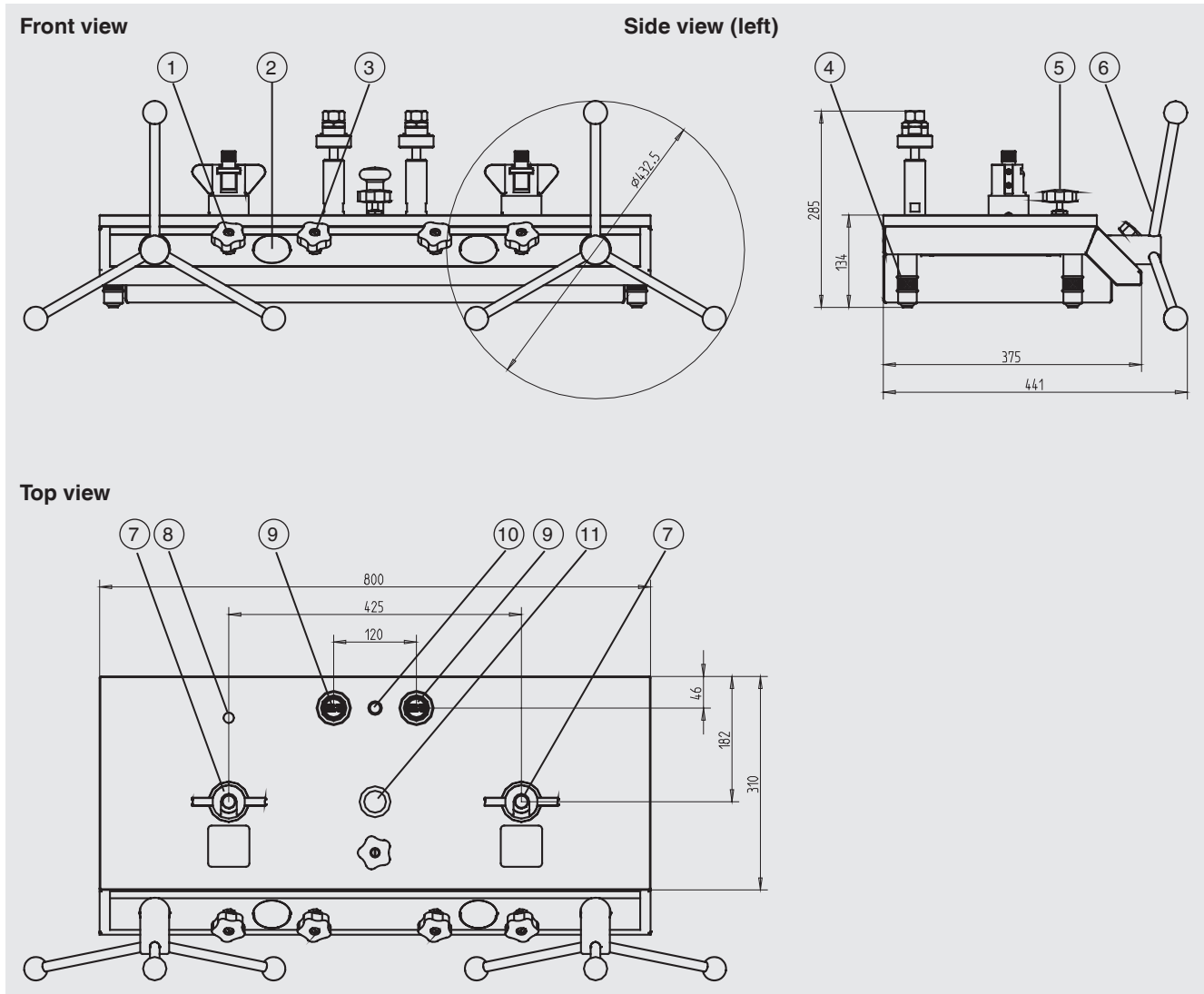
### Example 2:

Measuring range of the piston-cylinder system: 250 bar  
 Accuracy of the piston-cylinder system: 0.008 %  
 Static pressure: 200 bar  
 Differential pressure measured value: 2 bar

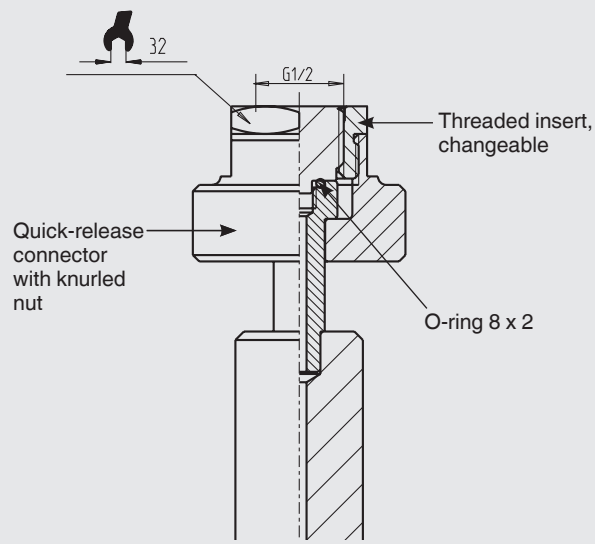
	Measurement uncertainty	Lower limiting value of the measurement uncertainty
Proportion of static pressure	0.0001 % of 200 bar = <b>0.2 mbar</b>	0.2 mbar
Proportion of differential pressure	0.008 % of 2 bar = 0.16 mbar	<b>0.2 mbar</b>
Overall accuracy	$\pm 2 * \sqrt{(0.2 \text{ mbar}/2)^2 + (0.2 \text{ mbar}/2)^2} = 0.283 \text{ mbar}$ which corresponds to <b><math>\pm 0.014</math> %</b> of reading	

## Dimensions in mm (in)

The figure shows a pneumatic CPB5600DP base. The hydraulic version and hydraulic high-pressure version do not differ from it dimensionally, only in the arrangement of the control elements.



### Test item connector



- ① Outlet valve
- ② Test pressure gauge (only to max. 1,000 bar (14,500 psi))
- ③ Inlet valve (only on pneumatic versions)
- ④ Rotatable feet
- ⑤ Bypass valve
- ⑥ Spindle pump with star handle, removable
- ⑦ Connector for piston-cylinder system
- ⑧ Plug screw for oil reservoir (only on hydraulic versions)
- ⑨ Test item connection
- ⑩ Level
- ⑪ Priming pump

## CalibratorUnit model CPU6000

The models of the CPU6000 series are compact tools for use with a pressure balance (dead-weight tester). In particular when highly accurate measuring values, with measurement uncertainties of less than 0.025 %, are required, complicated mathematical calculations and corrections are necessary. With the CPU6000 in combination with the CPB-CAL (iPad® app) and/or WIKA-CAL (PC software) all critical ambient parameters can be registered and automatically corrected.

### The CPU6000 series is made up of three instruments

#### Weather station, model CPU6000-W

The CPU6000-W provides measured values such as atmospheric pressure, relative humidity and the ambient temperature of the laboratory environment.

#### Pressure balance sensor box, model CPU6000-S

The CPU6000-S measures the piston temperature and displays the floating position of the masses.

#### Digital multimeter, model CPU6000-M

The CPU6000-M fulfils the function of a digital multimeter and power supply unit when electronic pressure transmitters must be calibrated.

### Typical application

#### CPB-CAL iPad® app

The iPad® application calculates the masses for pressure balances (dead-weight testers) or the reference pressure while taking the measured parameters from the CPU6000 into account. The conversion can be carried out in all common pressure units. As an additional parameter, the local gravity can be given for location-independent measurements.

#### WIKA-CAL PC software - Weight calculator

With the demo version of the WIKA-CAL software and a CPB series pressure balance (dead-weight tester), the masses to be applied and the corresponding reference pressure can be determined. The pressure balance data (dead-weight tester data) can be entered into the database manually or imported automatically via an XML file available online.

All ambient parameters and piston temperature can be entered manually into WIKA-CAL or can be measured automatically with the CPU6000 series, so that the highest accuracy can be achieved. WIKA-CAL demo version can be downloaded free of charge from the WIKA website.

Further specifications on the CPU6000 series can be found in data sheet CT 35.02.

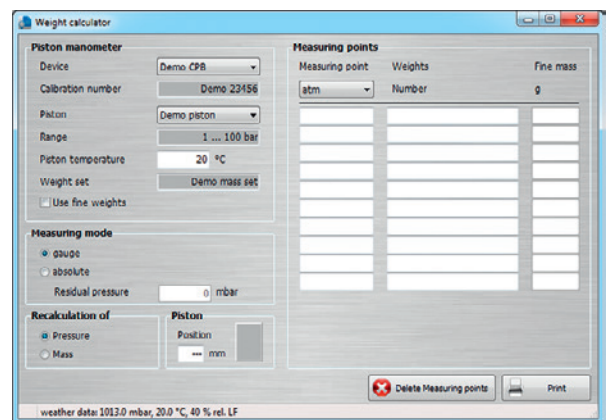
For details of the WIKA-CAL calibration software see data sheet CT 95.10.



CPU6000 series and iPad® app CPB-CAL



Model CPU6000-W, CPU6000-S, CPB5800 and PC with WIKA-CAL software



WIKA-CAL PC software - Weight calculator

## Further pressure balances / dead-weight testers within our calibration technology programme

### Dead-weight tester in compact design, model CPB3800

#### Measuring ranges:

Hydraulic 1 ... 120 to 10 ... 1,200 bar  
(10 ... 1,600 to 100 ... 16,000 psi)

**Accuracy:** 0.05 % of reading  
0.025 % of reading (optional)

For specifications see data sheet CT 31.06



Dead-weight tester in compact design,  
model CPB3800

### Pneumatic pressure balance, model CPB5000

#### Measuring ranges:

Pneumatic -0.03 ... -1 to +0.4 ... +100 bar  
(-0.435 ... -14 to +5.8 ... +1,500 psi)

**Accuracy:** 0.015 % of reading  
0.008 % of reading (optional)

For specifications see data sheet CT 31.01



Pneumatic pressure balance, model CPB5000

### Hydraulic pressure balance, model CPB5800

#### Measuring ranges:

Hydraulic Single-piston measuring ranges:  
1 ... 120 to 2 ... 300 bar  
(10 ... 1,600 to 30 ... 4,000 psi)

Dual-piston measuring ranges:  
1 ... 60 bar / 10 ... 700 bar to 1 ... 60 bar /  
20 ... 1,400 bar  
(10 ... 800 psi / 100 ... 10,000 psi to  
10 ... 800 psi / 200 ... 20,000 psi)

**Accuracy:** 0.015 % of reading  
up to 0.006 % of reading (optional)

For specifications see data sheet CT 31.11



Hydraulic pressure balance, model CPB5800

### Pressure balance for high pressure, model CPB5000HP

#### Measuring ranges:

Hydraulic 25 ... 2,500, 25 ... 4,000 or 25 ... 5,000 bar  
(350 ... 40,000, 350 ... 60,000 or  
350 ... 70,000 psi)

**Accuracy:** 0.025 % of reading  
0.02 % of reading (optional)

For specifications see data sheet CT 31.51



Pressure balance for high pressure,  
model CPB5000HP

## Accessories

### Set of fine increment masses M1 and F1

The masses included in the standard scope of delivery are ideally suited for everyday use. If even smaller intermediate values need to be generated, using one of the class M1 or F1 set of fine increment masses with the following masses is recommended:

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 fine increment masses

### Adapter sets for quick-release connector

As a standard, the pressure balance is equipped with a quick-release connector for connecting the test item. For this purpose, the following threaded inserts, which can be easily changed, are available:

- Adapter set: G ¼, G ⅜, ½ NPT, ¾ NPT and M20 x 1.5
- Adapter set NPT: ⅛ NPT, ¼ NPT, ⅜ NPT and ½ NPT

Additionally, the adapter sets include spare O-rings as well as a spanner with SW32 flats and SW14 flats, for changing the adapters.

Other threaded inserts are available on request.



Adapter set

Designation/Version	Order no.
Set of fine increment masses (1 mg up to 50 g), class F1	7093874
Set of fine increment masses (1 mg up to 50 g), class M1	14025325
Adapter set for quick-release connector in case with G ¼, G ⅜, ½ NPT, ¾ NPT and M20 x 1.5 threaded inserts for insertion in the knurled nut on the test item connector	2036941
Adapter set "NPT" for quick-release connector in case with ⅛ NPT, ¼ NPT, ⅜ NPT and ½ NPT threaded inserts for insertion in the knurled nut on the test item connector	12563626
90° angled connection piece, for test items with back mounting connection	1564838
Separator, max. 1,000 bar (14,500 psi)	1565389
Dirt trap, -1 ... +1,000 bar (14,500 psi), volume 0.2 litre	2015820
Dirt trap, -1 ... +1,000 bar (14,500 psi), volume 0.03 litre	2015714
O-ring set consisting of 5 pcs. 8 x 2 and 5 pcs. 4 x 2.2	12328562
Operating fluid for CPB5000 up to max. 4,000 bar (60,000 psi), 1 litre	2099882
Cleaning set for ConTect systems, pneumatic	12485943
Cleaning set for ConTect systems, hydraulic	12481425

## Scope of delivery

- Base
- Priming pump
- Spindle pump for filling, pressure generation and fine pressure adjustment
- Piston connection with ConText quick-release connector (on pneumatic and hydraulic base)
- Piston connection with M30 x 2 female thread (on pneumatic base with separator and hydraulic high pressure)
- 2 quick connectors for test items
- 2 piston-cylinder systems with mass carrier
- 2 basic mass sets in carrying case
- 2 extension mass sets in carrying cases (depending on the measuring range)
- Masses, manufactured to local gravity (standard value: 9.80665 m/s<sup>2</sup>)
- Operating fluid 1.0 litre (only for hydraulic version) or 0.25 litre (for separator version)
- Additional sealing set
- Operating instructions in German and English language
- Factory calibration certificate

## Options

- Systems with increased accuracy to 0.008 % (depending on measuring range)
- Further pressure units
- Storage case for piston-cylinder systems
- DKD/DAkkS calibration certificate

## Ordering information

Model / Instrument version / Measuring range / Accuracy / Gravity value g / Storage case for piston-cylinder systems / Installation of CPU6000-S Calibrator Unit sensor technology / Calibration for the pressure balance / Additional ordering information

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