Digital dead-weight tester
Model CPD8500

Applications

- Calibration laboratories
- Avionics/Aerospace equipment manufacturers
- Precision pressure sensor manufacturers
- Calibration service companies and service industry

Special features

- Measuring range to 500 bar [7,250 psi]
- Accuracy to 35 ppm of reading
- Absolute and gauge pressure measurement
- No placing of masses required
- Intuitive touchscreen based user interface

Digital dead-weight tester, model CPD8500

Description

Design

The model CPD8500 digital dead-weight tester is an instrument that combines the performance of a manual pressure balance with the efficiency and usability of a compact digital primary standard. The instrument offers a broad pressure range with various measuring heads from 1 ... 500 bar and 2 ... 20 bar abs. [15 ... 7,250 psi and 29 ... 290 psi abs.].
The CPD8500 digital dead-weight tester is equipped with an internal environmental monitoring module, a head temperature probe and a precision vacuum sensor for automatic detection of sensitive parameters. An optional internal or external barometric reference provides additional flexibility for the measurement of gauge or absolute pressure ranges.

Application

Accuracies as high as 35 ppm of reading make the CPD8500 comparable to a reference primary standard and an ideal tool for calibrating transfer standards.

In absolute mode, the CPD8500 offers continuous measurement, unlike a traditional piston gauge where vacuum is interrupted to load masses.

This makes the instrument an easy and fast solution for premium calibrations. The internal automatic lubrication system drives higher and lower pressure ranges without the need for an additional pressure supply, limiting contamination and enhancing the piston-cylinder system performance.

Ease of use

The CPD8500 utilises proven piston-gauge technology with a high-accuracy load cell for precision calibration without the need to load any external mass sets. The displayed pressure value is internally compensated for changes in ambient conditions, local gravity and piston-cylinder temperature. This eliminates the need for manual or external complex calculations.

Data sheets showing similar products and accessories:
Pressure controller, modular version; model CPC6050; see data sheet CT 27.62
Pressure controller, high-end version; model CPC8000; see data sheet 28.01
WIKA-Cal calibration software; see data sheet CT 95.10

The CPD8500 base instrument has integral leveling feet for easy leveling. The feet are padded to reduce vibrational effects. The instrument also supports full downward compatibility to the absolute and gauge measuring heads of its predecessor, CPD8000.

Intuitive user interface
The CPD8500 digital dead-weight tester is easy to use with the touchscreen display and an intuitive user interface. The software is capable of storing information of up to 8 measuring heads for quick measuring head setup and operation.

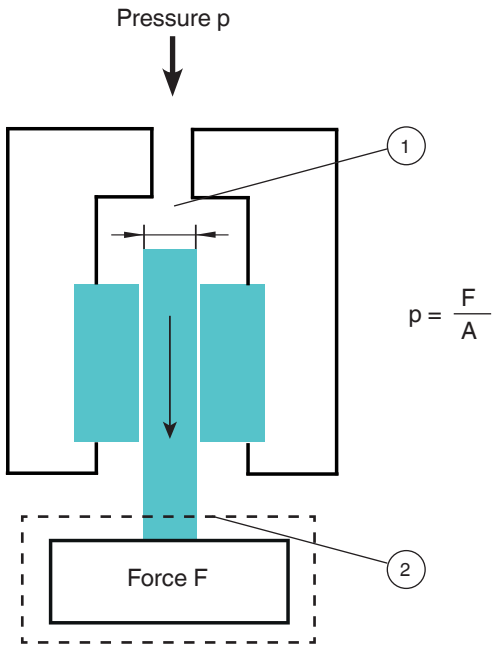
The CPD8500 software offers the ability to perform up to 11 points in-instrument adjustments on the various sensors installed inside.

Additionally, the instrument can also be remotely controlled using either the Mensor standard or the CPD8000 command sets. There is an IEEE-488.2, RS-232, USB and Ethernet interface for communication with other instruments, so the CPD8500 can be integrated into existing systems.

Reliable efficiency with the performance of a primary standard

The working principle
The CPD8500 works on a unique principle which follows the fundamental operating principle of a pressure balance or piston gauge.

- The pressure is applied on the measuring head to the effective area of the piston and converted into a proportional force. The force is transferred to the measuring load cell housed inside the base instrument.
- The measuring load cell continuously measures and calculates the pressure-generated force.
- The base instrument converts the measured force to the equivalent pressure and corrects for the environmental influences.



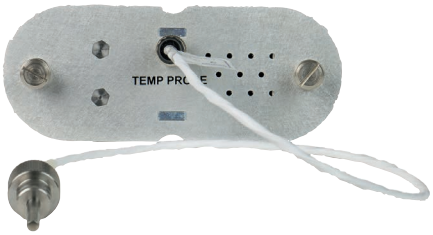
Model CPD8500 basic principle

(1) Effective area A

(2) Base instrument with load cell

Auto detection of ambient conditions
The CPD8500 digital dead-weight tester is equipped with an internal environmental monitoring module (EMM) to constantly monitor any changes in ambient pressure, temperature and relative humidity.

Changes in ambient parameters have significant effect on the validity of pressure readings. The instrument informs the user of the changes to these conditions and activates quick calibration to ensure premium performance.
The EMM is easily interchanged and removed for calibration and repair.



Removable EMM with head temperature probe

Auto detection of piston-cylinder health
The CPS8500 measuring head houses a piston-cylinder system to convert pressure into force. A motor keeps the piston inside the cylinder rotating to maintain equilibrium. The CPD8500 automatically detects contaminants inside the piston-cylinder system and prevents damage to the instrument.

Multiple heads for one base instrument
The CPD8500 base instrument supports up to 8 measuring head configurations at one time, allowing a wide operating range with one base instrument. The measuring heads can be removed, exchanged and installed for best performance with a few easy steps. Each head configuration can be copied to the base instrument with a USB stick to ensure swift and correct entry of all parameters.

Compatibility
The CPD8500 digital dead-weight tester is capable of accessing all the features of the CPS8500 while also being completely backward compatible with the measuring heads for its predecessor, CPD8000.
The absolute measuring heads Legacy models 610, 410, 110 and 111 can be installed on the CPD8500 base instrument to continue utilising the existing measuring heads.

Measuring head
Fig. left: Legacy for absolute pressure
Fig. right: Legacy for gauge pressure

Model CPS8500 measuring head
The CPS8500 is equipped with on-board flash memory that stores all head data information needed to provide accurate calibrations and readings through the calibration interval.
The CPD8500 and CPS8500 connect with a mounted switch that enables the head information to automatically transmit all data to the CPD8500.

Measuring head
Fig. left: Model CPS8500A for absolute pressure
Fig. right: Model CPS8500G for gauge pressure

Specifications for measuring head including piston-cylinder system

Model CPS8500			
Pressure ranges		**Piston-cylinder system Kn** [1]	**Lubrication media**
Gauge pressure	0 ... 1 bar [0 ... 14.5 psi]	0.1 bar/kg [1.45 psi/kg]	■ Dry, clean air ■ Nitrogen
	0 ... 2 bar [0 ... 29 psi]	0.2 bar/kg [2.9 psi/kg]	
	0 ... 5 bar [0 ... 72.5 psi]	0.5 bar/kg [7.25 psi/kg]	
	0 ... 10 bar [0 ... 145 psi]	1 bar/kg [14.5 psi/kg]	■ Dry, clean air ■ Nitrogen over Drosera oil
	0 ... 20 bar [0 ... 290 psi]	2 bar/kg [29 psi/kg]	■ Dry, clean air ■ Nitrogen over sebacate oil
	0 ... 50 bar [0 ... 725 psi]	5 bar/kg [72.5 psi/kg]	
	0 ... 100 bar [0 ... 1,450 psi]	10 bar/kg [145 psi/kg]	
	0 ... 200 bar [0 ... 2,900 psi]	20 bar/kg [290 psi/kg]	
	0 ... 500 bar [0 ... 7,250 psi]	50 bar/kg [725 psi/kg]	
Absolute pressure	0 ... 2 bar abs. [0 ... 29 psi abs.]	0.2 bar/kg [2.9 psi/kg]	■ Dry, clean air ■ Nitrogen
	0 ... 5 bar abs. [0 ... 72.5 psi abs.]	0.5 bar/kg [7.25 psi/kg]	
	0 ... 10 bar abs. [0 ... 145 psi abs.]	1 bar/kg [14.5 psi/kg]	
	0 ... 20 bar abs. [0 ... 290 psi abs.]	2 bar/kg [29 psi/kg]	
Calibration interval	5 years		
Permissible pressure			
Permissible pressure media	Dry, clean air or nitrogen (ISO 8573-1:2010 class 5.5.4 or better)		
Maximum pressure	100 % FS of the measuring head		
Connections			
Pressure port adapters	■ 0 ... 2 bar abs. [0 ... 29 psi abs.] ■ 0 ... 5 bar abs. [0 ... 72.5 psi abs.]	■ KF16 flange ■ With coalescing filter ⅛" NPT female	
	■ 0 ... 10 bar abs. [0 ... 145 psi abs. ■ 0 ... 20 bar abs. [0 ... 290 psi abs.]	7/16-20 SAE female	
Wetted parts	■ 2017 aluminium ■ 2024 aluminium ■ 303 stainless steel ■ 304 stainless steel ■ 316 stainless steel ■ Tungsten Carbide ■ Sapphire	■ Buna N ■ FKM/FPM ■ Silicone grease ■ Drosera oil ■ Sebacate oil ■ Urethane	
Filter elements	■ 0 ... 2 bar abs. [0 ... 29 psi abs.] ■ 0 ... 5 bar abs. [0 ... 72.5 psi abs.]		
	Pressure ports	20-micron filters to prevent contamination	
	Vacuum/vent ports	External 0.01-micron coalescing filter to prevent contamination when venting vacuum	

1) Kn is defined as the piston-cylinder coefficient determining the pressure generated per kilogram of mass exerted on the CPD8500 chassis.

Accuracy		
Standard [1) 2)]	50 ppm [3)]	
Premium [4) 5)]	35 ppm Compatible only with absolute and gauge CPS8500 up to 20 bar [290 psi]	
Calibration interval	50 ppm	2 years
	35 ppm	1 year

1) The accuracy is defined by the total measurement uncertainty, which is expressed with the coverage factor (k = 2) and includes the following factors: the intrinsic performance of the instrument, the measurement uncertainty of the reference instrument, long-term stability, influence of ambient conditions, drift and temperature effects over the compensated range with recommended zero point setting on power up.
2) Standard accuracy: Between 0 ... 25 % of the full scale, the accuracy is 50 ppm of one fourth of full scale value and between 25 ... 100 % of the full scale, the accuracy is 50 ppm or 0.005 % of reading
3) PPM = parts per million of the reading.
4) Premium accuracy: Between 0 ... 25 % of the full scale, the accuracy is 35 ppm of one fourth of full scale value and between 25 ... 100 % of the full scale, the accuracy is 35 ppm or 0.0035 % of reading
5) The accuracy of 35 ppm is warranted on a matched pair of CPS8500 and CPD8500 and the pair must be calibrated together

Specifications for digital dead-weight tester

Base instrument, model CPD8500			
Instrument			
Instrument version	Desktop case		
Weight	Absolute pressure	Approx. 23.5 kg [52 lb] incl. all internal versions without measuring head	
	Gauge pressure	Approx. 18 kg [40 lb] incl. all internal versions without measuring head	
Warm-up time	Up to 4 hours to rated accuracy		
Display			
Screen	7.0” colour LC display with resistive touchscreen		
Resolution	5 ... 8 digits depending on range and units		
Connection			
Pressure connections	■ Reference port ■ Vacuum port		
	Absolute pressure	2 ports with KF16 flanges	
Barometer port adapter	10-32 UNF port with 5/32 barb fitting		
Wetted parts	■ 2017 aluminium ■ 2024 aluminium ■ Stainless steel 304 ■ Stainless steel 316 ■ Nickel ■ Buna N	■ FKM/ FPM ■ Urethane ■ PCTFE ■ Silicone grease ■ Christo Lube MCG 1030	
Permissible pressure			
Reference port/vacuum port	2 Pa ... 100 kPa abs. [15 mTorr ... 750 Torr abs.]		

Accuracy [1)]		
Environmental monitoring module and head temperature		
Head temperature sensor	10 ... 40 °C [50 ... 104 °F]	±0.5 °C
Ambient temperature sensor	-40 ... +125 °C [-40 ... +257 °F]	±1.0 °C
Relative humidity sensor	0 ... 100 % of relative humidity	±5 %
Ambient pressure sensor	552 ... 1,170 mbar abs. [8 ... 17 psi abs.]	±2 % of reading
Residual vacuum		
High-accuracy vacuum sensor	0.1 ... 1,000 mTorr	±0.8 % of readingt
Calibration interval	2 years	

1) The accuracy is defined by the total measurement uncertainty, which is expressed with the coverage factor (k = 2) and includes the following factors: the intrinsic performance of the instrument, the measurement uncertainty of the reference instrument, long-term stability, influence of ambient conditions, drift and temperature effects over the compensated range with recommended zero point setting on power up.

Communication	
Interface	■ RS-232 ■ IEEE-488.2 ■ USB ■ Ethernet
Communications protocol	10/100Based-T
Baud rate	■ 9600 ■ 19200 ■ 38400 ■ 57600 ■ 15200
Response time	Ca. 100 ms
Command sets	■ Mensor ■ CPD8000

Voltage supply and performance data	
Operating supply	■ AC 100 ... 120 V, 50/60 Hz ■ AC 220 ... 240 V, 50/60 Hz
Power consumption	Max. 50 VA
Fuse	1.0 A, 250 V; SLO-BLO 5 x 20 mm
Power cord	■ For Europe ■ For USA/Canada ■ For UK ■ For China ■ For India

Operating conditions	
Place of use	Laboratory
Operating altitude	Max. 3,048 m [10,000 ft] above sea level
Mounting position	Horizontal
Compensated range	15 ... 40 °C [59 ... 104 °F]
Storage temperature range	-20 ... +70 °C [-4 ... +158 °F]
Humidity	5 … 95 % relative humidity
Condensation	Non-condensing
Shock resistance	Max. 2 G
EMC (HF field)	EN 61326 emission (group 1, class A) and immunity (industrial application)

Approvals

Logo	Description	Country
CE	**EU declaration of conformity**	European Union
	EMC directive [1)] EN 61326-1 emission (group 1, class A) and immunity (industrial application)	
	Low voltage directive	
	RoHS directive	

1) This is class A equipment for emissions and is intended for use in industrial environments. In other environments, e.g. residential or commercial installations, it can interfere with other equipment under certain conditions. In such circumstances the operator is expected to take the appropriate measures.

Certificates

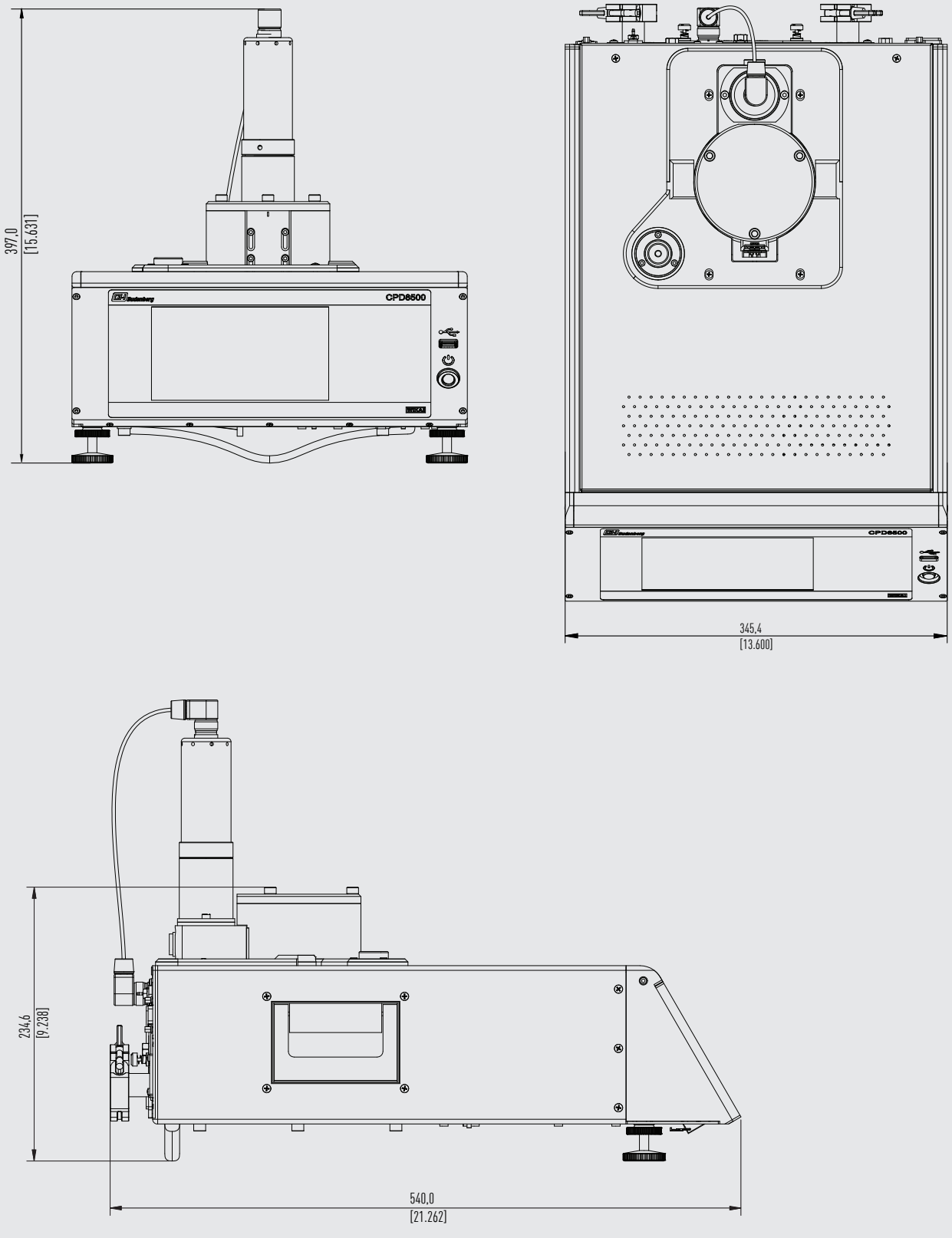
Certificate	
Calibration [1]	
Barometric Reference	■ Without ■ A2LA calibration certificate (standard on factory) (traceable and accredited in accordance with ISO/IEC 17025) ■ DAkkS calibration certificate (traceable and accredited in accordance with ISO/IEC 17025)
CPS8500	Calibration of effective area of the piston – absolute ■ Without ■ Standard - Accuracy of 50 ppm IS-25 (IntelliScale) ■ Premium - Accuracy up to 35 ppm (traceable to national standard IS-25 (IntelliScale))
	Calibration of effective area of the piston – gauge ■ Without ■ Standard - Accuracy of 50 ppm IS-25 (IntelliScale) ■ Premium - Accuracy up to 35 ppm (traceable to national standard IS-25 (IntelliScale))
CPD8500	■ Standard – For a overall accuracy of 50 ppm IS-25 (IntelliScale) ■ Premium - For a overall accuracy of 35 ppm IS-25 (IntelliScale)
Recommended calibration interval	1 year (dependent on conditions of use)

1) Calibration in a horizontal position/operating position.

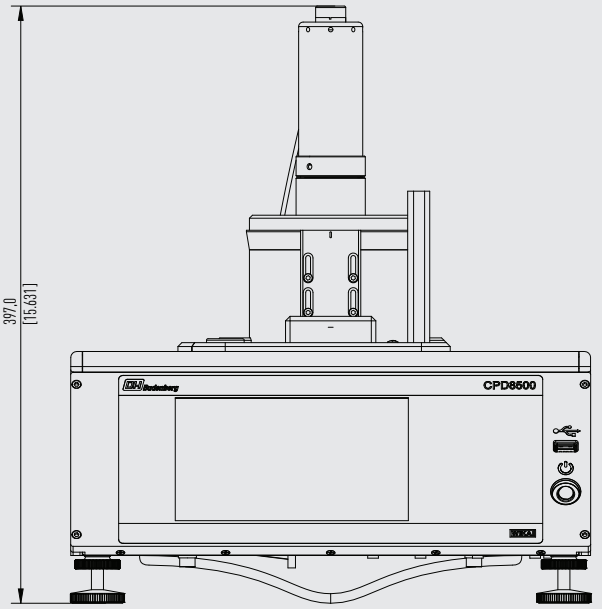
→ Approvals and certificates, see website

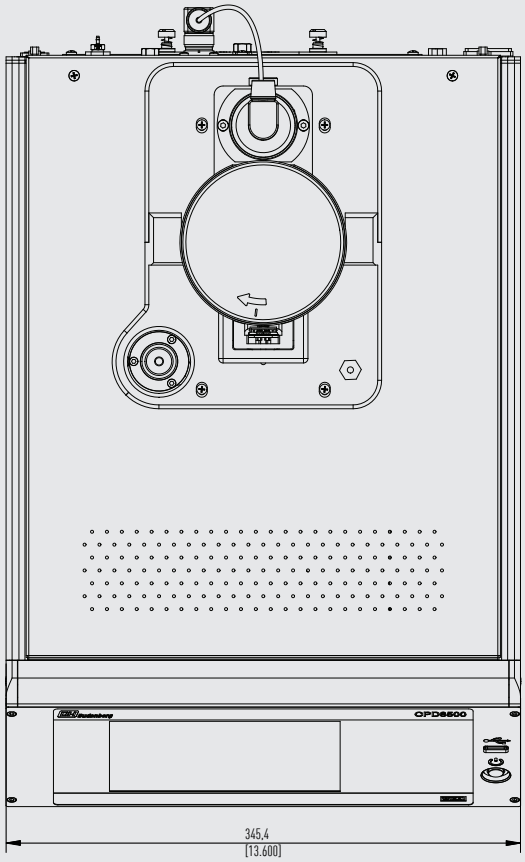
Dimensions in mm [in]

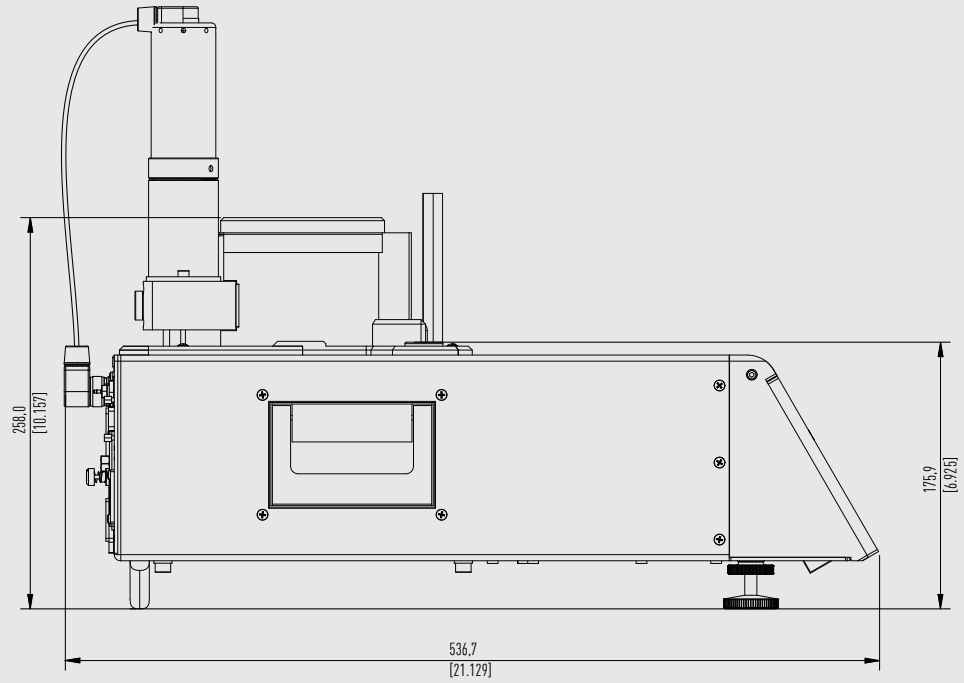
Absolute pressure version



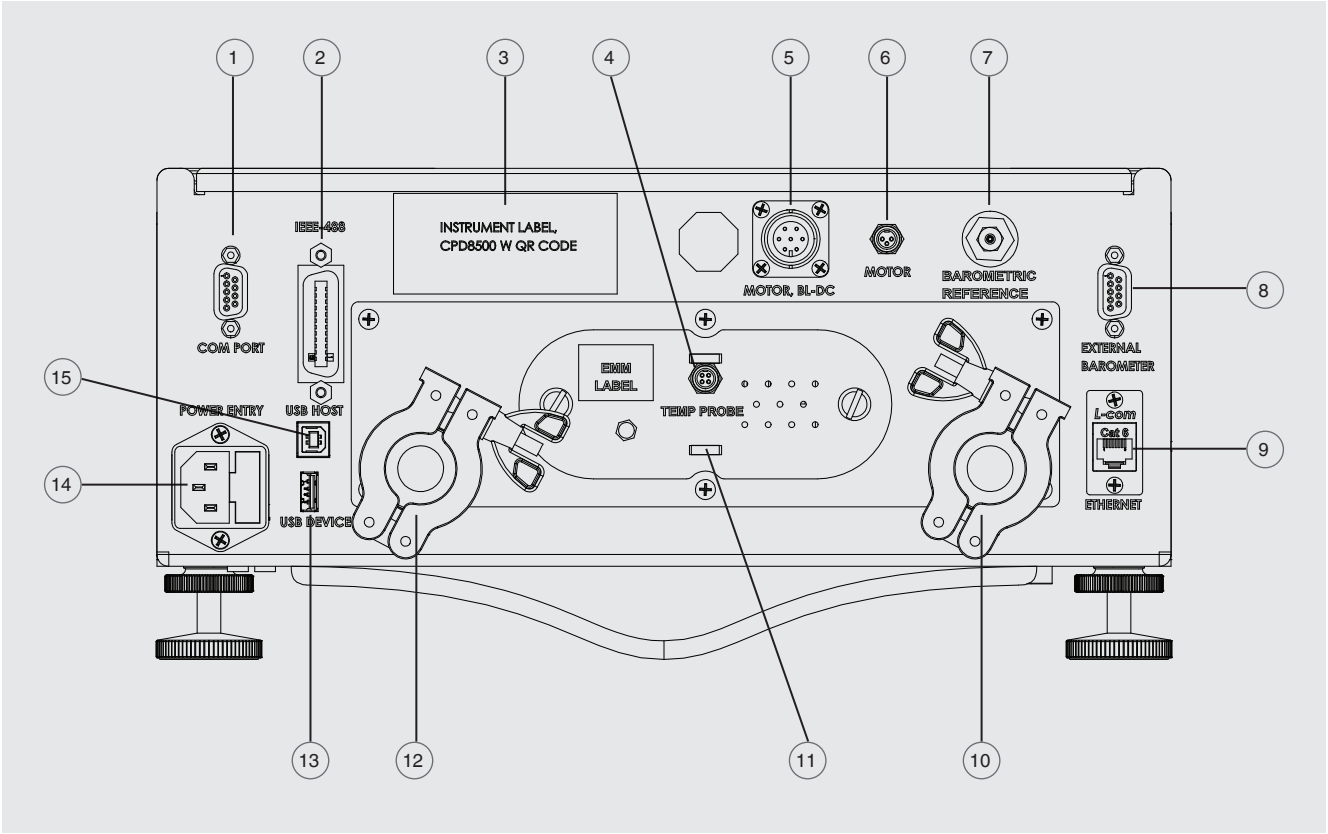
Gauge pressure version







Electrical and pressure connections - rear view

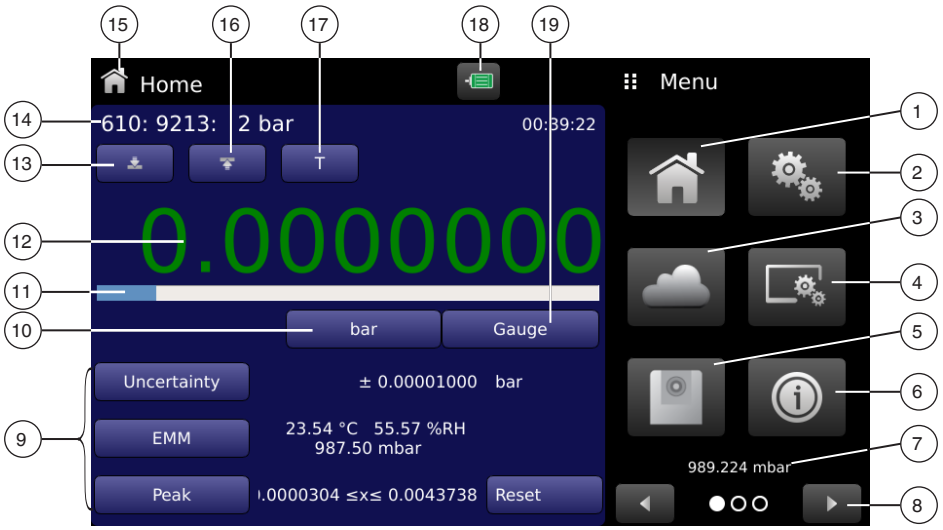


1. RS-232 interface
2. IEEE-488 interface
3. Instrument label
4. Head temperature probe interface
5. Brushless DC motor interface
6. Brushed motor interface
7. Internal barometric reference port
8. External barometric reference interface
9. Ethernet port
10. Vacuum reference pressure port to measuring head (abs. version only)
11. Environmental monitoring module (EMM)
12. Vacuum reference pressure port to vacuum pump (abs. version only)
13. USB interface (host) for service
14. Power supply
15. USB host

Touchscreen and intuitive operator interface

Shortly after power-up, the standard home screen (see following figure) is displayed. This is the Home application displaying all the necessary information to operate and read pressure from the CPD8500. The colour of the current pressure value (13) indicates the validity and stability of the reading. The customisable auxiliary menu (9) displays measurements from various sensors within the instrument.
The various applications on the right one third of the screen provide access to setup menus like the measuring head details, stable limits for the EMM, instrument settings and properties.

Standard desktop/main screen



(1) Home application
(2) General settings
(3) EMM settings
(4) Display settings
(5) Head settings
(6) Information application
(7) Barometric pressure reading (optional)
(8) Menu scroll features forward/back
(9) Auxiliary displays either peak value, rate or alternative units
(10) Current pressure mode
(11) Bar graph
(12) Current measured value
(13) Zero point setting
(14) Active measuring head incl. measuring range
(15) Current application name
(16) Span adjustment function
(17) Tare adjustment function
(18) Motor status icon
(19) Operating mode

Accessories and spare parts

Description [1]		Order code
		CPX-A-D8
	**Barometric reference** Measuring range: 8 ... 17 psi abs. Accuracy to 0.01 % of reading	-3-
	Measuring range: 552 ... 1,172 mbar abs. Accuracy to 0.01 % of reading	-K-
	Measuring range: 552 ... 1,172 hPa abs. Accuracy to 0.01 % of reading	-J-
	Gauge adapter	-A-
	**Transport case** For model CPD8500 and one model CPS8500 measuring head	-C-
	**Transport case** For tow model CPS measuring heads	-P-
	**Environmental monitoring module (EMM)** With factory calibration certificate	-E-
	Calibration adapter For ambient module	-S-
	**Calibration adapter** For barometric reference, voltage supply and software	-5-
	Calibration adapter For vacuum sensor	-B-
	**Vacuum sensor with A2LA calibration**	-F-
	**Accessory kit** For absolute pressure	-G-
	**Accessory kit** For gauge pressure	-H-

Description [1]		Order code
		CPX-A-D8
	**Replacement oil** Sebacate oil For measuring heads to > 20 bar [> 290 psi], 0,25 litres	-M-
	Replacement oil Drosera oil For measuring heads to ≤ 20 bar [≤ 290 psi], 0,25 litres	-N-
Ordering information for your enquiry:		
	1. Order code: CPX-A-D8 **2. Option:**	⇓ [ ]

1) The figures are an example and may change depending on the state-of-the-art in design, material composition and representation.

Scope of delivery

- Digital dead-weight tester model CPD8500
- Accessory kit for gauge pressure and absolute pressure
- 1.5 m [5 ft] power cord
- Adapters and fittings for pressure connections
- Carrying case for one CPD8500 and CPS8500
- Operating instructions
- A2LA calibration certificate for standard accuracy

Ordering information

CPD8500

Model / Base instrument / Measuring head / Barometric reference / Type of certificate for barometric reference / Type of certificate for instrument calibration / Mass set / Accessories / Power cord / Further approvals / Additional ordering information

CPS8500

Model / Installed with a digital dead-weight tester base CPD8500 / Head with piston-cylinder system / Calibration for piston area absolute / Calibration for piston area gauge / Adapter / Transport case / Further approvals / Additional ordering information

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