

Welcome to Tech Tuesday



Fundamentals of Pressure Controllers and Pressure Sensors

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Fundamentals of Pressure Controllers

What are they? How do they work? Why are they used?

What is a Pressure Controller?

- Automatic pressure calibrator with pressure measuring as well as regulation capabilities to the desired pressure value
- Along with the appropriate software, it is capable of performing complete calibration cycle automatically
- Quick and easy to use interface
- Consists of valve regulators for pressure control
- Highly stable and accurate transducers for pressure measurement

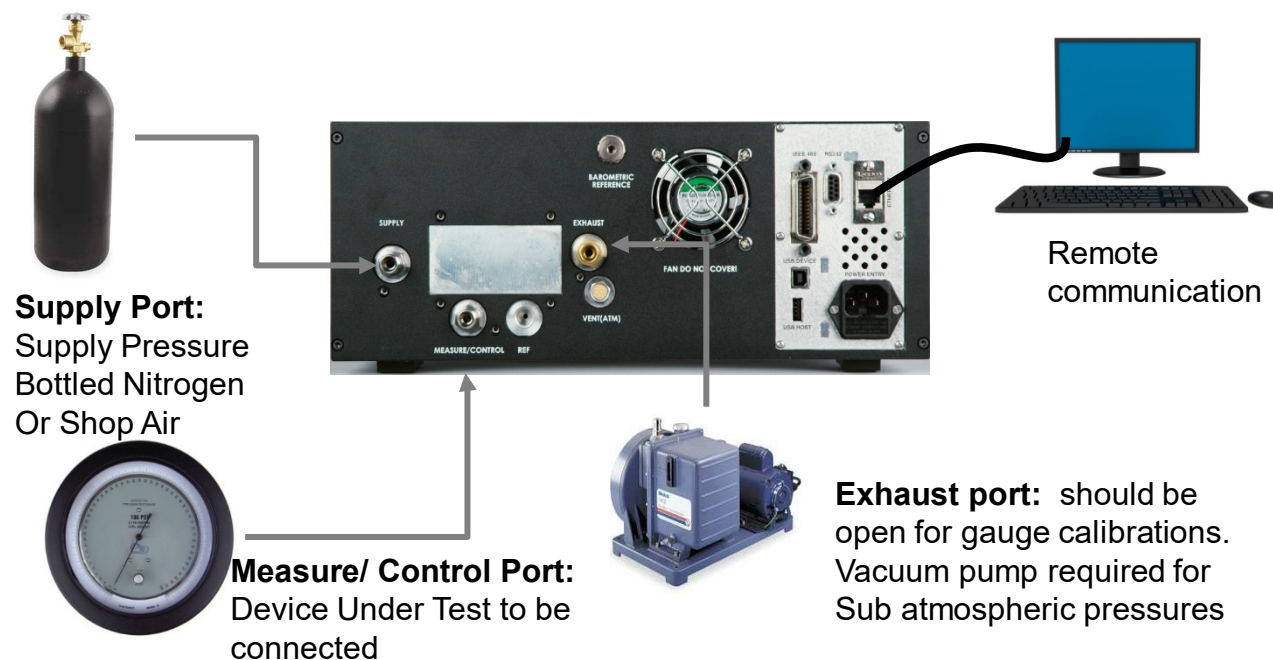


- Saves time
- Increases efficiency
- Stable pressure source



How Does a Pressure Controller Work?

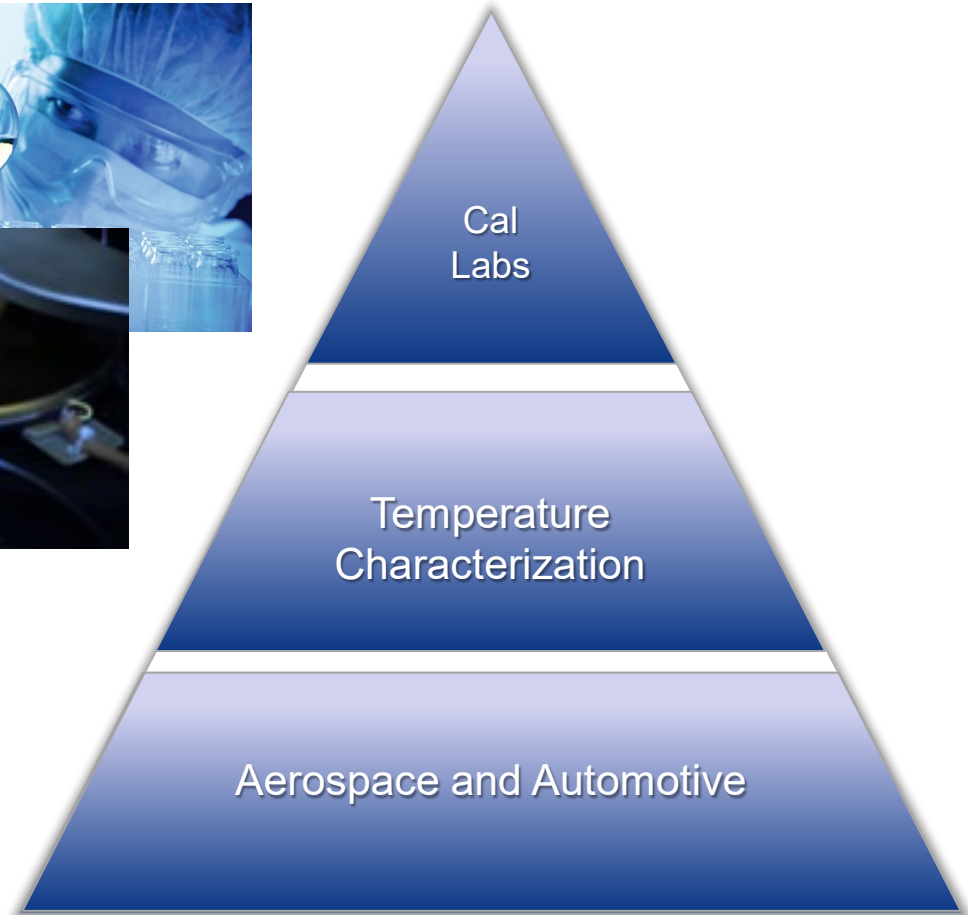
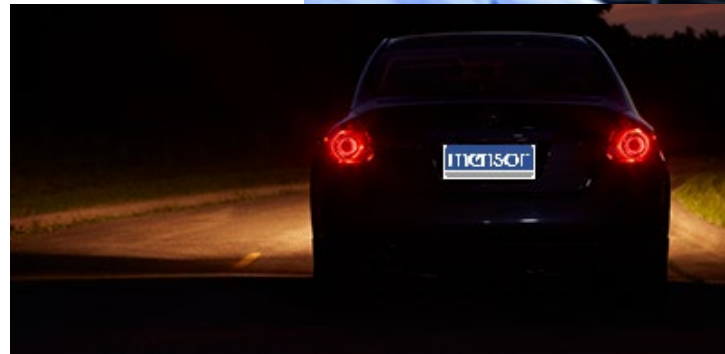
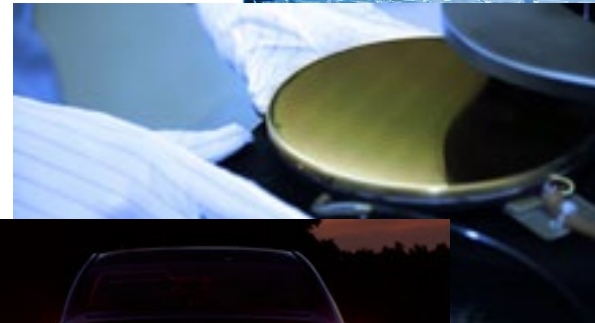
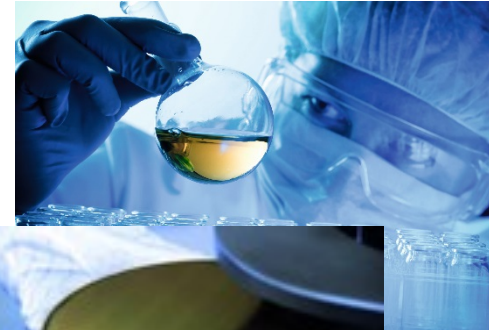
- Stable pressure source: Controller can be used as a stable pressure source to drive the pressure in to a DUT. Calibration is then performed by comparing the DUT readout with the Controller readout. The valve technology inside automatically drives and maintains the desired pressure
- Measuring DUT pressure: Controller can be used as a precision indicator to accurately measure the pressure in a DUT. Calibration is then performed by pressurizing the DUT with another pressure reference and then comparing the DUT readout with the controller readout



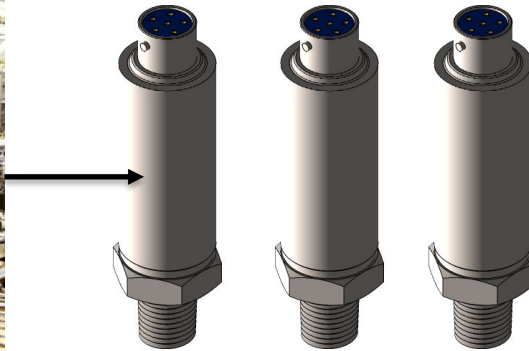
Typical connections to a pressure controller

Standard Production Environments

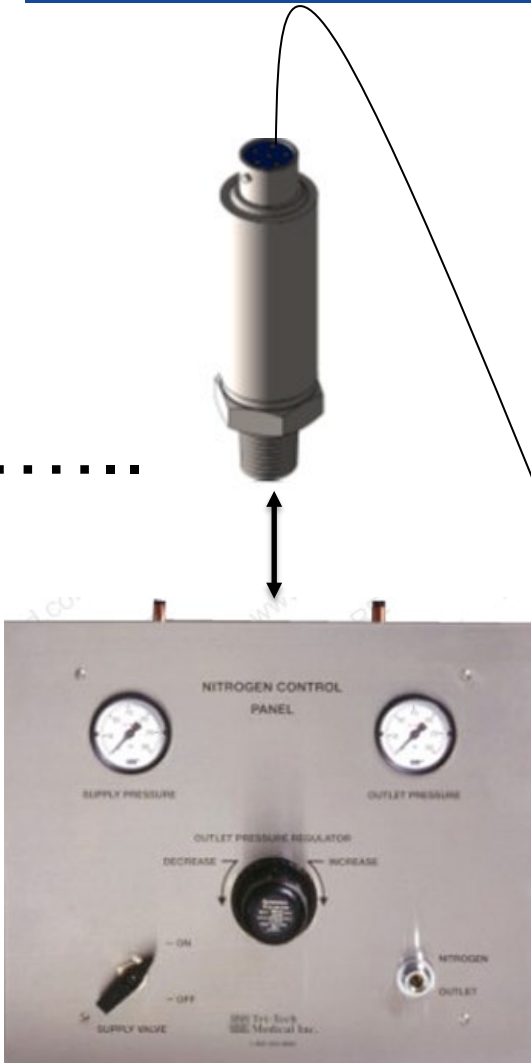
- End of Line production testing of pressure sensors
- Temperature characterization pressure transducers
- Automotive sensor calibration



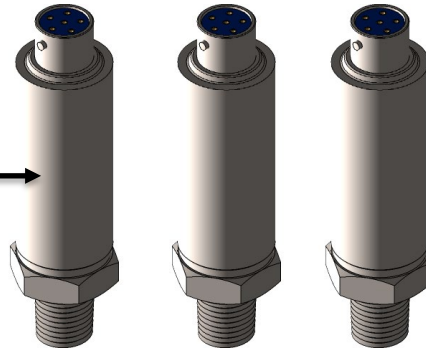
Traditional EOL Sensor Testing



- Manual adjustments required
- Hysteresis in regulators is common
- Time consumption for 3-5 test points



Automation of Process



.....



- Stable and reliable output
- Software driven with PC
- Fully automated
- Increased throughput
- Save \$\$\$



Temperature Characterization



Oven Chamber

+



Pressure Panel

=

Standard method of characterizing
transducers in a production environment

- Numerous pressure lines
- Manual pressure regulation
- Full-time employee interaction

Automation of Process

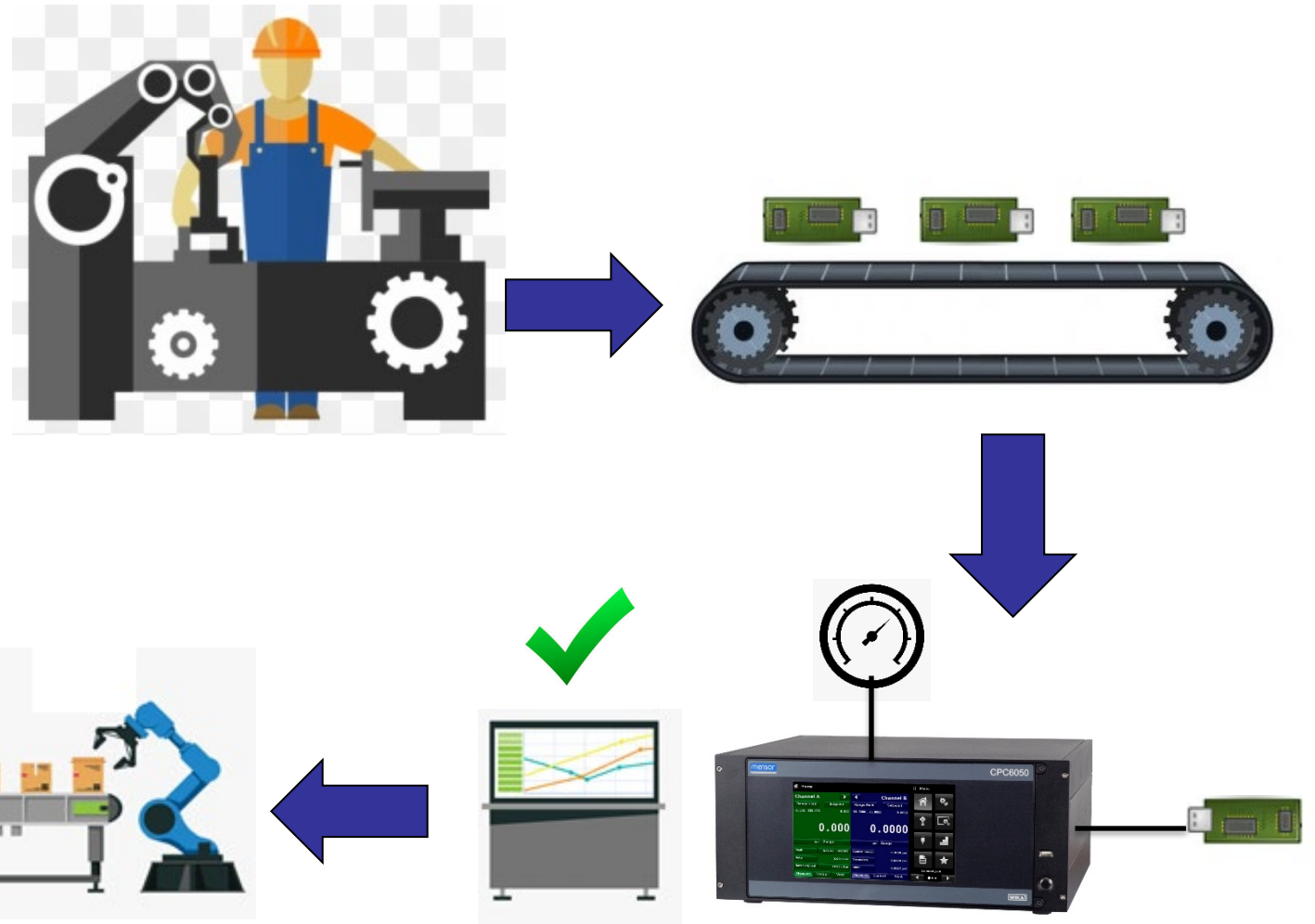


Rack with automated controllers installed

- Introduce automated controllers to the process
- Each controller has dynamic ranges for multiple DUT device types on a single pressure line
- All-in-one system possible with multiple controllers, pressure boost and vacuum pump
- Fully automated process!!

Calibration of Automotive Sensors

- Automotive transducers typically have a low accuracy criteria compared to precision pressure controllers
- This allows for both testing and calibration procedures to be completed in a production environment
- After a verification/exercise cycle is performed, a fast 3-5 point calibration can also be accomplished!



Critical Leak Testing Processes

- Final checks of sealing components
- Food processing industry
- Pharmaceuticals and medical industry
- Space travel

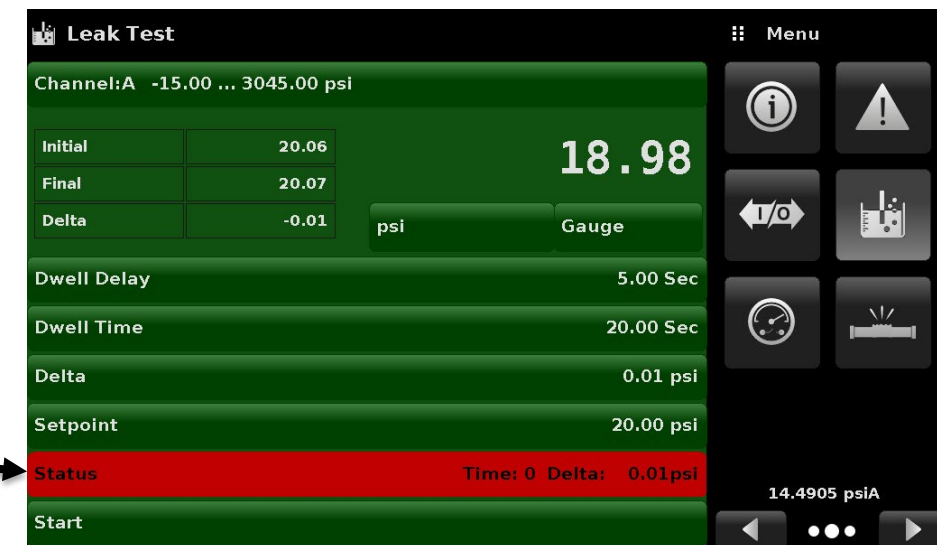
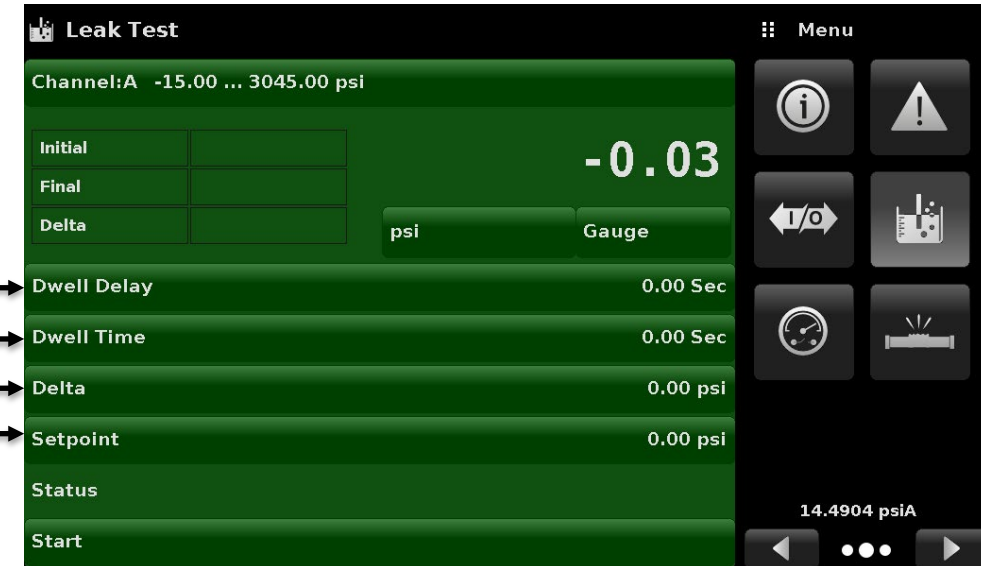


Automated Leak Testing

- Each of these industries have different criteria to meet for each product they are manufacturing!
- With automated processes, this procedure can be integrated directly into the production or verification line without the need of additional manual testing.
- Leak tests programs are built into automated pressure controller software to allow user defined criteria to determine a pass or failed test.

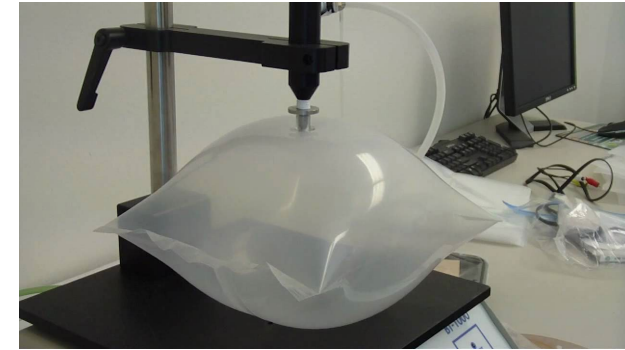
User defined leak rates

Local and remote notifications of Pass/Fail



Pressure Safety Testing

- Burst testing for sensitive equipment packaging
- Relief valve testing for cracking and reseating point
- Rupture or burst disc testing
- Pipeline testing in Oil/Gas

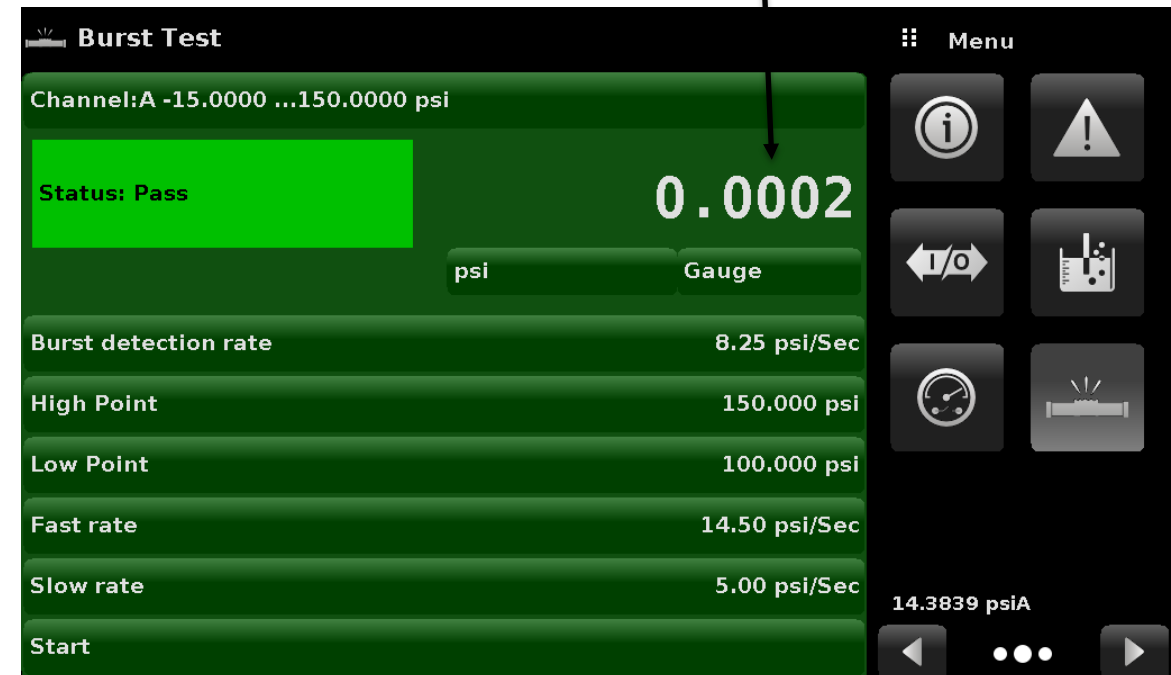


Burst Testing

- All of these safety applications require rigorous testing procedures
- Reliability is a key component of final product validation
- Sensitive devices require precise pressure measurements
- Combining burst testing inside a device with very accurate transducer readings can yield optimal results!!

Define criteria
for each
application!!

Accurate transducer reading



Conclusion

These are just a few examples of how automated pressure controllers can make significant contributions toward cost saving and process improvements!

- Automation
- Accuracy
- Reliability
- Flexibility
- Savings \$\$\$

Automated Pressure Controllers
0.36 psi up to 23,000 psi!



Standalone Transducers
0.36 psi up to 15,000 psi



Fundamentals of Pressure Sensors

How sensor accuracy can effect the quality of a pressure indication.

PRESSURE SENSOR

- A pressure sensor is a device that receives a pressure input and produces an electronic output that is proportional to the pressure applied to the sensor. These devices are also identified by other names such as Pressure Transducer or Pressure Indicating Transmitter.
- Absolute pressure sensors provide a pressure indication that is relative to a perfect vacuum. This instrument would typically show something equivalent to 1013.25 hPa, 1 Bar, or 29.92" Hg at sea level.
- Gauge pressure sensors provide a pressure indication that is relative to barometric pressure. This instrument would typically show 0 PSI when measuring barometric pressure.
- Bi-Directional pressure sensors provide a pressure indication that is an absolute difference from the gauge reference. This device can produce a pressure indication that is higher or lower than the gauge reference. So, it is referred to as "Bi-Directional".



ACCURACY

- The word Accuracy gets thrown around quite a bit. There are many definitions for Accuracy but the main point to remember is that Accuracy is how close a measurement is to the true value.
- At Mensor, we define Accuracy as the total uncertainty of an instrument. The total uncertainty is then broken down into linearity, hysteresis, repeatability, temperature errors and the uncertainty of the calibration standard used to calibrate the instrument. These values are important because they are all quantifiable and allow for Mensor to maintain uniformity and traceability of the instrument calibrations. This value is typically shown as a percent of full scale value or percent of reading. An example would be a 100 PSI transducer with .01% full scale accuracy.
- $100 \text{ PSI} \times .01\% \text{ FS} = .01 \text{ PSI}$ of total uncertainty
- This means that with a pressure of 10 PSI and an accuracy of .01% FS, the instrument is rated for producing an output that is between 9.99 to 10.01 PSI.



TEMPERATURE COMPENSATION

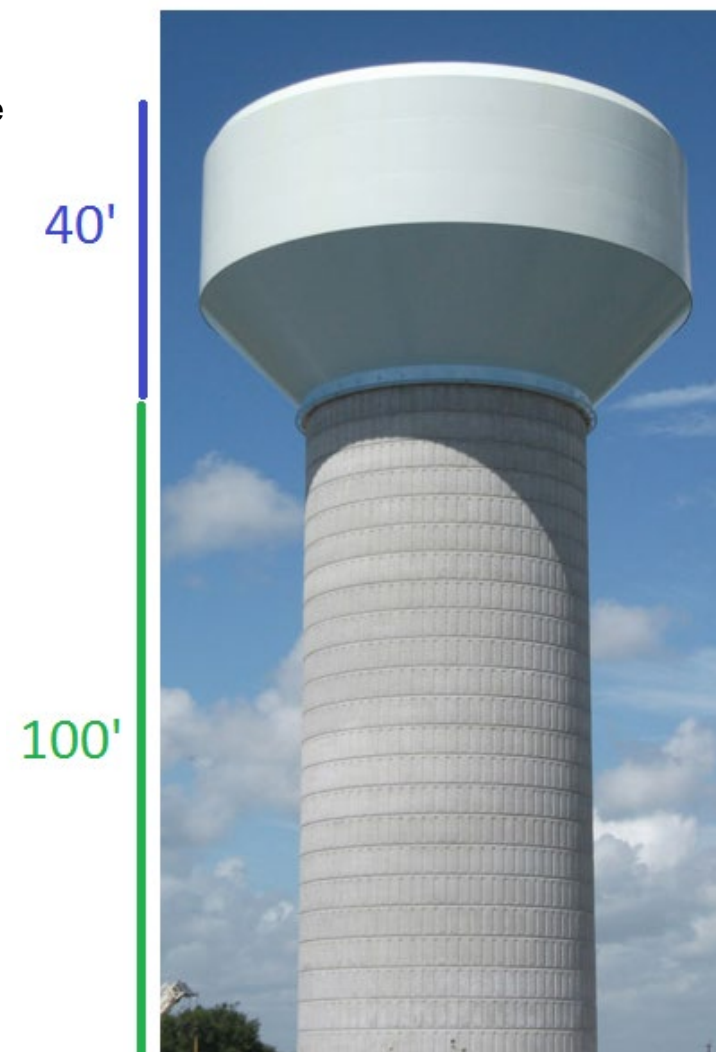
- An important variable to consider when selecting a pressure sensor is the effects of operating temperature.
- Silicon based, piezoresistive pressure sensors are sensitive to heat. This can cause the resistance of the bridge circuit to change. This typically results in the accuracy of a pressure sensor to drift when exposed to a different temperature than what it was calibrated at.
- At Mensor, we have developed our own proprietary technology that allows for us to compensate for the effect that operating temperature has on our sensors. We identify this by the specification for “Compensated Temperature Range”. Most of our instruments offer a compensated range from 0° to 50° C but we can offer a wider range if a customer desires.



Permissible ambient conditions	
Compensated temperature range	0 to 50 °C (32 to 122 °F)
Operating temperature range	-40 to 85 °C (-40 to 185 °F)
Storage temperature range	-40 to 85 °C (-40 to 185 °F)
Humidity	0 ... 95% r.h. (non -condensing)
Operating altitude	<3000 meters (10,000 feet)
Measure port internal volume	<1 cc
Reference port internal volume	~ 40 cc

EXAMPLE APPLICATION

- In the example of an elevated storage tank, a pressure indicating transmitter is used to measure how much water is available in the storage tank. A pressure indicating transmitter is used to measure water pressure at the bottom of the storage tank, thus allowing a user to deduce the height of the water column above the instrument and the volume of water in the tank.
- With a 100' Tank Elevation and a 40' Tall Tank, the total height would be 140'. A full storage tank like this could produce a pressure reading like:
 - $140' \times .4335 \text{ PSI/Ft of head pressure} = 60.69 \text{ PSI}$
 - An empty tank would look like:
 - $100' \times .4335 \text{ PSI/Ft of head pressure} = 43.35 \text{ PSI}$
- With an instrument that has .5% FS accuracy at a 70 PSI range, the rated error of the instrument is then $\pm .35 \text{ PSI}$ over the entire range of the instrument. With a 40' diameter water tank, that equates to...
 - $.35 / .4335 = .8074 \text{ Feet of error height in the water column measurement}$
 - $.8074 \times 1256.6371 \text{ (area of 40' diameter tank)} = \pm 1014.6088 \text{ Ft}^3 \text{ of Water or } \pm 7589.8009 \text{ gallons in the error volume.}$



EXAMPLE APPLICATION CONTINUED

- Take the same example but include an instrument that has a greater level of accuracy.
- With an instrument that has .008% FS accuracy at a 70 PSI range, the rated error of the instrument is then $\pm .0056$ PSI over the entire range of the instrument. With a 40' diameter water tank, that equates to...
- $.0056 / .4335 = .0129$ Feet of error height in the water column measurement
- $.0129 \times 1256.6371$ (area of 40' diameter tank) = ± 16.2106 Ft³ of Water or ± 121.2637 gallons in the error volume.
- The negative effects of not being able to account for an error volume in this application can possibly lead to over filling the storage tank or not turning on lift pumps at the correct time. However, consider the implications of an error volume containing something much more valuable than water. Often time, bulk fuels or refined products are stored in a similar manner but they are more valuable than water. So the cost associated with the error volume goes up.



Questions?



Calibration Technology



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Ability to Meet Any Challenge

The WIKA group of companies is a worldwide leader in pressure and temperature measurement. As a family-run business acting globally, WIKA employs over 7,900 highly qualified employees. The company also sets the standard in the measurement of level and flow, and in calibration technology. Founded in 1946, WIKA is today a strong and reliable partner for all the requirements of industrial measurement technology, thanks to a broad portfolio of high-precision instruments and comprehensive services.

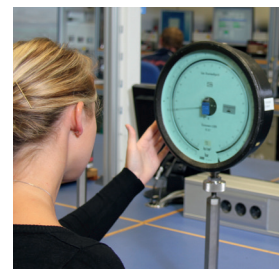
WIKA ensures flexibility and the highest delivery performance with manufacturing locations around the globe. Every year, over 50 million quality products, both standard and customer-specific solutions, are delivered in batches of 1 to over 10,000 units. With numerous wholly-owned subsidiaries and partners, WIKA supports its customers worldwide competently and reliably. We have experienced engineers and sales experts in your area.



Efficient logistics



**Fully automatic
production**



**Certified calibration
laboratories**

WIKA Product Lines

The WIKA program covers the following product lines for various fields of application.

Electronic Pressure Measurement

WIKA offers a complete range of electronic pressure measuring instruments: pressure sensors, pressure switches, pressure transmitters and process transmitters for the measurement of gauge, absolute and differential pressure. These instruments come supplied with standardized current or voltage output signals (also intrinsically safe per ATEX or with flameproof enclosure), interfaces and protocols for various field uses. WIKA is the leading manufacturer worldwide that develops and produces the full range of today's leading sensor technologies, whether ceramic thick film, metal thin film or piezo-resistive.

Mechatronic Pressure Measurement

With the almost unlimited options for different combinations of mechanical and electrical connections, we have an extraordinary range of instrument variants. Various digital and analog output signals are also available for these measuring instruments.

For our measuring instruments, we use the latest sensors, tested in automotive applications millions of times over. They work without any kind of mechanical contact, consequently they are wear-resistant, and there's absolutely no influence on the mechanics.

Mechanical Pressure Measurement

Indicating pressure gauges for gauge, absolute and differential pressure with Bourdon tube, diaphragm or capsule pressure elements have been tested millions of times over. These instruments cover scale ranges from 0 ... 0.5 mbar to 0 ... 7,000 bar and 0007 psi to 0 ... 100,000 psi, with indication accuracies of up to 0.1 %.

Diaphragm Seals

WIKA diaphragm seals, mounted with pressure gauges, pressure transducers, pressure transmitters, etc., are recognized and valued internationally for even the most difficult of measuring tasks. Therefore, the measuring instruments can be used at extreme temperatures (-130 ... +400 °C and -200 ... +750 °F), and with aggressive, corrosive, heterogeneous, abrasive, highly viscous or toxic media. The optimal diaphragm seal designs, materials and filling media are available for each application.

Electrical Temperature Measurement

Our range of products includes thermocouples, resistance thermometers (also with local display), temperature switches as well as analog and digital temperature transmitters for all industrial applications, covering measuring ranges from -200 ... +1,600 °C and -300 ... +2,900 °F.

Mechatronic Temperature Measurement

We can offer a wide variety of combined instruments because our mechanical temperature measuring instruments have integrated switch contacts and output signals. With switch contacts, the pointer position triggers a change-over. Electrical output signals are realized via an additional, independent sensor circuit (resistance thermometer or thermocouple).

Mechanical Temperature Measurement

The mechanical temperature measuring instruments work on the bimetal, expansion or gas actuation principle and cover scale ranges from -200 ... +700 °C and -300 ... +1,300 °F. All thermometers are suited for operation in a thermowell if necessary.

Level Measurement

WIKA has a comprehensive range of level measuring instruments available for temperatures up to 450 °C and 842 °F, specific gravity from 400 kg/m³ and pressure ranges up to 420 bar and 6,000 psi. This includes standard instruments and customized products.

Calibration Technology

WIKA offers a broad product range of calibration instruments for the physical units of measurement for pressure and temperature and electrical measurands. To ensure unmatched performance from many of our calibration instruments, WIKA owns numerous patents. The range of services covers the calibration of pressure and temperature measuring instruments in our accredited ISO/IEC 17025 calibration laboratories and a mobile service to calibrate your instruments on site.

From Individual Components...

WIKA is the ideal partner for solutions in calibration technology. Whether you require only a single instrument quickly or you need a fully-automated calibration system designed for the laboratory or production, we are able to offer an appropriate solution for each application.

The following product matrix will assist you in finding the appropriate instrument for test and measurement parameters.



Portable Pressure Generation

Test pumps serve as pressure generators for testing mechanical and electronic pressure measuring instruments through comparative measurements. These pressure tests can take place in the laboratory or workshop, or on site at the measuring point.



Measuring Components

High-precision pressure sensors and very stable standard thermometers are ideal as references in industrial laboratories. Due to their analog or digital interfaces they can be connected to existing evaluation instruments.



Hand-helds, Calibrators

Our hand-held measuring instruments (process tools) offer simple capability for measurement or simulation of all established measurement parameters on site. They can be operated with a wide variety of pressure sensors or thermometers.

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Pressure

Temperature

Current, voltage, resistance

...to a Fully Automated System

In the past few years, WIKA has successfully integrated three renowned manufacturers of calibration equipment into the Group.

Mensor is known in the market for its outstanding portfolio of pressure controllers and solidifies WIKA's position as the worldwide market leader in calibration.

DH-Budenberg's product range includes high-end pressure primary standards and transfer standards of the Desgranges & Huot brand, as well as laboratory and industrial standards of the Budenberg brand.

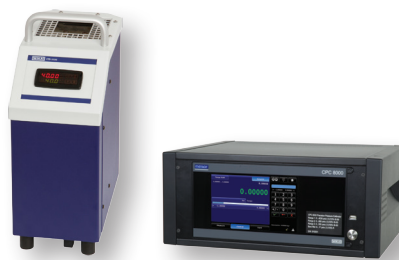
ASL resistance bridges with highly stable thermometers are used specifically in temperature laboratories.



Digital Indicating Precision Measuring Instruments

High-accuracy digital precision measuring instruments are ideal for applications as reference standards in industrial laboratories, enabling high-accuracy calibration. They feature exceptionally simple handling and an extensive range of functionality.

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Digital Precision Instruments and Controllers

These instruments offer exceptional convenience, due to their integrated controller. Typically, a fully automated setting of the required value can be set via the interface.

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Fully Automatic Calibration Systems as Integrated Solutions

Fully automated calibration systems are customer-specific, turnkey installations which can be fitted in laboratories as well as in the production environment. With integrated reference instruments and calibration software, calibration certificates can be generated and archived in a simple and reproducible way.

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Pressure
Temperature
Current, voltage, resistance

Portable Pressure Generation

Simple Manual Pressure Generation

Test pumps serve as pressure generators for the testing, adjustment and calibration of mechanical and electronic pressure measuring instruments through comparative measurements.

These pressure tests can take place in the laboratory or workshop, or on site at the measuring point.

CPP7-H

Pneumatic hand test pump



Measuring range: ■ -12 ... +100 psi
■ -800 mbar ... +7 bar
■ -80 kPa ... +.7 kPa

Medium: Ambient air

Special feature: ■ Pressure and vacuum generation switchable
■ Low weight
■ Compact dimensions

CPP30

Pneumatic hand test pump



Measuring range: ■ -13 psi ... +500 psi
■ -950 mbar ... +35 bar
■ -95 kPa ... +3.5 kPa

Medium: Ambient air

Special feature: ■ Pressure and vacuum generation switchable
■ Compact dimensions

CPP120-X

Pneumatic comparison test pump



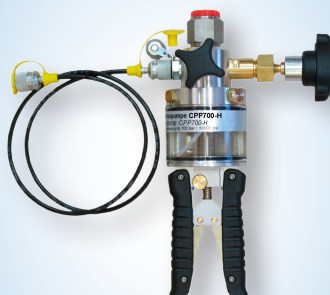
Measuring range: ■ 0 ... 1,700 psi
■ 0 ... 120 bar

Medium: Clean, dry, non-corrosive gases

Special feature: ■ Accurate pressure setting
■ Robust industrial series

CPP700-H, CPP1000-H

Hydraulic hand test pump



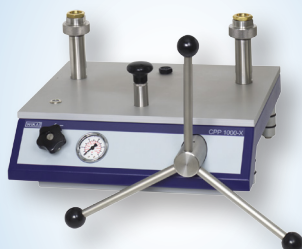
Measuring range: ■ 0 ... 10,000 or 0 ... 14,500 psi
■ 0 ... 700 or 0 ... 1,000 bar
■ 0 ... 70 or 0 ... 100 MPa

Medium: Oil or water

Special feature: ■ Integrated medium reservoir
■ Ergonomic handling

CPPxx00-X

Hydraulic comparison test pump



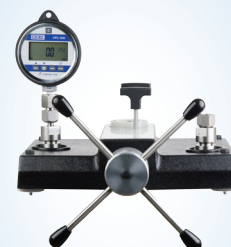
Measuring range: ■ 0 ... 14,500 to 0 ... 100,000 psi
■ 0 ... 1,000 to 0 ... 7,000 bar
■ 0 ... 100,000 to 0 ... 700 MPa

Medium: Oil or water

Special feature: ■ Integrated reservoir and priming pump
■ Robust laboratory version

CPP1200-X

Hydraulic comparison test pump



Measuring range: ■ 0 ... 17,500 psi
■ 0 ... 1,200 bar
■ 0 ... 120 MPa

Medium: Hydraulic (oil)

Special feature: ■ Robust instrument base with integrated high-pressure generation

Hand-helds, Calibrators

Portable calibration instruments for mobility in the accurate measurement and recording of pressure profiles

For these portable hand-held measuring instruments, exchangeable pressure sensors are available with measuring ranges up to 11,600 psi, 8,000 bar, or 800,000 kPa.

They are particularly suitable as test instruments for process technology, machine building, etc. Data recorded in the instrument can be evaluated via PC software.

CPT2500

USB pressure transmitter



- Measuring range:
- 0 ... 0.4 to 0 ... 14,500 psi
 - 0 ... 0.025 to 0 ... 1,000 bar
 - 0 ... 2.5 to 0 ... 100 MPa
- Accuracy: 0.2 %, 0.1 % (optional)
- Special feature:
- Recording interval adjustable from 1 ms ... 10 s
 - No external voltage supply required
 - Data storage and evaluation directly via PC

CPH6200

Hand-held pressure indicator



- Measuring range:
- 0 ... 0.4 to 0 ... 14,500 psi
 - 0 ... 0.025 to 0 ... 1,000 bar
 - 0 ... 2.5 to 0 ... 100 MPa
- Accuracy: 0.2 %, 0.1 % (optional)
- Special feature:
- Integrated data logger
 - Differential pressure measurement (optional)

CPH6300

Hand-held pressure indicator



- Measuring range:
- 0 ... 0.4 to 0 ... 14,500 psi
 - 0 ... 0.025 to 0 ... 1,000 bar
 - 0 ... 2.5 to 0 ... 100 MPa
- Accuracy: 0.2 %, 0.1 % (optional)
- Special feature:
- Robust and waterproof case with IP 65, IP 67
 - Integrated data logger
 - Differential pressure measurement (optional)

CPH6400

Precision hand-held pressure indicator



- Measuring range:
- 0 ... 3.5 to 0 ... 90,000 psi
 - 0 ... 0.25 to 0 ... 6,000 bar
 - 0 ... 25 to 0 ... 600 MPa
- Accuracy: 0.025 %
- Special feature:
- Integrated data logger
 - Temperature measurement (optional)

Complete test and service cases

These cases can be assembled exactly to your requirements, allowing you to be fully equipped on site!



Hand-helds, Calibrators

Calibrations can be documented directly in the calibrator and later read on a PC. As another option, a calibration certificate can be generated through software.

CPH6000

Process calibrator



Measuring range:

- 0 ... 4 to 0 ... 116,000 psi
- 0 ... 0.25 to 0 ... 8,000 bar
- 0 ... 0.03 to 0 ... 800 MPa

Accuracy: 0.025 %

Special feature:

- Function of calibration
- Pressure switch test

CPH7000

Portable process calibrator



Measuring range:

- - 15 ... 360 psi
- -1 ... 25 bar

Accuracy: 0.025 %

Special feature:

- Integrated pressure generation
- Measurement of pressure, temperature, current, voltage, ambient conditions
- Supply of pressure, current and voltage
- Calibration function, data logger and switch test

Pascal 100

Hand-held multi-function calibrator



Measuring range:

- 0 ... 14,500 psi
- 0 ... 1,000 bar
- 0 ... 100 MPa

Accuracy: 0.025 %

Medium: Clean, dry, non-corrosive gases

Special feature:

- Integrated pressure generation
- Large display with touchscreen
- Measurement and simulation of pressure, temperature, current, voltage, resistance, frequency

CPG2300

Hand-held pressure loop calibrator

mentor



Measuring range:

- 0 ... 6,000 psi
- 0 ... 400 bar
- 0 ... 40 MPa

Accuracy: 0.015 %

Medium: Clean, dry, non-corrosive gases

Special feature:

- Dual transducers
- Optional mA loop measurement
- Optional barometric range

Precision Pressure Measuring Instruments

Electrical measuring systems that convert pressure into an electrical signal and optionally visualize it

Due to the low ISO/IEC 17025 measurement uncertainty of down to 0.008 %, these instruments find their primary application as a factory/working standard for testing and/or calibrating a variety of pressure measuring instruments.

CPG500

Digital pressure gauges



Measuring range: ■ -15 ... +230 to 0 ... 14,500 psi
■ -1 ... +16 to 0 ... 1,000 bar
■ -100 ... +1600 to 0 ... +100 MPa

Accuracy: 0.25 %

Special feature: ■ Simple operation using 4 buttons
■ Robust case with protective rubber cap, IP 67

CPG1500

Precision digital pressure gauge



App "myWika device"
on Google Play Store
and Apple App Store



Measuring range: ■ -15 ... 0 to 0 ... 150,000 psi
■ -1 ... 0 to 0 ... 10,000 bar
■ -100 ... 0 kPa to 0 ... 1,000 MPa

Accuracy: 0.1%, 0.05 % (optional)

Special feature: ■ Integrated data logger
■ Wika-CAL compatible
■ Data transfer via Wika-Wireless
■ Robust case IP65

CPT6010

Digital pressure transducers



Measuring range: ■ 0 ... 5 to 0 ... 6,000 psi
■ 0 ... 0.35 to 0 ... 400 bar
■ 0 ... 35 kPa to 0 ... 40 MPa

Accuracy: 0.02 %

Special feature: ■ RS-232 / RS-485
■ Robust stainless steel housing

CPT61X0

Precision pressure sensor



Measuring range: ■ 0 ... 0.36 to 0 ... 6,000 psi
■ 0 ... 0.025 to 0 ... 400 bar
■ 0 ... 2.5 kPa to 0 ... 40 MPa

Accuracy: 0.01 %

Special feature: ■ RS-232 or RS-485 connection
■ Analog output (optional)

CPG2400

Pressure indicator, single channel



Measuring range: ■ 0 ... 0.36 to 0 ... 6,000 psi
■ 0 ... 0.025 to 0 ... 400 bar
■ 0 ... 2.5 kPa to 41 MPa

Accuracy: 0.03 %

Medium: Non-corrosive gases, > 1 bar liquids
Special feature: ■ Barometer

CPG2500

Precision pressure indicator, 1 or 2 channel version



Measuring range: ■ 0 ... 0.36 to 0 ... 42,000 psi
■ 0 ... 0.025 to 0 ... 2,900 bar
■ 0 ... 2.5 kPa to 290 MPa

Accuracy: 0.01 % ... 0.008%

Medium: Non-corrosive gases, > 1 bar liquids
Special feature: ■ Up to 2 transducers
■ Barometric reference (optional)
■ External transducers

Pressure Controllers

Electronic controllers that quickly and automatically provide a precision pressure output

Due to the high accuracy and control stability, these types of instruments are especially suitable as references for production lines and laboratories to carry out automatic testing and/or calibration of all types of sensors.

CPC2000

Low-pressure version

menzor



Measuring range: ■ 0 ... 0.015 to 0 ... 15 psi
■ 0 ... 1 to 0 ... 1,000 mbar
■ 0 ... 0.1 to 0 ... 10 kPa

Accuracy: 0.1/0.3 % (for 0 ... 1 mbar)

Medium: Ambient air

Special feature: ■ Integrated pressure generation
■ Integrated battery

CPC4000

Industrial version

menzor



Measuring range: ■ 0 ... 5 to 0 ... 3,045 psi
■ 0 ... 0.35 to 0 ... 210 bar
■ 0 ... 35 kPa to 0 ... 21 MPa

Accuracy: 0.02 %

Medium: Dry clean air or nitrogen

Special feature: ■ Low cost
■ Automatic contamination prevention system
■ Two transducers

CPC6050

Standard version

menzor



Measuring range: ■ 0 ... 0.36 to 0 ... 3,045 psi
■ 0 ... 0.025 to 0 ... 210 bar
■ 0 ... 2.5 kPa to 0 ... 21 MPa

Accuracy: 0.01 %

Medium: Dry clean air or nitrogen

Special feature: ■ Up to 2 control/measuring channels with 2 transducers each
■ Transducers exchangeable

CPC7000

Pneumatic high-pressure controller

menzor



Measuring range: 0 ... 1,500 psi to 0 ... 10,000 psi
0 ... 100 bar to 0 ... 700 bar
0 ... 10 MPa to 0 ... 70 MPa

Accuracy: 0.01 %

Medium: Nitrogen

Special feature: ■ Robust and low-wear valve technology with long-term stability
■ Up to three interchangeable transducers

CPC8000

Precision version

menzor



Measuring range: ■ 0 ... 5 to 0 ... 6,000 psi
■ 0 ... 0.35 to 0 ... 400 bar
■ 0 ... 35 kPa to 0 ... 40 MPa

Accuracy: 0.01 ... 0.008 %

Medium: Dry clean air or nitrogen

Special feature: ■ Excellent control stability and overshoot-free control
■ Up to three interchangeable reference transducers

CPC8000-H

High-pressure version

menzor



Measuring range: 75 ... 10,000 to 300 ... 23,000 psi
5 ... 700 to 20 ... 1,600 bar
0.5 ... 70 MPa to 0.2 ... 160 MPa

Accuracy: 0.01 %

Medium: Hydraulic oil or water

Special feature: ■ High stability, also for large volumes
■ Up to two interchangeable reference transducers

Air Data Instruments

Air Data instruments provide measurement and control of pressure that is equivalent to altitude and airspeed.

An air data test set is an electronic controller which, based on a supply pressure, automatically provides a pressure at a variable and adjustable rate. Air data test sets are specifically developed to convert the pressure to be controlled into an altitude or rate of climb and airspeed.

An air data test set is particularly suitable as a reference for aircraft workshops, instrument manufacturers and calibration laboratories in the aviation industry, to make calibrations on sensors and displays because of the high accuracy, control stability and ability to simulate altitude and airspeed.

Air data indicators measure altitude and airspeed and provide rate of change indication for both.

CPA8001

Air Data Test Set

menzor



Measuring range:	<ul style="list-style-type: none"> ■ Up to 50 psi abs. ■ Up to 3.4 bar abs. ■ Up to 340 kPa abs.
Accuracy:	0.009 % ... 0.01 %
Medium:	Dry, clean air or nitrogen
Special feature:	<ul style="list-style-type: none"> ■ Excellent control stability, even with rate control ■ Overshoot-free control

CPA2501

Precision air data test indicator



Measuring range:	<ul style="list-style-type: none"> ■ Altitudes up to 100,000 ft ■ Speeds up to 1,150 knots
Accuracy:	Down to 0.01 % FS
Special feature:	<ul style="list-style-type: none"> ■ RVSM compliant ■ Ps, Qc, Ps/Pt or Ps/Qc configuration

Pressure Balances, Industrial Series

Compact and powerful primary standards with excellent operating characteristics, based on the physical principle of Pressure = Force/Area

The direct measurement of pressure ($p = F/A$), as well as the use of high-quality materials enable low measurement uncertainty, in conjunction with an excellent long-term stability.

The measurement uncertainty can be ensured with the selection of a dual-range piston-cylinder system with automatic measuring range switching, even with a single measuring system, over a large pressure range.

CPB3500

Pneumatic compact version



Measuring range: ■ 0 ... 1,700 psi
■ 0.015 ... -1 to 1 ... 120 bar

Accuracy: 0.015 ... 0.006 %

Medium: Non-corrosive gases

Special feature: ■ Compact dimensions and low weight
■ 1 bar piston can be used for positive and negative overpressure.

CPB3800

Compact version



Measuring range: ■ 15 ... 1,700 to 150 ... 17,000 psi
■ 1 ... 120 to 10 ... 1,200 bar
■ 100 kPa ... 12 MPa to 100 kPa ... 120 MPa

Accuracy: 0.05 ... 0.025 %

Medium: Hydraulic (oil)

Special feature: ■ Compact dimensions and low weight
■ Instrument base can now also be combined with the CPB5800 piston-cylinder systems

CPB5000

Pneumatic version



Measuring range: ■ -0.4 ... -15 to 6 ... 1,500 psi
■ -0.03 ... -1 to 0.4 ... 100 bar
■ -3 ... -100 to 40 ... 10 MPa

Accuracy: 0.015 ... 0.008 %

Medium: Non-corrosive gases

Special feature: Patented system for fast piston-cylinder exchange

CPB5800

Hydraulic version with dual-range piston-cylinder systems



Measuring range: ■ 15 ... 1,700 to 15 ... 20,000 psi
■ 1 ... 120 to 1 ... 1,400 bar
■ 100 kPa ... 12 MPa to 100 kPa ... 14 MPa

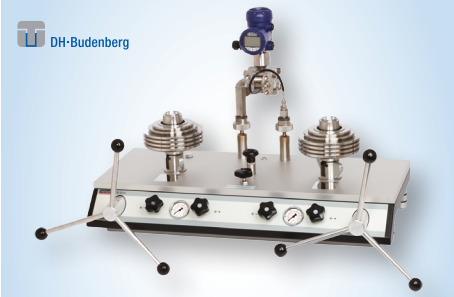
Accuracy: 0.015 ... 0.006 %

Medium: Operating fluid or others on request

Special feature: ■ Dual-range piston-cylinder systems with fully automated changing between ranges
■ Instrument base can now also be combined with the CPS5000 piston-cylinder systems

CPB5600DP

Differential pressure version



Measuring range: ■ .5 ... 30 to 360 ... 23,000 psi
■ 0.03 ... 2 to 25 ... 1,600 bar
■ 3 ... 200 kPa to 2.5 ... 160 MPa

Accuracy: 0.015 ... 0.008 %

Medium: Non-corrosive gases or special oil

Special feature: Two complete pressure balances within one case for real differential pressure measurements under static pressure

CPB5000HP

High-pressure version



Measuring range: ■ 25 ... 2,500 to 25 ... 5,000 bar
■ 360 ... 36,000 to 360 ... 72,000 psi
■ 2.5 ... 250 to 2.5 ... 500 MPa

Accuracy: 0.025 ... 0.02 %

Medium: Hydraulic (oil)

Special feature: Robust instrument base with integrated high-pressure generation

Pressure Balances, High-End Version

High-accuracy and powerful primary standards with excellent operating characteristics, based on the physical principle of Pressure = Force/Area

The direct measurement of pressure ($p = F/A$), as well as the use of high-quality materials enable low measurement uncertainty, in conjunction with excellent long-term stability. Furthermore, an automatic mass handling system and pressure generation ensures fully-automated calibration. Therefore, the pressure balance has been used for years in factory

and calibration laboratories in industry, national institutes and research laboratories, and also in production by sensor and transmitter manufacturers.

CPB6000

Highest-accuracy primary standard

DH Desgranges & Hux



Measuring range: ■ 60 ... 72,000 psi
■ 4 ... 5,000 bar
■ 400 kPa ... 500 MPa

Accuracy: 0.0035 ... 0.0015 %

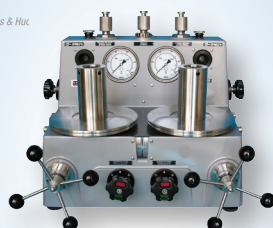
Medium: Dry, clean air, nitrogen or hydraulic (oil)

Special feature: Different instrument variants for the highest demands

CPB6000DP

Primary standard for differential pressure

DH Desgranges & Hux



Measuring range: ■ 400 ... 12,000 psi
■ 30 ... 800 bar
■ 3 MPa ... 80 MPa

Accuracy: 0.005 ... 0.002 %

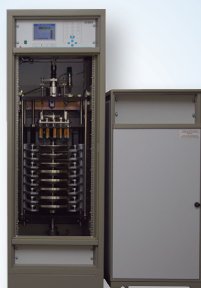
Medium: Non-corrosive gases

Special feature: For differential pressure measurements from 10 Pa to 800 bar

CPB8000

Automatic primary standard

DH Desgranges & Hux



Measuring range: ■ 7200 ... 72,000 psi
■ 500 ... 5,000 bar
■ 50 MPa ... 500 MPa
■ Others on request

Accuracy: 0.005 ... 0.003 %

Medium: ■ Sebacate oil
■ Others on request

Special feature: Automated calibration of the highest-accuracy pressure sensors, integrated pressure generation

CPD8000

Digital pressure balance

DH Desgranges & Hux



Measuring range: ■ 15 ... 7,200 psi
■ 1 ... 500 bar (abs. and rel.)
■ 100 kPa ... 50 MPa

Accuracy: 0.005 ... 0.002 %

Medium: Non-corrosive, dry gases

Special feature: unique operating principle, ideal for automatic calibrations, no mass handling needed

Accessories for Pressure Balances

CPU6000 series

Calibrator unit



- Determination of the required mass loads or the reference pressure for calibration with pressure balances
- Recording of certificate-relevant data
- Calibration of relative pressure measuring instruments with absolute pressure references and vice versa
- Easy calibration of pressure transmitters through the voltage supply and multimeter function

WIKI-CAL

Calibration software



- Creation of calibration certificates for mechanical and electronic pressure measuring instruments
- Fully automatic calibration with pressure controllers
- For the recording of certificate-relevant data in combination with the CalibratorUnits of the CPU6000 series
- Determination of the required mass loads for pressure balances
- Calibration of relative pressure measuring instruments with absolute pressure references and vice versa

Correction of the Environmental Conditions to Achieve the Best Possible Accuracies

WIKI-CAL calibration software Calibrator Unit CPU6000 iPad app CPB-CAL

Auxiliary device for calibrations of dead weight testers for the highest accuracy

The specified accuracy of pressure balances is valid under reference conditions, i.e. ambient temperature 20 °C, atmospheric pressure 1,013 mbar, relative air humidity 40 % and for a specific installation location with a local gravitational acceleration. For ambient conditions that deviate from these, if required, corrections must be made.

$$p_e = \left[\frac{m \cdot \left(1 - \frac{\rho_l}{\rho_m} \right) \cdot g_l + \sigma \cdot c}{A \cdot \left[1 + (\alpha + \beta) \cdot (t - 20) + \lambda_{p_e} \right]} + (\rho_{F1} - \rho_l) \cdot g_l \cdot \Delta h \right] \cdot 10^{-5}$$



Description

With the demo version of the WIKI-CAL software and a CPB series pressure balance, the mass discs are applied and the corresponding reference pressure can be determined. The pressure balance data can be entered into the database manually or imported automatically via an online XML file. With the CPU6000 series instruments, the accuracy can be further increased. With the CPU6000-W, the ambient conditions can be measured, and with the CPU6000-S, the piston temperature can be measured and these can be taken into account in the calculations. As an additional parameter, the local gravity value can be given for location-independent measurements. If a pressure transmitter is being calibrated, this can automatically be read with the CPU6000-M. Thus the CPU6000-M is used as voltage supply and multimeter. Through the simple and user-friendly operation with the CPB-CAL iPad® app, the mass discs to be applied for a given pressure value can be calculated.

Calibration Software


Easy and fast creation of high-quality calibration certificates

WIKI-CAL calibration software is used for generating calibration certificates or data logging for pressure measuring instruments. Get a free demo version download from the homepage. The template will guide you through the creation process of a document. Calibration certificates can be created with the Cal-Template and data logging can be created with the Log-Template.

In order to switch from the demo version to a full version of the respective template, you must purchase a USB key with the template. The pre-installed demo version automatically changes to the selected full version when the USB key is inserted and will be available as long as the USB key is connected to the computer.

WIKI-CAL

Calibration software



- Creation of calibration certificates for mechanical and electronic pressure measuring instruments
- Fully automatic calibration with pressure controllers
- For the recording of certificate-relevant data in combination with the CalibratorUnits of the CPU6000 series
- Determination of the required mass loads for pressure balances

- Calibration of relative pressure measuring instruments with absolute pressure references and vice versa



Cal Demo

Generation of calibration certificates limited to 2 measuring points, with automatic initiation of pressures via a pressure controller.



Cal Light

Generation of calibration certificates with no limitations on measuring points, without automatic initiation of pressures via a pressure controller.



Cal

Generation of calibration certificates with no limitations on measuring points, with automatic initiation of pressures via a pressure controller.



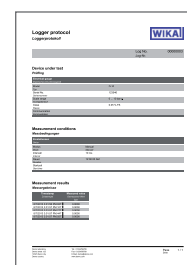
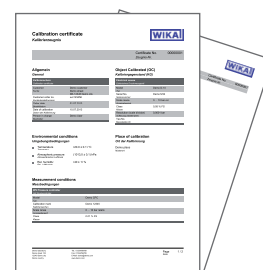
Log Demo

Creation of data logger test reports, limited to 5 measured values.



Log

Creation of data logger test reports without limiting the measured values.





Reference Thermometers

Conventional contact thermometers

Due to the excellent stability and the geometrical conformance, these standard thermometers are ideally suited for applications in industrial laboratories. Simple comparative calibrations can be carried out in baths, in tube furnaces and in dry-well calibrators.

The advantage of these reference thermometers is the wide temperature range, which makes them flexible to operate. Furthermore, we can ensure a long service life due to their low drift.

<div>CTP2000</div> <div>Platinum resistance thermometer</div> <div></div> <div><div>Measuring range:</div><div>■ -200 ... +450 °C ■ -328 ... +842 °F</div><div>Stability:</div><div>< 50 mK after 100 h at 450 °C</div><div>Dimensions:</div><div>Ø 4 mm, l = 500 mm</div><div>Special feature:</div><div>■ 4-wire connection ■ Ends with 4 mm banana plugs</div></div>	<div>CTP5000</div> <div>Reference thermometer</div> <div></div> <div><div>Measuring range:</div><div>■ -196 ... +660 °C ■ -320 ... +1,220 °F</div><div>Sensor type:</div><div>Pt100, Pt25</div><div>Dimensions:</div><div>Depending on version</div><div>Special feature:</div><div>Free cable ends, DIN or SMART connector</div></div>	<div>CTP9000</div> <div>Thermocouple</div> <div></div> <div><div>Measuring range:</div><div>■ 0 ... 1,300 °C ■ 32 ... 2,372 °F</div><div>Thermocouple:</div><div>Type S per IEC 584, class 1</div><div>Dimensions:</div><div>Ø 7 mm, l = 600 mm (incl. handle)</div><div>Special feature:</div><div>■ Cold junction optional ■ 1,500 mm cable ■ Ends with 4 mm banana plugs</div></div>
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Hand-Helds

Portable measuring and calibration instruments for mobile use

Various designs of portable thermometers are available. They are used as test instruments for a wide variety of fields such as sterile process technology, manufacturing, etc.

Depending on the version, functions such as data logging and a serial interface are available, so that immediate on-site measurements can be made and documented, and with this, the data can also be simultaneously acquired.

CTR1000

Infrared hand-held thermometer



Measuring range: ■ -60 ... +1,000 °C
■ -67 ... +1,832 °F

Accuracy: 2 K or 2 % of measured value

Special feature: Thermocouple connection (optional)

CTH6200

Hand-held thermometer



Measuring range: -50 ... +250 °C
-58 ... +482 °F

Accuracy: < 0.2 K (complete measuring chain)

Sensor type: Pt100

Special feature: Integrated data logger

CTH6300

Hand-held thermometer



Measuring range: ■ -200 ... +1,500 °C
■ -328 ... +2,732 °F

Accuracy: 0.1 K ... 1 K

Sensor type: Pt100, TC

Special feature: 2 channels (optional)

CTH6500

Hand-held thermometer



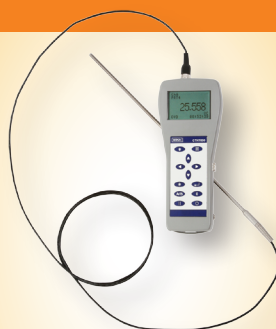
Measuring range: ■ -200 ... +1,500 °C
■ -328 ... +2,732 °F

Accuracy: 0.03 ... 0.2 K

Sensor type: Pt100, TC

CTH7000

Hand-held thermometer



Measuring range: ■ -200 ... +962 °C
■ -328 ... 1,763 °F

Accuracy: 0.015 K

Sensor type: Pt100, Pt25 and NTC

Special feature: Integrated data logger

Portable Temperature Calibrators

Electronic controllers which automatically supply a dry temperature output

Due to the high reliability, accuracy and ease of use, this type of instrument is appropriate as a factory/working standard for the automatic testing and/or calibration of temperature measuring instruments of all types.

The major advance of the large sleeve diameters and the fast stable temperature control is that calibration times can be reduced.

CTI5000

Infrared calibrator



Measuring range: ■ 50 ... 500 °C
■ 122 ... 932 °F
Accuracy: 1 K, usually 0.8 K
Stability: 0.1 ... 0.4 K
Special feature: Large diameter of measuring surface

CTD9100-375

Compact temperature dry-well calibrator



Measuring range: ■ t_{amb} ... 375 °C
■ t_{amb} ... 707 °F
Accuracy: 0.5 ... 0.8 K
Stability: 0.05 K
Immersion depth: 100 mm

CTD9100

Temperature dry-well calibrator



Measuring range: ■ -55 ... +650 °C
■ -67 ... 1,202 °F
Accuracy: 0.15 ... 0.8 K
Stability: 0.01 ... 0.05 K
Immersion depth: 150 mm

CTM9100-150

Multi-function calibrator



Measuring range: ■ -35 ... +165 °C depending on application
■ -31 ... +329 °F depending on application
Accuracy: 0.3 ... 1 K depending on the application
Immersion depth: 150 mm
Special feature: Application as dry-well calibrator, micro calibration bath, infrared calibrator and surface calibrator

CTD9300

Temperature dry-well calibrator



Measuring range: ■ -35 ... +650 °C
■ -31 ... +1,202 °F
Accuracy: 0.1 ... 0.65 K
Stability: 0.01 ... 0.1 K
Immersion depth: 150 mm

CTD9100-1100

High-temperature dry-well calibrator



Measuring range: ■ 200 ... 1,100 °C
■ 392 ... 2,012 °F
Accuracy: 3 K
Stability: 0.3 K
Immersion depth: 220 mm, bore depth 155 m

Calibration Baths

Electronic controllers that automatically and quickly supply a stable temperature within a liquid bath

This type of instrument is particularly suitable as a factory/work-
ing standard for the automatic testing and/or calibration of the
widest range of temperature sensors - independent of diameter.

Its measuring chamber has high reliability, accuracy and ex-
ceptional homogeneity. A special micro calibration bath design
enables on-site applications.

CTB9100

Micro calibration bath



Measuring range:	■ -35 ... +255 °C ■ -31 ... +437 °F
Accuracy:	0.2 ... 0.3 K
Stability:	±0.05 K
Special feature:	■ Short heating and cooling times ■ Easy to use

CTB9400

Calibration bath, medium measuring range



Measuring range:	■ 28 ... 300 °C ■ 82 ... 572 °F
Stability:	0.02 K
Immersion depth:	200 mm
Medium:	Water, oil or similar media

CTB9500

Calibration bath, low measuring range



Measuring range:	■ -45 ... +200 °C ■ -49 ... 392 °F
Stability:	0.02 K
Immersion depth:	200 mm
Medium:	Water, oil or similar media

Resistance Thermometry Bridges

Electronic thermometry bridges that measure with high accuracy

Resistance thermometry bridges measure resistance ratios with high accuracy by using standard resistors, which are indicative of the temperature, among other things. These instruments are not only used in the field of temperature measurement, but also in electrical laboratories because of their high accuracy.

CTR2000

Precision thermometer

ASL



Measuring range: ■ -200 ... +850 °C
■ -328 ... +1,562 °F
Accuracy: 0.01 K (4-wire), 0.03 K (3-wire)
Sensor type: Pt100, Pt25
Special feature: ■ 3-wire measurement (optional)
■ Up to 8 channels integrated in the instrument (optional)

CTR3000

Multi-function precision thermometer



Measuring range: ■ PRT: -200 ... +962 °C (-328 ... +1,764 °F)
■ TC: -210 ... +2,315 °C (-346 ... +4,199 °F)
■ Thermistor: 0 ... 500 kΩ
Accuracy: Up to 0.005 K
Sensor type: PRT, TC and thermistors
Special feature: ■ Expandable to up to 44 channels (optional)
■ Integrated data logger and scanner

CTR5000

Precision thermometer

ASL



Measuring range: ■ -200 ... +962 °C
■ -328 ... +1,764 °F
Accuracy: 0.01 K, optional 0.005 K
Sensor type: Pt100, Pt25
Special feature: ■ Integrated data logger (optional)
■ Up to 64 channels

CTR6000

DC resistance thermometry bridge

ASL



Measuring range: ■ -200 ... +962 °C
■ -328 ... +1,764 °F
Accuracy: ± 3 mK (full range)
Sensor type: PRT, thermistors or fixed resistors
Special feature: ■ Expandable to up to 60 channels (optional)
■ Internal resistors 25 Ω, 100 Ω, 10 kΩ, 100 kΩ

CTR6500

AC resistance thermometry bridge

ASL



Measuring range: ■ -200 ... +962 °C
■ -328 ... 1,764 °F
Accuracy: 0.1 ... 1.25 mK depending on resistance ratio
Sensor type: SPRT, PRT or fixed resistor
Special feature: ■ Expandable to up to 60 channels (optional)
■ Internal resistors 25 Ω, 100 Ω
■ AC technology

CTR9000

Primary-standard resistance thermometry bridge

ASL



Measuring range: 0 ... 260 Ω
Accuracy: 0,1 ppm, 20 ppb optional
Sensor type: SPRT, PRT or fixed resistor
Special feature: ■ Expandable to up to 60 channels (optional)
■ 4 selectable standby currents possible (optional)
■ AC technology

Standard Reference Resistors, AC/DC

Electrical comparison standard

These are reference resistors with high-accuracy, fixed resistance values, which are used in connection with resistance thermometry bridges. They are also used as standards in accredited electrical laboratories.

CER6000-RR

Reference resistor

ASL



Resistance value: 1, 10, 25, 100, 300, 400, 500, 1.000 and 10.000 Ω

Long-term stability: $< \pm 5$ ppm per year

Special feature: ■ Low temperature coefficient
■ Rugged stainless steel construction

CER6000-RW

Standard reference resistor

ASL

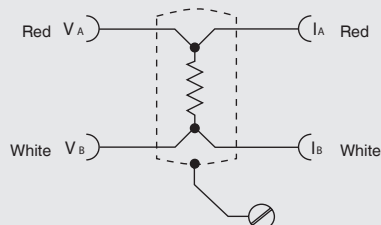


Resistance value: 1, 10, 25, 100, 300, 400, 500, 1.000 and 10.000 Ω

Long-term stability: 2 ppm per year (HS version 0.5 ppm per year)

Special feature: ■ Low temperature coefficient
■ Rugged stainless steel construction

Connections of the reference resistor, Model CER6000-RR



Reference resistor, model CER6000-RR with 100 Ω



Reference resistor, model CER6000-RR with different resistance range

Hand-Helds, Calibrators

Portable measuring and calibration instruments for mobile use

These instruments are used for calibration in industry (laboratories, production, workshops), in calibration service companies and in quality assurance due to unparalleled performance characteristics and low measurement uncertainties.

CEP1000

Hand-held loop calibrator



Measuring range:	0 ... 24 mA, 0 ... 28 V
Accuracy:	0.015 %
Special feature:	Simulates, powers and measures 2-wire transmitters

CEP3000

Hand-held temperature calibrator



Measuring range:	<ul style="list-style-type: none"> ■ -10 ... +75 mV, 5 ... 3,200 Ω ■ -200 ... +1,200 °C (type J) ■ -300 ... +2,000 °F (type J) ■ -200 ... +800 °C (Pt100) ■ -300 ... +1,500 °F (Pt100)
Accuracy:	0.4 °C (type J), 0.33 °C (Pt100)
Special feature:	Measurement and simulation of thermocouples and resistance thermometers

CEP6000

Hand-held multi-function calibrator



Measuring range:	<ul style="list-style-type: none"> ■ 0 ... 24 mA, 0 ... 30 V, 5 ... 4,000 Ω ■ 2 CPM ... 10 kHz ■ -210 ... +1,200 °C (type J) ■ -350 ... +2,000 °F (type J) ■ -200 ... +800 °C (Pt100) ■ -300 ... +1,500 °F (Pt100)
Accuracy:	0.015 %
Special feature:	Measurement and simulation of thermocouples, resistance thermometers, resistance, current, voltage, frequency, pulse and pressure

CED7000

High-precision process calibrator



Measuring range:	<ul style="list-style-type: none"> ■ 0 ... 100 mA, 0 ... 100 V, 5 ... 4,000 Ω ■ -210 ... +1,200 °C (type J) ■ -350 ... +2,000 °F (type J) ■ -200 ... +800 °C (Pt100) ■ -300 ... +1,500 °F (Pt100)
Accuracy:	0.003 %
Special feature:	High-precision measurement and simulation of thermocouples and resistance thermometers, resistance, current, voltage and pressure

Pascal ET

Hand-held multi-function calibrator



Measuring range:	<ul style="list-style-type: none"> ■ 0 ... 100 mA, 0 ... 80 V, 5 ... 10,000 Ω ■ 0 ... 50 kHz ■ -190 ... +1,200 °C (type J) ■ -300 ... +2,000 °F (type J) ■ -200 ... +850 °C (Pt100) ■ -300 ... +1,500 °F (Pt100)
Accuracy:	0.008 %
Special feature:	<ul style="list-style-type: none"> ■ Large display with touchscreen ■ Integrated data logger and calibration function ■ Measurement and simulation of temperature, current, voltage, resistance, frequency, pressure

Complete Solutions

Simple checking or professional calibration

CTH6200

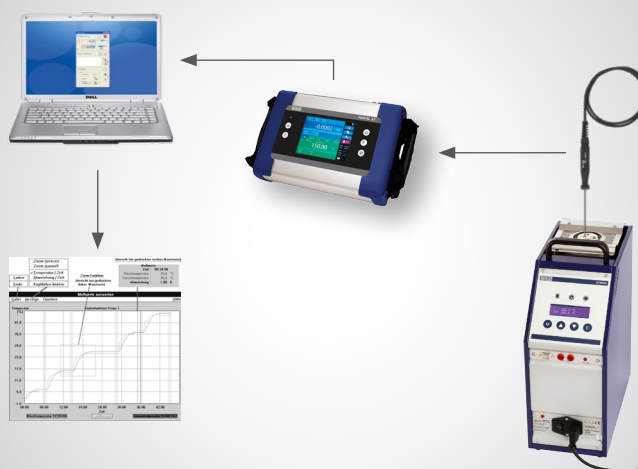
Online temperature measurement



Optional: With data logging and subsequent transfer of the logged data to a PC.

Pascal ET

On-site calibration of a temperature sensor



- Stable control of temperature with the CTD9100-1100 dry-block calibrator
- Accurate measurement of temperature with the Pascal ET logging, hand-held multi-function calibrator
- Transfer of the calibration data to a PC incl. generation of the calibration certificate

Calibration Systems

Turnkey, customer-specific systems and installations with corresponding software

We can design an integrated solution from our extensive product line with the required degree of automation. These systems are well-proven and used in Mensor's own accredited laboratories and manufacturing plants.

A few examples of our custom systems are shown below to showcase our capabilities.

Rack equipment



- Custom pressure equipment for production, test, and calibration
- High speed operation with accuracies to 0.01%
- Up to 12 channels per system

Carts and mobile equipment



- Custom configurations of mobile racks and carts
- Low profile casters to fully pneumatic wheels
- Standard pressure instruments or special purpose designs
- Accuracies can vary based on equipment included

Bench or desktop equipment



- Bench or desktop system designs
- Accuracy, range and auxiliary equipment to meet user needs

High speed and high volume controller



- Ranges to 1500 psi
- Absolute, gauge, bi-directional or vacuum
- Uncertainty: 0.01% IntelliScale-50, 0.01%FS, 0.025%FS
- Up to four pressure control channels per instrument

Compressed air, nitrogen, oil or water
Complete turnkey system

Calibration Systems

CPH6000, CPP30

Calibration of a process transmitter



- Pressure generation with the pneumatic hand test pump CPP30
- Reading of the electrical signal of the process transmitter via the electrical input of the CPH6000
- Recording of the calibration in the CPH6000 and later evaluation on a PC in conjunction with the EasyCal software

CPH6400, CPP5000-X

High-pressure calibration



- Pressure generation with the hydraulic high-pressure pump CPP5000-X
- Reading of the electrical signal of the calibration item via a digital indicator
- Online acquisition of the calibration data and generation of calibration certificates in conjunction with the WIKA-CAL software

Rack mounted pressure booster



- Boost dry gas
- Model 75RM-boost 300 to 6000 psi with 85 psi shop air
- Model 73RM-boost shop air from 80 to 400 psi

Compressed air, nitrogen
Complete turnkey system

Vacuum/pump compressor set



- 1, 2, or 3 compressors and/or vacuum pumps
- 120 v AC
- Clean, dry pumps
- Pressures to 50 psi
- Vac to 28.5 inHg

Pressure regulating console



- Custom pressure panels
- Can include gauges, regulators, valves, panel meters, alarms, and indicators

Operating Principle

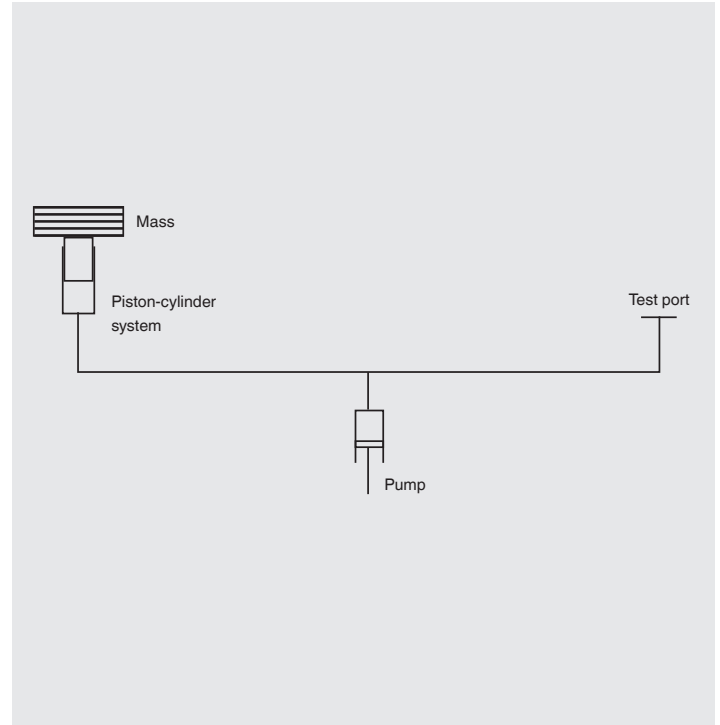
Deadweight Testers

Mechanical dead weight testers (primary standards) based on the physical principle $\text{Pressure} = \text{Force}/\text{Area}$

Deadweight testers add a precisely defined force by placing mass pieces on the top of a piston-cylinder system. By producing a certain pressure (counter pressure) inside the pressure balance by using e.g. the integrated hand pump, an equilibrium is achieved. In the state of equilibrium, the pressure is high enough that the mass pieces, incl. the free-running piston of the piston-cylinder system, are floating, which will lead to a very accurate pressure at the test port.

In this case, you'd need a pressure supply, but only for pneumatic applications > 145 psi (10 bar), or a vacuum source for negative pressure versions.

Advantage: Large measuring range coverage, long recalibration intervals and stand-alone operation.

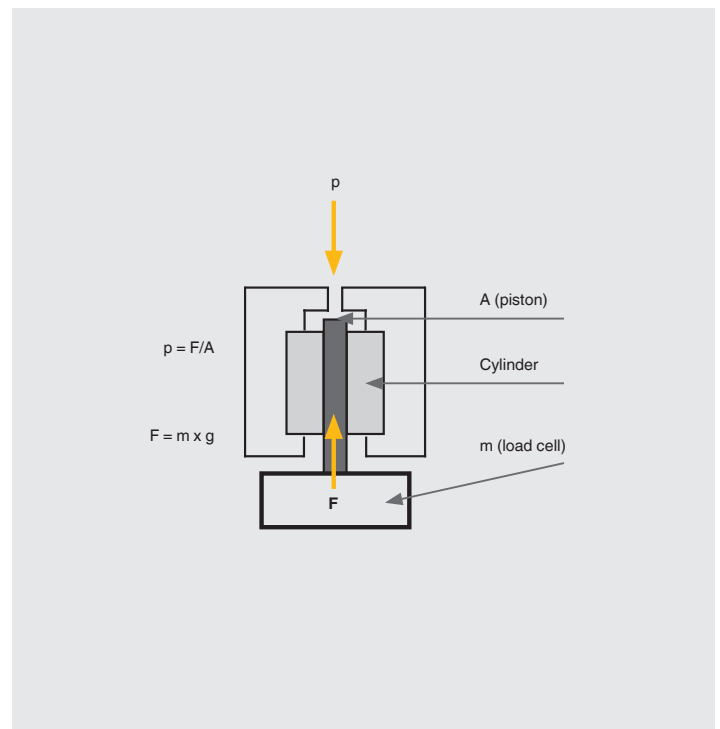


Digital Pressure Balances

Digital pressure balances require no mass-disc handling.

In contrast to the mechanical dead weight testers, no mass discs are used with digital pressure balances. Instead, with a piston-cylinder unit, the applied pressure, p , is converted into a force, F , ($F = p \times A$), which is then "weighed" ($m = F/g$), i.e. the cylinder pressure is directed onto a load cell which works on the principle of electromagnetic force compensation.

This unique measuring principle of digital pressure balances in combination with pressure controllers enables a fully-automatic calibration with the highest accuracy. With the integrated measurement module for environmental conditions, the reference value is automatically corrected.



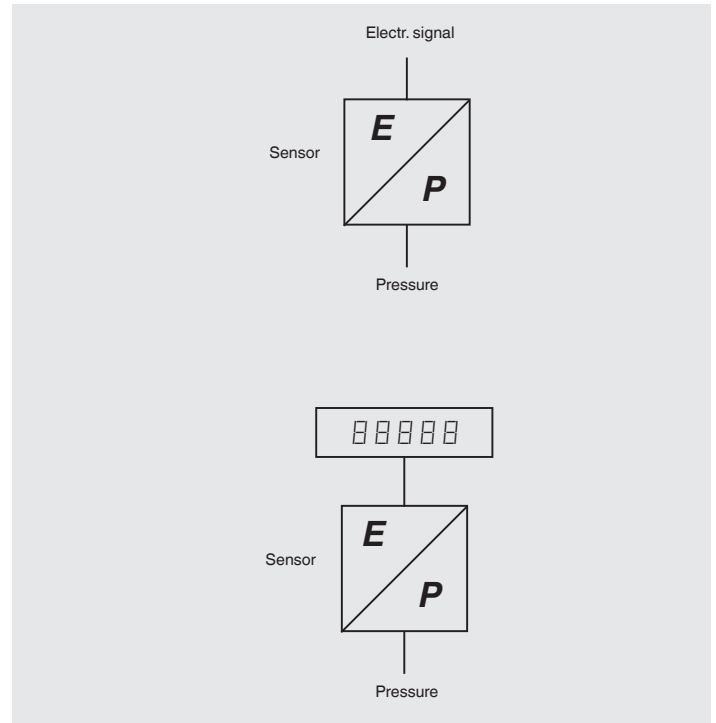
Pressure sensor and pressure sensor with display or pressure indicator

Electrical measuring systems which convert pressure into an electrical signal and optionally visualize it.

Pressure sensors and indicators convert the physical property of pressure into a proportional electrical signal which is accessible via analog or digital interface for further use or processing. Indicators usually offer, in addition to displaying the signal in various pressure units, the ability to use diverse functions such as MIN/MAX memory, etc.

The resource needed in this case is a power supply.

Advantage: pressure signal available via electrical interface and, if required, displayed visually.



Pneumatic Pressure Controller

Electronic controllers which quickly and automatically provide a pressure output from a supply pressure.

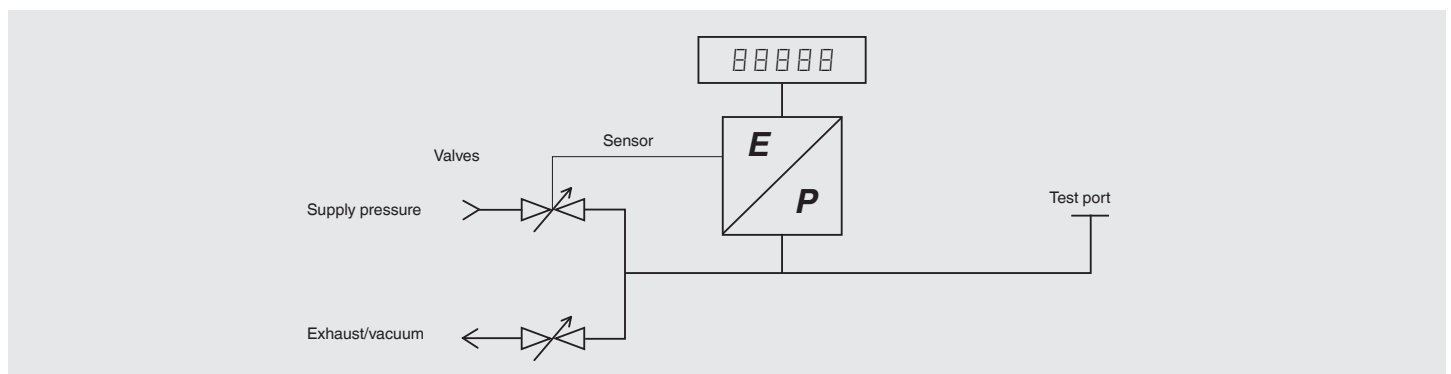
Pneumatic: An entered set point, set via keypad or electrical interface, is quickly and accurately made available at the output (test port), using a precision pressure sensor and a regulator. To control pressure values lower than the ambient air pressure, a vacuum source must also be connected to the device.

Hydraulic: Here, a fluid medium (e.g. distilled water) is compressed by the control unit. This is done by a closed-loop control circuit based on a pneumatic primary control circuit (175 ... 435 psi / 12 ...

30 bar) and a mechanical pressure multiplier with a hydraulic output (secondary circuit).

The resources needed in this case are, in addition to a power supply, a pressure supply and if needed a vacuum source.

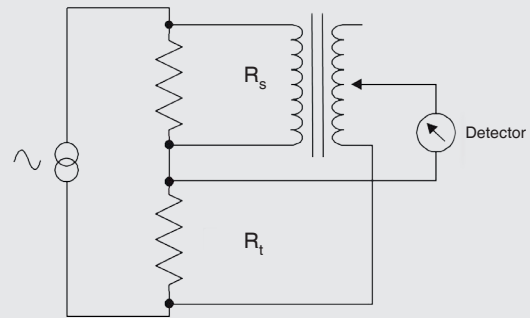
Advantage: Fast pressure output and full automation via electrical interface. The Sensor provides continuous feedback to the regulator via the control algorithm to precisely control the output.



Operating Principle

AC Resistance Thermometry Bridges

When a constant current is passed through a thermometer of resistance R_t and a fixed reference resistor of known value R_s , the voltage across them will be in direct proportion to their resistance values. The ratio of the two voltages and therefore of the two resistors, can be measured very accurately using high-precision potentiometer techniques employed in the ASL AC bridges. As R_s is known, R_t can be determined from $n=R_t/R_s$, where n is the measured ratio.



The Advantages of the AC Resistance Bridge

ASL's low-frequency AC (alternating current) bridge technology has major advantages over DC (direct current) systems for high-precision measurement of platinum resistance thermometers, two of which are:

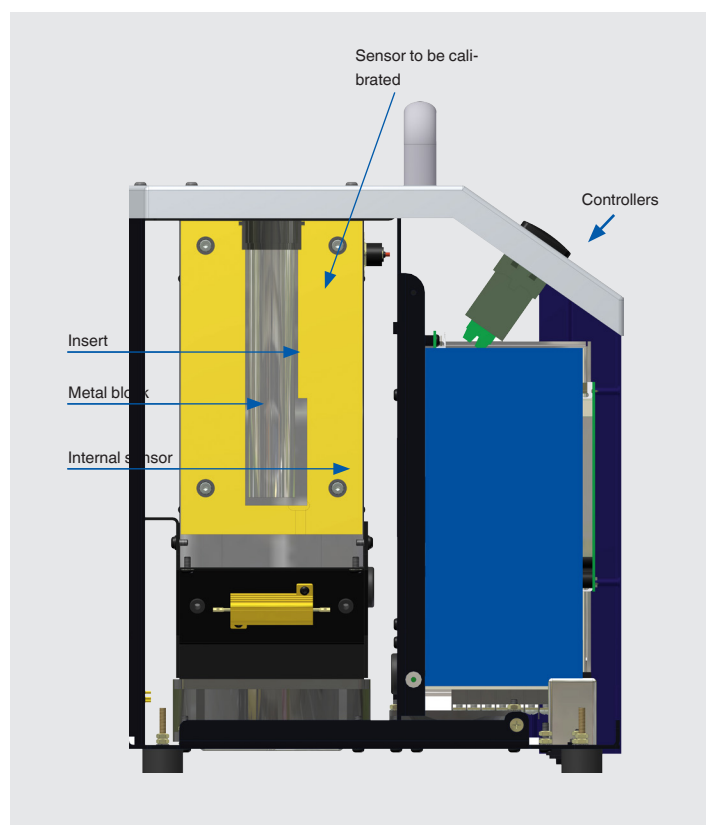
- DC generates small voltages in the thermometer, reference resistor and cables, across every junction where different materials are used, for example copper, tin, platinum, palladium, nickel etc. These voltages, which add to or subtract from the measured voltages, are dependent on the various temperature differences at these junctions, hence they are referred to as "Thermal EMFs". These variable voltages cause measurement errors and the more accurate DC bridge systems switch the polarity of the current to try to solve the problem, taking between 2 and 4 seconds for each reversal. The ASL AC bridges with their AC current perform this reversal automatically 75 times a second, a much more effective solution.
- Active circuits, which are fundamental to the performance of DC systems suffer from ambient temperature changes and the effects of component aging. Fundamental to the ASL AC bridges accuracy is its inductive potentiometer - a passive, precision voltage divider, the performance of which is unaffected by ambient temperature change and by time. DC bridges require very stable and accurate electronics to achieve their performance. Because active circuitry within the AC bridge is secondary to performance, the effects of active component drifts and aging are therefore minimised. This results in an instrument which does not require regular recalibration to remain within specification.

Dry-well Calibrators

Electronic controllers which automatically supply a temperature in a dry block.

These instruments produce a controllable temperature within a solid block, to calibrating thermometers in the bores within the block.

A temperature dry-well calibrator consists, at the very least, of a solid block, a temperature control unit for the block and a calibrator thermometer (internal reference) with a display for determining the block temperature.



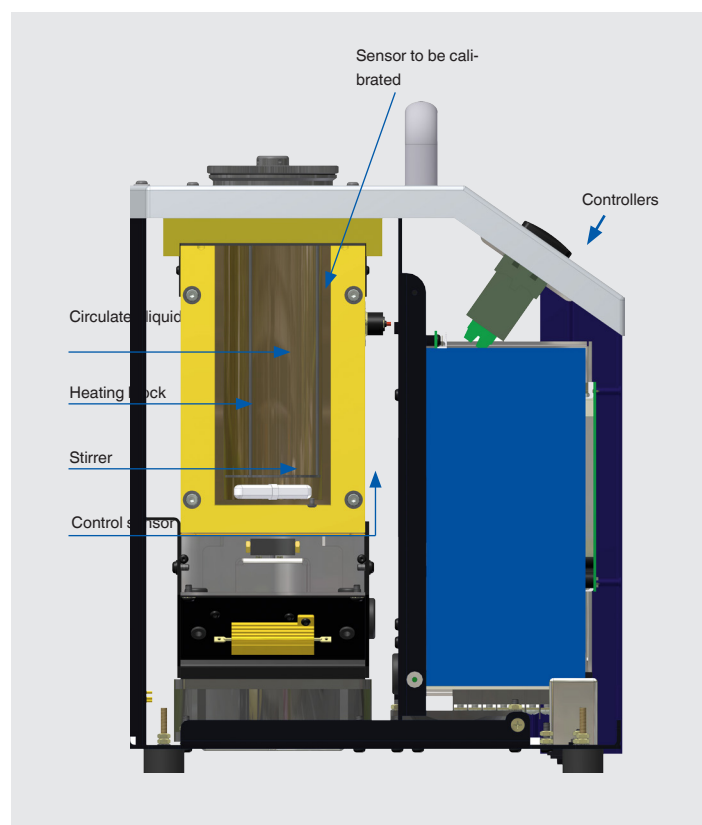
Calibration Baths

Electronic controllers which automatically supply a temperature in a liquid bath

These instruments produce a controllable temperature within a liquid tank, to calibrating thermometers.

A micro calibration bath consists, at the very least, of a liquid tank, a correctly selected liquid for the tank and a calibrator thermometer (internal reference) with a display for determining the tank temperature.

The components mentioned above are combined as a compact instrument.



Mensor Calibration Services

Mensor has established a reputation for world-class service and support by providing customers with skilled technical assistance, quality service and re-calibrations with fast turn-around times.



Precision Pressure Calibration

Calibration services are provided for all of Mensor's product lines as well as a wide range of other pressure instrumentation from manufacturers such as GE, Druck, Fluke, Ruska, DHI, PSI, Rosemount and Heise.

The Mensor calibration laboratory is controlled by a Quality Management System (QMS) that has been certified to ISO 9001:2008 and accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 and also meets the requirements of ANSI/NCSL Z540-1-1994. Accreditation is by the American Association for Laboratory Accreditation (A2LA). Both certificates can be viewed on the Mensor web site at www.mensor.com.

Mensor's calibration laboratory can calibrate pressure ranges from 10 inH₂O up to 30,000 psi.

Documentation Supplied

Mensor provides a National Institute of Standards and Technology (NIST) traceable A2LA accredited 17025 Calibration Certificate with each calibration. Accredited calibration certificates are provided for all calibrations at no extra charge that are within our A2LA Scope Accreditation.

Types of calibrations offered:

- Absolute
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- Gauge
- Vacuum
- Compound
- Pneumatic media
- Hydraulic media
- Altitude
- Airspeed

Contact Mensor or email tech.support@mensor.com for information on your specific requirements. Fill out and print the Product Return Form on the Mensor website to provide us with instructions needed for calibration services.



Mensor Repair Services

Instrument Repair Service

Mensor's objective is to provide quality customer support whether troubleshooting an instrument over the telephone or servicing a customer-owned instrument at our facility. We will make every attempt to assist you in solving your problem or repairing your instrument at your place of business. Our teams of service technicians have over 75 years of combined instrument repair experience for a wide range of WIKA Calibration Technology products such as:

- Mensor pressure controllers and gauges
- DH-Budenberg Industrial Deadweights
- Desgranges & Hout Primary Deadweight Standards
- ASL Thermometry Bridges
- WIKA Temperature Calibrators

Before returning an instrument for repair, please contact Mensor's Customer Service Dept or email Customer service at tech.support@mensor.com. who can provide you with an estimated price and approximate lead time. Fill out the Product Return Form and include the printed confirmation email within the return package and send to the following address:

Mensor
201 Barnes Drive
San Marcos, TX 78666
Toll Free: (800) 984-4200 (USA & Canada only)
Tel: (512) 396-4200
Fax: (512) 396-1820
Email: tech.support@mensor.com

Firm Price Quotation

After the instrument is received by Mensor, a thorough check is made of the instrument. It is only after this step that we can provide you with a firm price and full description of the service to be performed for your final approval.

Warranty Policy

New products have up to a 2-year warranty on parts and labor. Repair work is covered by a ninety (90) day warranty, which includes parts and labor. Please notify Mensor immediately if you experience a problem or if the instrument is not performing to your expectations.

Global Service Centers (4)

Mensor is committed to providing support within countries and regions where our products are used. We presently have four service centers located outside of the USA and we will be adding more service centers to support other area where Mensor products are used. Our Global Service Centers are presently located in:

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Boon Lay Way
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Email: sales@tisinstruments.com

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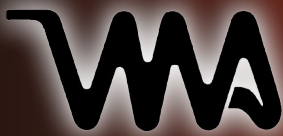
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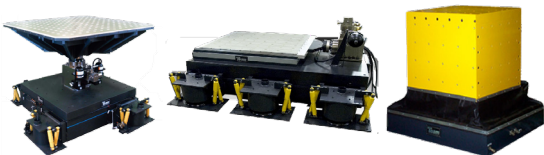
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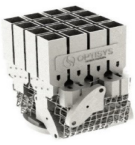
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- Telemetry Repeaters
- Antenna Tracking Receivers
- Automated Telemetry Test Systems



- Software Defined Radios
- Space HAIPE COMSEC
- Space Processors
- Space Networking & Payload Interface Electronics



- Telemetry & Data Systems
- Everything Over IP
- Rugged USB Hubs & Repeaters
- Deployable Tactical Systems
- Custom Product Solutions for Mission-Critical Requirements



- Configurable Ground and Range Equipment for Civil, Commercial, Defense and Intelligence Aerospace Applications
- Front End Processors
- Ruggedized Integrated Test Sets
- Space Link Extension (SLE) Gateways
- Integrated Field-Deployable Ground Stations



- Heavy duty, Ka-Shield and EMI/RFI Shielded Cabinets
- N6 Shielded Watertight NEMA Cabinets and NEMA Enclosures
- Challenger Cabinets
- Sub-Rack Card Cages
- Customized Products



- RF, Microwave & Fiber Optic Products for Military & Industrial Applications
- Passive Optical Components
- Challenger Cabinets
- RF/Optical Link Modules & Plug-Ins
- Systems Engineering & Custom Solutions



- RF & Microwave Products for Telemetry, Telecommunication, and Satellite Communication
- Multicouplers
- Frequency Converters & Translators
- RF Switching & Distribution Systems