2465

MODEL 2465

Gas piston gauge

Now Featuring 10 ppm Expanded Uncertainty

- Autofloat controller and manually operated systems available
- Pressure range: -1000 mbar–70 bar gauge, 14 mbar to 70 bar absolute
- Accuracy to 0.0001% (10 ppm) of reading
- Precision better than 3 ppm
- Stability better than 3 ppm per two years
- Gauge, absolute, vacuum, and low pressure modes

Gas piston gauge

The Model 2465 Gas Piston Gauge has a long history of serving national standards laboratories, commercial industry and government organizations as a gas piston gauge standard for over 40 years. Since its original introduction, enhancements have been made to increase performance and reduce operator workload. The autofloat controller configuration is a recent example of Ruska's commitment to provide an easy to use, high performance, primary standard to the pressure calibration and metrology community. Ruska continues it's leadership position in the field of primary pressure standards by providing the Model 2465 with the capability of generating pressures to within a total expanded uncertainty of 10 parts per million to 7 bar and 11 parts per million to 70 bar. No other commercially available pressure standard can produce this level of performance over this pressure range! The Model 2465 continues to be the world's choice for a gas pressure standard.

The Model 2465 is available in a variety of configurations to meet individual requirements. The three basic components of the Model 2465 are the Instrument Base, one or more Piston/Cylinder Assemblies, and a single Mass Set. The Autofloat Controller can be added to minimize operator workload and skill requirements, or select an economical Pressure Control Pack. Last, decide which accessories and options will be required.

Instrument Base
The instrument base is designed with functionality, economy and space conservation in mind. All electronic components are housed away from the instrument base to eliminate errors caused by thermal effects and magnetic fields. The thermally isolated motor drive is connected to the cylinder—eliminating pressure fluctuations and maximizing productivity. A durable, acrylic bell jar is provided to allow absolute and vacuum modes of operation. A KF16 fitting is provided to simplify installation and allow low reference pressures.

Piston/Cylinder Assemblies
Piston and cylinder assemblies are manufactured from proven materials that have evidenced superior strength, durability, low distortion, low thermal coefficients and virtually undetectable hysteresis over the last several decades, and have an unparalleled record of long-term stability. Tungsten carbide is used for all pistons and cylinders, except where the demand for accurate low pressures is met by using high quality stainless steel (low range piston). The lower density of steel facilitates generating pressures down to 14 mbar.

Assemblies install quickly into the pressure column without the need for special tools. Piston/cylinder assembly changeout can be completed in less than one minute. Four assemblies are now available to generate pressures over the total range of the system.

Mass Set
Each mass is machined to a nominal value and is made from non-magnetic materials to provide long-term stability and eliminate sensitivity to magnetic fields. For ease of use, the entire mass set totals just 6 kg, with a maximum platter mass of 1 kg. A laboratory grade trim mass set is included to allow any pressure increment within the range and resolution of the piston/cylinder assembly.

Autofloat Controller
The autofloat controller provides a means of reducing operator workload while achieving the unparalleled performance provided by the Model 2465. The operator simply applies the mass load as instructed by the software, and then selects the autofloat icon on the menu bar. The autofloat controller automatically generates the desired pressure to establish the correct piston float position. A three-color status bar at the bottom of the software screen indicates when the piston is floating within acceptable limits and a reading from the device under test can be entered.

Once the pressure is established, the autofloat controller monitors the speed of piston rotation and automatically engages the Model 2465 motor as required. Since the motor rotates the cylinder, readings can be taken even when the motor is operating, avoiding time-consuming delays.

The autofloat controller also monitors piston temperature, float position, reference vacuum in the bell jar, and sink rate, along with ambient temperature, pressure and humidity to determine air density. This data is transferred to the software which applies all environmental corrections and updates the generated pressure in real time. The autofloat controller also activates the vacuum pumps if required.

To provide additional capability, the autofloat controller is provided with a barometric reference sensor to allow system operation in absolute, vacuum (negative gauge) and low pressure mode.

The autofloat controller communicates through an RS-232C interface with WinPrompt® 32 software, a powerful calibration management tool. The user can set up procedure files consisting of a table of pressures required to calibrate a particular device. Each time the device requires calibration, the operator opens the procedure file, generates each pressure setpoint, enters the reading from the device, and then saves the results as a calibration file. Calibration reports can be printed from WinPrompt 32.

Model 2465 with autofloat controlle

For customization, WinPrompt 32 supports the Dynamic Data Exchange (DDE) function of Windows so that all data can be easily transferred to word processing and spreadsheet programs for automated report generation and analysis.

Manual Pressure Control
For manual operation, the Model 2465 can be provided with a manually operated Pressure Control Pack, instead of the autofloat controller, for regulating and controlling the system pressure and float position. The optional Model 2456 Deadweight Gauge Monitor and WinPrompt software adds further capability to the manual system (see separate Model 2456 literature for additional information and specifications).

Upgrade
An existing Model 2465 can be upgraded with the autofloat controller. With the upgrade option, the existing instrument base is modified at the factory. The system makes use of existing piston/cylinder assemblies and mass set for a cost-effective and easy method of gaining system automation. This option allows the user to retain the valuable calibration history on the piston/cylinder assembly(s) and mass set. Refer to the 2465 Upgrade literature for more information.

er and optional notebook PC shown

Operating Modes
The Model 2465 is capable of operating in gauge, absolute, vacuum and low pressure mode.

Gauge mode—pressure is achieved by simply loading the appropriate mass load to the top of the piston.

Absolute mode—A vacuum pump can be connected to the reference pressure port, using standard KF16 vacuum fittings. The appropriate mass load is applied and the bell jar is placed on the instrument base. The vacuum pump evacuates the bell jar and the residual amount of pressure is measured either automatically with the autofloat controller, with the Model 2456 Deadweight Gauge Monitor, or with a standard vacuum gauge.

Vacuum mode—is achieved by generating a subatmospheric pressure with the Model 2465 and autofloat controller utilizing the internal, high accuracy, barometric reference sensor. The system subtracts the generated pressure from the barometric reference sensor and displays the result: a vacuum (negative gauge) pressure.

Low pressure mode—allows the operator to generate pressures down to 0 mbar gauge and is achieved by generating an absolute pressure at or above atmospheric pressure with the Model 2465 and autofloat controller again utilizing the internal barometric reference sensor. The system subtracts barometric pressure from the generated pressure. This mode overcomes traditional tare pressure limitations (tare pressure is the mass of the piston divided by its area), and is especially useful when calibrating low pressure devices with ranges from fractions of a millibar to 70 mbar.

Accessories
Model 2456 Deadweight Gauge Monitor and WinPrompt software—for users who do not require the autofloat capability, but want to add a level of automation to the Model 2465. Working in combination, these accessories assist in promoting consistent technique and improving calibration productivity. The Model 2456 continuously monitors piston temperature, float position, and sink rate, and optionally air density and reference vacuum. WinPrompt software calculates mass-to-pressure and pressure-to-mass values, and automatically reads and displays real-time piston gauge parameters.

Lines and fittings kits—lines and fittings kits are available to ensure that you have all the components needed to install the system and begin performing calibrations.

Vacuum pumps—for applications where absolute, vacuum or low pressure mode calibrations will be performed, two vacuum pumps are required. The pump used to evacuate the bell jar to achieve an absolute reference pressure should have a minimum capacity rating of 100 liters/minute and achieve an ultimate total pressure of 2E-03 mbar (1.5E-03 Torr). The vacuum pump for evacuating the test port should have a capacity of 50 liters/minute or greater and also achieve an ultimate total pressure of 2E-03 mbar (1.5E-03 Torr). The autofloat configuration requires each pump to be equipped with an auto-vent valve so that the vacuum line is vented to atmosphere when the pump is turned off. Ruska can provide high quality vacuum pumps that meet these requirements. Ruska supplied pumps also include a backstream filter to prevent contamination of the Model 2465 and device under test along with a muffler for quiet operation.

MODEL 2465

Specifications

GENERAL

Pressure range
Gauge mode: 14 mbar to 70 bar
Absolute mode: 14 mbara to 70 bara
Vacuum mode: -1000 to 0 mbar[a]
Low pressure mode: 0 mbar to 70 mbar

Electrical power
115/230 VAC, 50/60 Hz, 15W

Temperature
Operating temperature 15–28 °C, storage temperature -20 to 70 °C

Humidity
Operating humidity 20–75% relative humidity, non-condensing; storage humidity 0–90%

Pressure medium
High purity nitrogen or dry, clean air with less than 0.5 ppm hydrocarbon and less than 5 ppm H_2O content, dew point less than or equal to -50 °C, and less than 50 micron particulate size. Although lower quality gas can be used, the frequency of piston/cylinder cleaning will be increased.

PERFORMANCE

Precision (type A uncertainty)
Better than 3 ppm[b]

Long-term stability
Better than 1.5 ppm per two years[b]

Resolution[c]
1 ppm or 1 mg

PISTON/CYLINDER ASSEMBLIES

Low range
Nominal area: 3.4 cm^2
Pressure range: 14 mbar to 1.7 bar
Minimum autofloat pressure: 70 mbar
Accuracy: 0.001% RDG or 0.0007 mbar (threshold pressure 70 mbar)[c]
Materials: piston is 440C stainless steel, cylinder is cemented tungsten carbide
Thermal coefficient: 1.5E-05/°C

Lower mid range
Nominal area: 0.84 cm^2
Pressure range: 117 mbar to 7 bar
Minimum autofloat pressure: 350 mbar
Accuracy: 0.001% RDG or 0.003 mbar (threshold pressure 275 mbar)[c]
Materials: piston and cylinder are cemented tungsten carbide
Thermal coefficient: 9.1E-06/°C

Upper mid range
Nominal area: 0.168 cm^2
Pressure range: 0.14 to 35 bar
Minimum autofloat pressure: 1.4 bar
Accuracy: 0.0011% RDG or 0.027 mbar (threshold pressure 2.4 bar)[C]
Materials: piston and cylinder are cemented tungsten carbide
Thermal coefficient: 9.1E-06/°C

High range
Nominal area: 0.084 cm^2
Pressure range: 140 mbar to 70 bar
Minimum autofloat pressure: 2.4 bar
Accuracy: 0.0011% RDG or 0.027 mbar (threshold pressure 2.4 bar)[c]
Materials: piston and cylinder are cemented tungsten carbide
Thermal coefficient: 9.1E-06/°C

MASS SET

Total mass: 6 kg
Maximum mass platter: 1 kg
Includes trim mass set

AUTOFLOAT SYSTEM

Autofloat controller
Positive shut-off controller automatically generates pressure and maintains piston float position at desired pressure. Includes WinPrompt 32 software.

Autofloat range
Low range piston/cylinder: 70 mbar to 1.7 bar
Lower mid range piston/cylinder: 350 mbar to 7 bar
Upper mid range piston/cylinder: 1.4 to 35 bar
High range piston/cylinder: 2.4 to 70 bar

Float position[d]
Inductive sensor
Float position resolution: 0.001 cm
Sink rate resolution: 0.001 cm/minute

Piston temperature[d]
4-wire 100Ω PRT
Accuracy: ±0.1 °C
Resolution: 0.01 °C

Air density[d]
Sensor types
Temperature: thin film platinum 1000Ω RTD
Humidity: capacitive IC humidity sensor
Barometric pressure: piezoresistive, monolithic silicon pressure transducer
Accuracy
Temperature: ±2 °C
Humidity: ±15%
Pressure: ±6.6 mbar

Vacuum reference[d]
Thermopile sensor
Accuracy: 10% of reading or 0.013 mbar (10 mTorr)[c]
Resolution: 0.001 mbar (1 mTorr)

Barometric reference sensor
Accuracy: better than ±0.14 mbar per year
Accuracy in low gauge mode: ±0.027 mbar
Resolution: 0.01 mbar

COMPUTER INTERFACE

Autofloat controller with WinPrompt 32
Requirements: Pentium level processor, RS-232C interface, monitor, mouse or other pointing device, keyboard; program requires 2MB available hard disk space; Windows 95 or higher

Model 2465 with Model 2456 and WinPrompt
Requirements: 386, 33 MHz or higher processor, RS-232C or IEEE-488 interface, monitor, mouse or other pointing device, keyboard; program requires 2MB available hard disk space; Windows 3.1 or higher.

[a]Vacuum pressure achieved depends on local barometric pressure
[b]Values are reported at the 95% confidence level (2σ)
[c]Whichever is greater
[d]Also applies to Model 2465 equipped with Model 2456 Deadweight Gauge Monitor. Additional information is provided in Model 2456 literature.

Due to Ruska Instrument's process of continuous improvement, the printed specifications are subject to change without notice.

Agent:

Ruska Instrument Corporation
P.O. Box 630009, Houston, TX 77063-0009
+(713) 975-0547 ■ Fax +(713) 975-6338
E-mail: ruska@ruska.com ■ http://www.ruska.com

A Druck Company

Document 0009-2465e

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邮编：518033 E-mail:szss20@163.com QQ: 195847376

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西安分公司：西安高新开发区 20 所(中国电子科技集团导航技术研究所)

西安劳动南路 88 号电子商城二楼 D23 号

TEL：029-81022619 13072977981 FAX:029-88789382