

# GE Sensing

## Features

- Automated primary standard for calibrating pitot static test sets
  - Pressure range: 0.4 to 103 inHg, optional range from 3.4 to 400 inHg
  - Accuracy to  $\pm 0.5$  feet, 0.003 knots
  - Ideal for calibrating RVSM compliant test sets
  - Absolute and gauge calibrations for Ps, Pt and Qc ranges
  - Calibrate in a variety of units including feet, meters, knots, inHg, mbar and several others
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# Model 2468

## Ruska Pitot Primary Standard

Model 2468 is a Ruska product. Ruska has joined other GE high-technology sensing businesses under a new name-GE Industrial, Sensing.



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The Model 2468 Pitot Static Primary Standard is specifically designed for calibrating today's high performance flight line and Air Data Test Systems. With the new autofloat controller, operator intervention is reduced to simply applying the mass load indicated by WinPrompt® software. WinPrompt applies all required correction factors, real time, to insure attainment of the highest level of performance available in a gas piston gauge which is required to calibrate today's RVSM compliant test sets. The Model 2468 is based on the popular Model 2465 Gas Piston Gauge which has a long history of serving national standards laboratories, commercial industry and government organizations as a primary pressure standard for over 40 years. Time-proven materials, hand craftsmanship, and a lineage of intercomparisons to national standards laboratories at the highest levels are coupled with new automated technology to make the Model 2468 Pitot Static Primary Standard the world's choice for calibrating Air Data Test Systems.

## Automating the Standard

The autofloat controller communicates through an RS-232C interface with WinPrompt software, a powerful Windows based calibration management program. WinPrompt automates all the functions required to perform an accurate calibration with ease. Since it is a Windows based application, it can communicate through the Dynamic Data Exchange (DDE) function with other Windows applications such as a word processor to provide customized calibration reports and spreadsheet applications to perform graphical or numerical analysis.

The process begins by creating a procedure file with the sequence of altitude or airspeeds required to calibrate a particular Pitot Static Tester. Although these instruments typically display altitude in feet and airspeed in knots, they usually require calibration in linear pressure units such as in.Hg or mbar. WinPrompt allows the procedure file to be setup in avionics units such as feet, meters, knots or pressure units such as inHg, mbar, kPa and many others. Once the procedure file has been created and saved, it can be recalled whenever the particular test set requires calibration, therefore minimizing setup time.

For each point to be generated, WinPrompt provides the operator with a list of masses (each individual mass is engraved with a unique sequence number) to apply to the top of the piston. The operator has the option of using trim masses supplied to generate an exact value, or accept the nominal value using only the main mass set.

With the first point selected, the operator uses the mouse to select the autofloat icon on the menu bar. The software then prompts the user to verify that the required masses have been applied. Upon confirmation by the user, the autofloat controller generates the requested pressure to the point where the piston is "floating". Once the pressure is established, the autofloat controller monitors all system parameters and updates the actual generated pressure, real-time. With a stable float position obtained, the status bar at the bottom of the screen changes from red to green indicating that the reading or adjustment of the device under test can be made. The device under test reading can be entered along with any particular comments in a separate text field. WinPrompt records this information along with the actual pressure generated by the Model 2468. The operator then proceeds through each step until all pressure points in the procedure file have been generated.

Once the calibration procedure is complete, the calibration file can be saved with a unique file name and a calibration report can be printed. Since WinPrompt supports the Windows Dynamic Data Exchange (DDE) function of Windows, all information can be exported to a spreadsheet program to perform mathematical and graphical functions and/or a word processing program for customized calibration report documents.

## Piston/Cylinder Assemblies

For calibrating most Pitot Static Test Sets, only the standard piston/cylinder supplied is required. The standard piston/cylinder generates pressures from 1.4 to 103 inHg in autofloat mode and from 0.4 to 103 inHg using a manual pressure adjuster. This provides an effective altitude range from -2000 to 65,000 feet in autofloat mode (-2000 to 90,000 feet using a manual adjuster) and airspeeds over 1000 knots. An optional piston/cylinder is available for generating pressures from 3.4 to 400 inHg allowing calibration of other pressure related devices, such as pressure transducers.

Both the standard and optional piston/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. Each piston/cylinder installs quickly into the pressure column without the need for special tools. Piston/cylinder assembly change-out can be completed in less than one minute.

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## Mass Set

The Model 2468 is provided with a single mass set that is used with either the standard or optional piston/cylinder. Each mass is engraved with a unique sequence number and a common serial number. A storage case is supplied which allows storage of the mass set and one or both piston/cylinders. Each mass is machined to a nominal value and is made from nonmagnetic materials to provide long-term stability and eliminate sensitivity to magnetic fields. For ease of use, the entire mass set totals just 26.40 lbs (12 kg), with a maximum platter mass of 2.2 lbs (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.

## 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 mode operation when calibrating altitude and other absolute reference devices. A KF16 fitting is provided to simplify installation and allow low reference pressures.

## Vacuum Pumps

In order to operate over the entire altitude and airspeed range, two vacuum pumps are required. One pump is connected to the reference port of the Model 2468 using a KF16 connection. This allows the area inside the bell jar to be evacuated which is required for altitude calibrations (absolute mode). A second vacuum pump is connected to the autofloat controller which allows automatic control of pressures down to 1.4 inHg absolute. In order to generate positive pressures, a regulated gas supply (clean dry air, or nitrogen) must be supplied to the autofloat controller. Ruska can supply vacuum pumps which are rated to the appropriate vacuum capacity and include an auto-vent valve and backstream filter for contamination prevention along with a muffler for quiet operation.

## Connecting Lines and Fittings

Ruska can provide an optional lines and fittings kit which includes all interconnecting tubing for pressure and vacuum supplies along with all required cables and adapters.



*The Model 2468 is used to calibrate test sets like the Druck 405F*

## Barometric Reference

The Model 2468 equipped with the autofloat controller is provided with a barometric reference sensor to allow system operation in absolute mode and also simulated absolute mode where establishing the bell jar vacuum (reference vacuum) is not required.

## Computer

The autofloat system requires a standard desktop or notebook computer for operation. A Pentium level processor, RS-232 interface and Windows 95/98 are the only requirements. The computer can be supplied by the customer or Ruska can provide an optional notebook computer with the system which is pre-loaded with Windows 95 or higher and WinPrompt software.

## Manual Configuration

Ruska also offers a manually operated pressure control system for setting the pressure and float position. This configuration can also be used with WinPrompt software and the Model 2456 Deadweight Gauge Monitor. The Model 2456 continuously monitors piston temperature, float position, and sink rate, and optionally air density and reference vacuum. WinPrompt calculates mass-to-pressure and pressure-to-mass values, and when used with the Model 2456, automatically reads and displays real-time piston gauge parameters. A separate brochure is available that covers the Model 2456 Deadweight Gauge Monitor.

# Model 2468 Specifications

## Pressure Range

### Autofloat Mode

#### Standard Piston/Cylinder

- Altitude: -2000 to 65,000 feet
- Airspeed: 175 to 1000 knots
- Pressure: 1.4 to 103 inHg (47 to 3500 mbar), gauge or absolute

#### Optional Piston/Cylinder

Pressure: 7.5 to 400 inHg (255 mbar to 13.5 bar), gauge or absolute

### Manual Mode

#### Standard Piston/Cylinder

- Altitude: -2000 to 95,000 feet
- Airspeed: 100 to 1000 knots
- Pressure: 0.4 to 103 inHg (13.5 to 3500 mbar), gauge or absolute

#### Optional Piston/Cylinder

Pressure: 3.4 to 400 inHg (115 mbar to 13.5 bar), gauge or absolute

## Accuracy

Altitude	Accuracy	Airspeed	Accuracy
0 ft	0.5 ft	100 kts	0.003 kts
30,000 ft	1.0 ft	500 kts	0.003 kts
60,000 ft	3.8 ft	1000 kts	0.006 kts

## Piston/Cylinders

### Standard Piston/Cylinder

- Nominal area: 0.52 in<sup>2</sup> (3.4 cm<sup>2</sup>)
- Pressure range: 0.4 to 103 inHg (13.5 to 3500 mbar), gauge or absolute
- Pressure Accuracy: 0.0015% RDG or 0.00003 inHg (0.001 mbar) (whichever is greater)
- Pressure Stability: 3 ppm per year
- Materials: piston is 440C stainless steel, cylinder is cemented tungsten carbide
- Thermal coefficient: 1.5E-05/°C

### Optional Piston/Cylinder

- Nominal area: 0.13 in<sup>2</sup> (0.84 cm<sup>2</sup>)
- Pressure range: 3.4 to 400 inHg (115 mbar to 13.5 bar), gauge or absolute
- Pressure Accuracy: 0.0015% RDG or 0.00015 inHg (0.005 mbar) (whichever is greater)
- Pressure Stability: 3 ppm per year
- Materials: piston and cylinder are cemented tungsten carbide
- Thermal coefficient: 9.1E-06/°C

## Mass Set

- Total mass: 26.4 lbs (12 kg)
  - Maximum platter mass: 2.2 lbs (1 kg)
- Includes trim mass set (1 mg to 20g) and storage case

## General

### Electrical Power

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

### Temperature

- Operating temperature 15°C to 28°C
- Storage temperature -20°C to 70°C

### Humidity

- Operating humidity 20 to 75% relative humidity, noncondensing
- Storage humidity 0 to 90% relative humidity, noncondensing

### Pressure Medium

High purity nitrogen or dry, clean air with less than 0.5 ppm hydrocarbon and less than 5 ppm H<sub>2</sub>O 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.

## Autofloat System

Positive shut-off controller automatically generates pressure and maintains piston float position at desired pressure.

### Float Position<sup>a</sup>

- Inductive sensor
- Float position resolution: 0.001 in or 0.001 cm
- Sink rate resolution: 0.001 inch/minute or 0.001 cm/minute

# Model 2468 Specifications

## Piston Temperature

- Four-wire 100 $\Omega$  PRT
- Accuracy:  $\pm 0.1^{\circ}\text{C}$  per year
- Resolution:  $0.01^{\circ}\text{C}$

## Air Density<sup>a</sup>

### Sensor types

- Temperature: thin film platinum 1000 $\Omega$  RTD
- Humidity: capacitive IC humidity sensor
- Barometric pressure: piezoresistive, monolithic silicon pressure transducer

### Accuracy

- Temperature:  $\pm 2^{\circ}\text{C}$
- Humidity:  $\pm 15\%$
- Pressure:  $\pm 5$  mmHg

## Vacuum Reference<sup>a</sup>

- Thermopile sensor
- Accuracy: 10% of reading or 10 mTorr (whichever is greater)
- Resolution: 1 mTorr

## Barometric Reference Sensor

- Accuracy: better than  $\pm 0.0008$  inHg
- Resolution: 0.0003 in.Hg

## Computer Interface

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

## Manual Control Pack

For users who prefer a manually operated system, the manual control pack can be provided with the Model 2468 instead of the autofloat controller.

The manual control pack includes pressure and vacuum inlet valves, precise pressure adjuster for fine pressure control, reference gauge and vent valve.

<sup>a</sup>Also applies to Model 2468 equipped with Model 2456 Deadweight Gauge Monitor. Additional information is provided in Model 2456 literature.

Expression of uncertainty conforms with the recommendations of the ISO Guide to Expression of Uncertainty in Measurement.

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

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