FLUKE®
Calibration

RUSKA 2465A

AutoFloat System

Users Manual

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Introduction

The RUSKA 2465A AutoFloat System combines the high precision and low uncertainty of the 2465 Pneumatic Piston Pressure Gauge with the ease-of-use of the 2465A-200 AutoFloat Controller and WinPrompt 32 software. All pressure generation functions, mass load computations and data collection are performed via WinPrompt Calibration Software to provide consistency and efficiency in the calibration routine.

System Description

The user activates the desired calibration routine through the WinPrompt software. At the direction of WinPrompt, the user installs the appropriate piston/cylinder assembly and loads the requested masses. For absolute mode operation, the user must also install the bell jar and operate the vacuum valve, as prompted by WinPrompt. WinPrompt then commands the pressure controller to pressurize the system and establish the proper piston float and rotation, during which time the status bar display in WinPrompt is red. The vacuum pumps will also be activated by WinPrompt as needed. Once proper piston float and rotation have been established, WinPrompt changes the status bar from red to yellow to green. As the piston position drifts out of optimum float range, the status bar changes to yellow, and then to red as the pressure controller activates to reestablish the optimum float position. After sufficient stabilization time, the user enters the reading from the device under test and WinPrompt proceeds with instruments for the next pressure in the sequence. This continues until all pressures in the sequence have been generated. The user can then print a Default Calibration Report or activate a third-party program that supports Dynamic Data Exchange (DDE), and print a Customer Calibration Report that includes links to actual WinPrompt data.

Although the RUSKA 2465A AutoFloat System is designed to minimize the burden on the user, it remains the user's responsibility to use good metrological practices. These include allowing adequate time for thermal stabilization, ensuring leak integrity of the pressure system, ensuring adequacy of the environmental controls, and acquiring a reliable value for the local acceleration of gravity.

How to Contact Fluke

To order accessories, receive operating assistance, or get the location of the nearest Fluke distributor or Service Center, call:

- Technical Support USA: 1-800-99-FLUKE (1-800-993-5853)
- Calibration/Repair USA: 1-888-99-FLUKE (1-888-993-5853)
- Canada: 1-800-36-FLUKE (1-800-363-5853)
- Europe: +31-402-675-200
- China: +86-400-810-3435
- Japan: +81-3-3434-0181
- Singapore: +65-738-5655
- Anywhere in the world: +1-425-446-5500

Or, visit Fluke's website at www.fluke.com.

To register your product, visit http://register.fluke.com.

To view, print, or download the latest manual supplement, visit http://us.fluke.com/usen/support/manuals.

Safety Information

⚠ Warning

Pressurized vessels and associated equipment are potentially dangerous. The apparatus described in this manual should be operated only by personnel trained in procedures that will assure safety to themselves, to others, and to the equipment.

Do not use oxygen as the pressure supply media. Use only dry, clean nitrogen. Do not exceed safe maximum inlet pressures as follows:

With low range piston/cylinder: 40 psi

With low/mid range piston/cylinder: 115 psi

With upper/mid range piston/cylinder: 515 psi

With high range piston/cylinder: 1015 psi

⚠ Warning

Do not use hydra carbon lubricants. Use only Fluke supplied lubricant unless otherwise specified in this manual. Always use replacement parts specified by Fluke.

⚠ Warning

When any maintenance is performed, turn off power and remove power cord.

Oxygen Compatibility

This instrument has been designed with components that will not introduce hydrocarbons into the calibration process. The O-ring and lubricating grease supplied with the instrument must not be substituted with other laboratory supplies.

Cleaning of the instrument for oxygen compatibility using liquid Freon and ultrasonic cleaning systems is permitted with the **exception of the Pistons and Cylinders.**

Keep Away From Live Circuits

Operating personnel must at all times observe safety regulations. Do not replace components or make adjustments inside the equipment with the voltage supply connected. Under certain conditions, dangerous potentials may exist when the power control is in the off position due to charges retained by capacitors. To avoid injuries, always remove power from, discharge, and ground a circuit before touching it.

Do Not Service or Adjust Alone

Do not attempt internal service or adjustment unless another person capable of rendering aid and resuscitation is present.

Resuscitation

Personnel working with or near dangerous voltages shall be familiar with modern methods of resuscitation. Such information may be obtained from your local American Medical Association.

Electrostatic Discharge Sensitive Parts

⚠ Caution

Electrostatic discharge sensitive (ESDS) is applied to low power, solid-state parts which could be damaged or destroyed when exposed to discharges of static electricity. Maintenance personnel are often not aware that an ESDS part has been damaged or destroyed because electrostatic discharges at levels less than 4,000 volts cannot be seen, felt or heard.

Compressed Air

Use of compressed air can create an environment of propelled foreign matter. Pressure system safety precautions apply to all ranges of pressure. Care must be taken during testing to ensure that all pneumatic connections are properly and tightly made prior to applying pressure. Personnel must wear eye protection to prevent injury.

Personal Protective Equipment

Wear eye protection approved for the materials and tools being used.

Inert Gases

Operation of pressure equipment may be accompanied by the discharge of inert gases to the atmosphere. The result is a reduction of oxygen concentration. Therefore, it is mandatory that all exhaust gases be vented outside the work area.

⚠ Warning

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

The AC main plug, switch and power cord shall remain readily accessible for operation.

Symbols Used In This Manual

In this manual, a **Warning** identifies conditions and actions that pose a hazard to the user. A **Caution** identifies conditions and actions that may damage the Autofloat System.

Symbols used on the AutoFloat System and in this manual are explained in Table 1.

Table 1. Symbols

Symbol	Description
CE	This equipment meets the requirements of all relevant European safety directives. The equipment carries the CE mark.
!	This symbol, on the instrument, indicates that the user should refer to the user manual
~	AC (Alternating Current)
⏚	Earth Ground
⚠	Important Information: refer to manual
	Do not dispose of this product as unsorted municipal waste. Go to Fluke's website for recycling information.

Setup

General Setup

The RUSKA 2465A AutoFloat System should be set up on a sturdy table in a location where the thermal fluctuations are at a minimum; as far as possible away from air conditioning vents, heaters and exterior windows. Drafts due to air handlers and personnel traffic are also undesirable. Use the following guide to make the connections between the various system components and to prepare the system for operation.

RUSKA 2465A-754 Deadweight Gauge (DWG) Base

1. Verify voltage selection on power receptacle and connect power cord.
2. Verify that the Rotation control switch on the rear of the DWG base is set to Automatic.
3. Connect the DWG base pressure port to the rear test port connection on the Pressure Controller chassis using a pressure line and fittings rated for 1000 psi. A flexible line rated to 1000 psi is included in the optional lines and fittings kit supplied with some systems.
4. Install the Vacuum Sensor into the DWG base.
5. Connect the Vacuum Sensor Cable to the Vacuum Sensor and to the rear panel connector on the Pressure Controller chassis labeled Vacuum.
6. Connect a BNC cable between the DWG base and the rear panel connector on the Pressure Controller chassis labeled Float.
7. Insert the PRT sensor into the DWG base and tighten the swage connector only enough to prevent the PRT from slipping out accidentally.
8. Connect the cable to the rear panel connector on the Pressure Controller chassis labeled PRT.
9. Connect the 11-pin cable between the DWG base and the rear panel connector on the Pressure Controller chassis labeled **Rotation**.

Vacuum Pumps

1. Plug the power cable from the Supply Vacuum Pump (the lower capacity, smaller body pump) to the rear panel electrical outlet on the Pressure Controller chassis labeled SUPPLY VACUUM PUMP.
2. Connect the Supply Vacuum Pump vacuum port to the rear panel connector on the Pressure Controller chassis labeled SUPPLY VACUUM using 3/8 inch or larger tubing. Suitable tubing is included in the optional lines and fittings kit supplied with some systems.
3. Verify that the power switch on the Supply Vacuum Pump is set to ON.
4. Plug the power cable from the Reference Vacuum Pump (the higher capacity, larger body pump) to the rear panel electrical outlet on the Pressure controller chassis labeled REFERENCE VACUUM PUMP.
5. Connect the Reference vacuum Pump vacuum port to the bell jar evacuation port flange on the side of the DWG base.
6. Verify that the power switch on the Reference Vacuum Pump is set to ON.

2465A-200 Pressure Controller Chassis and Computer

1. Connect a regulated pressure supply to the rear connection on the Pressure controller chassis labeled SUPPLY PRESSURE using a pressure line and fittings rated for operation at 1000 psi. Copper tubing and fittings rated for this application are included in the optional lines and fittings kit supplied with some systems.
2. Connect the Device Under Test pressure port to the rear Test Port connection on the Pressure controller chassis using a pressure line and fittings rated for operation at 1000 psi. A flexible line rated to 1000 psi is included in the operational lines and fittings kit supplied with some systems.
3. Connect communication cable between the computer and the rear panel connector on the Pressure Controller chassis labeled RS232.
4. Connect power cord from rear of Pressure Controller chassis to 120 or 230 VAC (nominal), supply as applicable.

Preparation for Use

1. Set power switch on the Pressure Controller to ON.
2. Set power switch on the computer to ON.
3. Adjust the pressure regulator to a setting a few percent greater than the intended operating pressure.
4. Activate WinPrompt calibration software.
5. Switch the computer display to show the 2465 Status window. Verify that all sensors are indicating properly. This may include verification that the correct calibration coefficients are loaded for each sensor.
6. Install a piston into the DWG base and load both parts of mass number 1 onto the piston.
7. Select the PRESSURIZE option from the WinPrompt menu, and pressurize the system to 1 psi if the low range is installed, 4 psi for the mid range piston, and 25 psi if the high range is installed.

8. Push down on the sleeve weight until the piston and sleeve weight are at the bottom of travel. If the FPI indication is within +/-0.005 of -0.200 inch, proceed to step 9. If the FPI sensor reading is outside this limit, perform the FPI alignment as follows:
   a. Activate the CALIBRATE item on the 24365 Status Window Menu, select FPI, then select the 5 POINT CALIBRATION button.
   b. Verify that the value in the ACTUAL field is set to -0.200 inches (or other appropriate value if different engineering units are selected). Press down on the sleeve weight until it is resting against the lower stop, then press OK.
   c. Verify that the value in the ACTUAL field is set to -0.100 inches. Remove the sleeve weight, install the 0.100 inch spacer ring around the pressure column and reinstall the sleeve weight. Press down on the sleeve weight until it is resting against the spacer ring, then press OK.
   d. Verify that the value in the ACTUAL field is set to 0.000 inches. Remove the sleeve weight and the 0.100 inch spacer ring. Install the 0.200 inch spacer ring and the sleeve weight. Press down on the sleeve weight until it is resting against the spacer ring, then press OK.
   e. Verify that the value in the ACTUAL field is set to +0.100 inches. Remove the sleeve weight, install the 0.100 inch spacer ring on top of the 0.200 inch ring, then reinstall the sleeve weight. Press down on the sleeve weight until it is resting against the spacer ring, then press OK.
   f. Verify that the value in the ACTUAL field is set to +0.200 inches. Remove the sleeve weight and the 0.100 inch spacer ring. Install the second 0.200 inch spacer ring on top of the first 0.200 inch ring, then reinstall the sleeve weight. Press down on the sleeve weight until it is resting against the spacer ring, then press OK.
   g. Press OK on the Float Position dialog box. Verify that the FPI indication is correct within +/-0.005 inch of calibration spacer combination. If not, repeat sequence a through g.
9. Select the VENT option from the WinPrompt menu.
10. If the Gauge pressure reading at the bottom of the WinPrompt display exceeds +/-0.20 form 0.00 psi (or equivalent value for other engineering units), zero the sensor before proceeding. To zero the reading select CALIBRATE from the 2465 status window menu, then select PRESSURE. Press the ZERO button, then press ENTER.

Basic Operating Routine

Activate Calibration Routine

Verify that the proper drivers have been loaded in the WinPrompt calibration program. Open an existing, or start a new *.CLB calibration file. The calibration file must include, but is not limited to, a piston and mass set, a pressure sequence (1 pressure point is acceptable), and current values for those process variables not remotely acquired, such as local gravity and head correction parameters.

Note

Float position must be set to DATA ACQUISITION for the AutoFloat System to function properly.

Generating Pressures

1. Select the first pressure in the pressure sequence using the mouse pointer.
2. Click on the FLOAT button and follow the instructions for verifying that the proper piston and masses are installed, then press ENTER.

The AutoFloat System will adjust the system pressure, establish piston float and rotation, and prompt the user via the color change in the status bar at the bottom of the WinPrompt display that the system is at pressure and the controller is inactive.

3. Once sufficient time has passed to allow for stabilization of the system, as indicated by normal float position and sink rate activity, select the CALIBRATION item from the WinPrompt menu, then select ACCEPT READING.
4. Type in the reading from the device under test and press ENTER.
5. Press the FLOAT button when WinPrompt advances to the next pressure in the sequence and repeat the above steps.

When all pressures in the sequence have been generated, the user can print a Default Calibration Report or activate a third-party program and print a Customer Calibration Report that includes links to the current WinPrompt data.

System Shutdown

1. Select VENT from the WinPrompt menu. Once the system is vented to atmosphere, select STOP.
2. Disconnect the test port pressure connection from the device under test.
3. Store all weights and piston/cylinder assemblies in the weight set storage box.
4. SHUT OFF the pressure supply and VENT any trapped gas to atmosphere.
5. If desired, switch power OFF to the Pressure Controller, the Deadweight Gauge and the computer.

Calibration

General

The RUSKA 2465A AutoFloat Controller incorporates electronic sensors used by the WinPrompt software to monitor the status of the deadweight gauge. The sensors and sensor circuits require periodic calibration to ensure continued accuracy of the AutoFloat system. The initial calibration interval is one year for all sensors and circuits, except for float position. The float position alignment should be performed on a monthly schedule.

Some of the sensors are located inside the AutoFloat Controller, while others are external. Some of the external sensors are calibrated separate from the AutoFloat Controller. The other sensors and sensor circuits are calibrated in situ. The in situ calibration routines are accessed from the 2465 Status program. The 2465 Status program is activated when the AutoFloat driver is installed from the WinPrompt Driver menu. The 2465 Status program provides access to the calibration coefficients for all sensors, and provides user screens to facilitate the in situ calibrations.

Specifications for the reference standards and other pertinent information required to perform the sensor and circuit calibrations are included in this section.

In Situ Sensor and Circuit Calibrations

Float Position Sensor

Three calibration spacer rings are provided with the system to facilitate calibration of the float position indication. Refer to Chapter 7, Calibration Menu, of the WinPrompt Users Manual for details on the calibration operations.

Pressure Sensor

Fluke recommends that the Pressure Sensor be calibrated using the AutoFloat system deadweight gauge pressure. Refer to Chapter 7, Calibration Menu, of WinPrompt Users Manual for details on the calibration operations.

Temperature Circuit

The AutoFloat controller includes an electronic circuit for measuring the temperature of the deadweight gauge. This circuit must be calibrated periodically to ensure continued accuracy of the AutoFloat pressure system. The temperature circuit is calibrated using precision external resistors. Refer to Chapter 7, Calibration Menu, of the WinPrompt Users Manual for details on the calibration operations.

Precision external resistors can be supplied by Fluke, or they can be acquired elsewhere. The precision resistors supplied by Fluke are configured with the mating connector to that used on the controller. If other resistors are used, the connections may not be as reliable as using the correct connector. Connect the leads as in Figure 1.

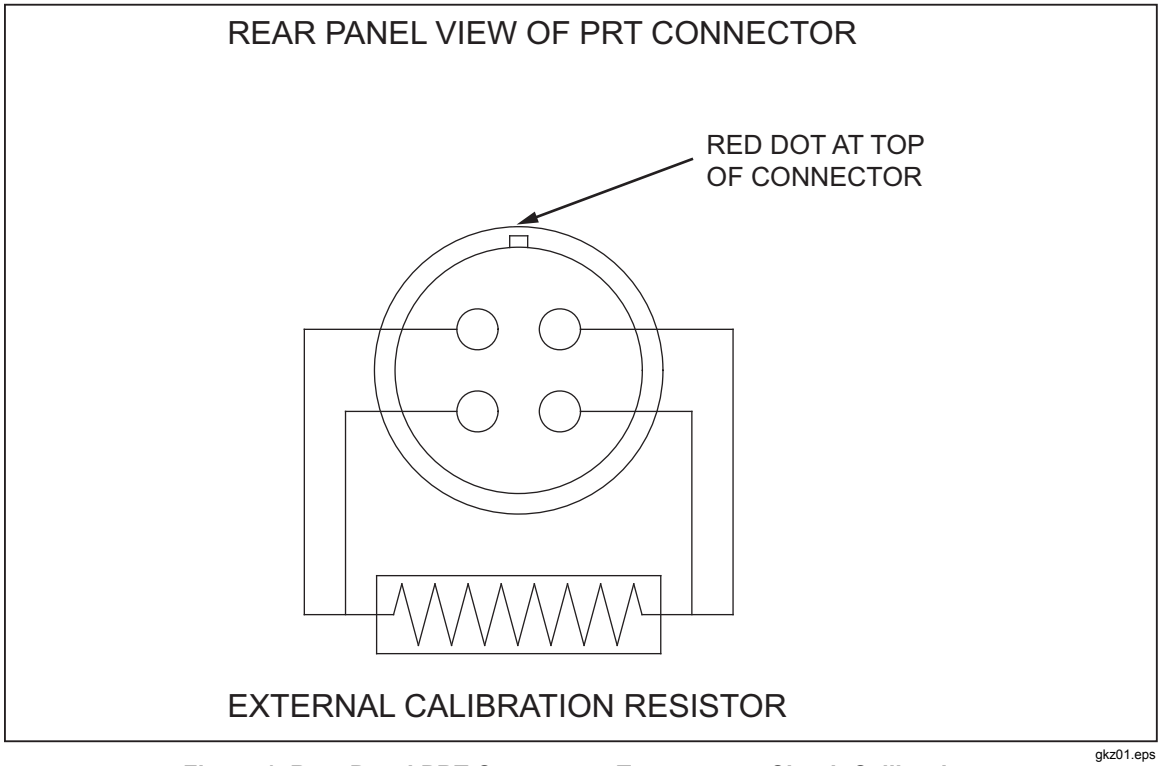

Figure 1. Rear Panel PRT Connector - Temperature Circuit Calibration

Vacuum Circuit

The AutoFloat controller includes an electronic circuit for measuring the vacuum present in the deadweight gauge reference chamber during absolute mode operation. This circuit must be calibrated periodically to ensure continued accuracy of the AutoFloat pressure system. The vacuum circuit is calibrated using a precision external D.C. voltage. Refer to Chapter 7, Calibration Menu, of the WinPrompt Users Manual for details on the calibration operations. Connect the external voltage as shown in Figure 2.

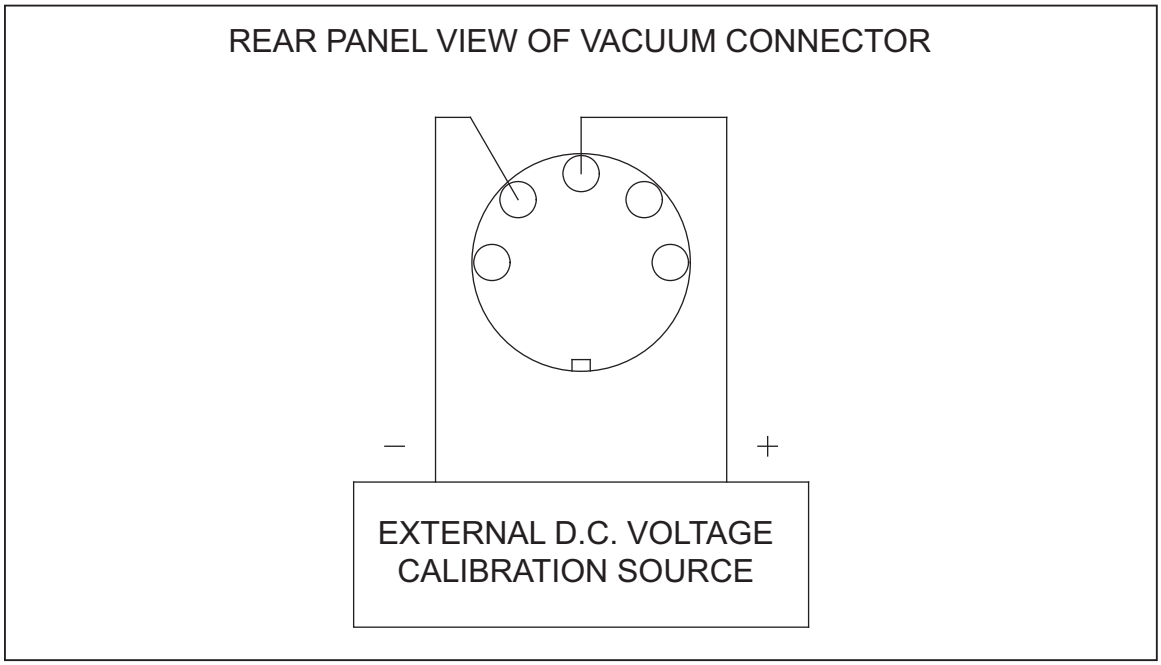

Figure 2. Rear Panel Vacuum Connector - Vacuum Circuit Calibration

Vacuum Sensor and Control Module

The vacuum sensor and control module are calibrated as a set. The sensor and control module are connected to the Auto-float controller after the AutoFloat vacuum circuit has been calibrated as described above. If adjustments to the vacuum sensor and control module are required, they are performed using the potentiometer in the end of the control module.

Rotation Sensor

No calibration or periodic alignment is required for the rotation sensor.

Reference Pressure Sensor

Fluke recommends that the Reference sensor be calibrated using the AutoFloat system deadweight gauge pressure. Refer to Chapter 7, Calibration Menu, in the WinPrompt Users Manual for details on the calibration operations.

Independent Calibrations

PRT Temperature Sensor

The temperature sensor is a conventional 4-wire, 100 ohm PRT, and is calibrated separate from the AutoFloat controller. The calibration of the probe must result in Rtp and a10 coefficients as defined by ITS-90. The PRT resistance is measured using traditional resistive temperature calibration methods. The Rtp and a10 coefficients are computed from the measured resistance values. The Rtp and a10 coefficients are entered into the AutoFloat system memory via the 2465A Status program. See Chapter 7, Calibration Menu, in the WinPrompt Users Manual for details on the calibration operations.

Refer to Figure 3 for the proper pin configuration to measure the PRT resistance.

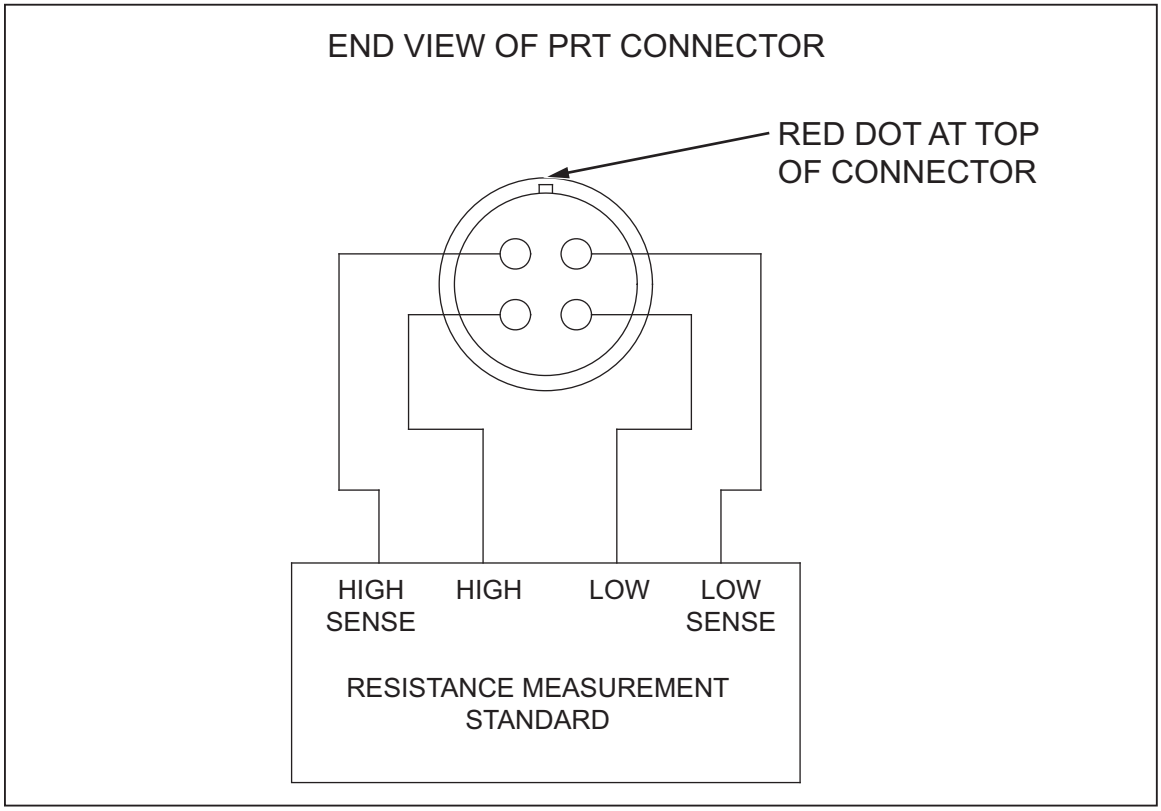

Figure 3. PRT Connector - Resistance Calibration

External Temperature Circuit Calibration Resistors

Precision external resistors are available as an option from Fluke to facilitate calibration of the AutoFloat system temperature circuit. These precision external calibration resistors are supplied with the mating connector to that on the rear panel of the instrument. The part numbers for the external resistors are 2455-11-007 (107 ohm) and 2455-11-008 (111 ohm). These resistors must be calibrated periodically to ensure continued accuracy of the temperature circuit calibrations. The resistors are calibrated using traditional resistance calibration methods suitable for determination of the resistance values to 0.001 ohms. The connections to the resistance standard are the same as for calibration of the PRT, as shown in Figure 3.

Air Density Module

The Air Density Module incorporates three sensors to monitor: Ambient Temperature, Barometric Pressure, and Relative Humidity. Calibration of the temperature and pressure sensors is accomplished by placing the module in a chamber that can safely accommodate temperatures from 18 to 28 degrees Celsius, and absolute pressures from 80 kPa to 114 kPa. The calibration chamber must incorporate an electrical feed-through for sensor power and serial communications. The maximum length for the power/communications cable should be limited to about 0.7 meter.

The applied temperatures should be 18 ^{o}C (+/-0.5 ^{o}C) and 28 ^{o}C (+/-0.5 ^{o}C), and should be known to +/-0.1 ^{o}C. The applied pressures should be 81 kPa (+/-2%) and 112 kPa (+/-2%), and should be known to +/-0.03%. The applied ambient humidity must be known to within 3%RH. Refer to Chapter 7, Calibration Menu, in the WinPrompt Users Manual for details on the calibration operations.

Maintenance

Fuse

F1:	26-255	Fuse	2A	3AB	SLOBLO	Part No. 109181
F2 & F3	26-231	Fuse	10A	3AB	SLOBLO	Part No. 109298

Cleaning

When necessary, clean externally using a damp lint-free cloth and mild liquid detergent.

Specifications

Pressure Ranges:	0.2 – 1000 psi (14 mbar – 70 bar)	
Overpressure Protection:	Relief valve set at 110% FS	
Connections:	Supply Pressure Port:	1/4 NPT
	Test port:	1/4 NPT
	Supply Vacuum:	1/4 NPT
Pressure Medium (test and control gas):	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 ^{o}C, and less than 50 micron particulate size. Although lower quality gas can be used, the frequency of piston/cylinder cleaning will increase.	
Gas Consumption:	Zero at commanded pressure with a leak tight system.	
Pressure Supply:	Low Range:	40 psi
	Low/Mid Range:	115 psi
	Upper Mid Range:	515 psi
	High Range:	1015 psi

Piston Temperature Input:	4 wire 100Ω PRT Accuracy: ±00.1 °C Resolution: 0.01 °C
Float Position Input:	Inductive Sensor Float position resolution 0.001 in (0.002 cm) Sink Rate resolution 0.001 in/min (.001 cm/min)
Vacuum Module Input:	Thermopile Sensor Accuracy 10% of reading or 10 mTorr Resolution: 1m Torr
Laboratory Environment Monitor Input:	(See LEM Users Manual)
Barometric Reference Sensor:	Accuracy +/0.002 psi (0.14 mbar)/year Resolution 0.00015 psi (0.01 mbar)
Computer Interface:	Standard: RS-232
Dimensions:	17" W x 15" D x 7" H (43 x 28 x 18 cm)
Weight:	30 lbs
Electrical Power Inlet:	110 – 120 VAC or 220 – 240 VAC, 50/60 HZ, single phase, 15 AMP MAX (separate part numbers for 115 VAC and 230 VAC) .
Electrical Power Outlet:	110 – 120 VAC or 220 – 240 VAC, 50/60 HZ, Single phase, 7 AMP each
Humidity:	Operating: 20 % – 70 % relative humidity Storage: 0 % – 90 % non-condensing
Temperature:	Operating: 15 °C to 28 °C (59 °F to 82 °F) Storage: -20 °C to 70 °C (-4 °F to 158 °F)
Ingress Protection:	IP 20, Indoor use, Altitude <2000m.
EMC:	EN 61326
Electrical Safety:	EN 61010
Pressure Safety:	Pressure equipment directive — class: Sound Engineering Practice (SEP).