FLUKE®
Calibration

RUSKA 2456

Piston Gauge Monitor

Users Manual

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Product Description

The Ruska 2456 Piston Gauge Monitor (PGM) combines the high precision and low uncertainty of the Ruska Piston Pressure Gauges with the WinPrompt software. All mass load computations and data collection are performed via WinPrompt Calibration Software to provide consistency and efficiency in the calibration routine.

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 Warnings

⚠ 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 hydrocarbon 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.

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 Piston Gauge Monitor.

Symbols used on the Piston Gauge Monitor and in this manual are shown in Table 1.

Table 1. Symbols

Symbol	Description
~	AC (Alternating Current)
⏚	Earth Ground
⚠	Important Information: refer to manual
⚠	Shock Hazard
	Do not dispose of this product as unsorted municipal waste. Go to Fluke's website for recycling information.

Overview

The primary function of the Ruska 2456 Piston Gauge Monitor is to provide accurate measurements and indications of float positions and sink rates for the mass platters used on piston pressure gauges manufactured by Fluke and other suppliers. The Ruska 2456 PGM provides an interface between the sensors on a piston pressure gauge and a PC. The WinPrompt software provides graphic as well as numeric display of the sensor data. In addition to this, it performs calculations for Pressure to Mass calibrations as well as Mass to Pressure calculations. With the appropriate options, the instrument is capable of simultaneously measuring float position from two separate locations on each of two different piston pressure gages.

Although the Ruska 2456 PGM 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.

The Ruska 2456 PGM has many additional standard and optional features which further assist the metrologist in obtaining the highest possible accuracy from piston pressure gages, while simplifying the process of taking data. These features are discussed below.

Features

The following features are standard in every PGM.

Float Position Indicator Calibration Performed in Software

There are no potentiometers and no interacting manual adjustments to be made in order to calibrate the position sensors. The user simply places precision calibration disks between the sensor and the mass platter and enters the resulting position via a front panel keypad. The internal microprocessor computes linearization coefficients, during calibration, and stores them in memory for use in accurately calculating and displaying float position and sink rate.

User Selectable Float Position Functions

Using the WinPrompt software, the user can select the number of position sensors to be activated, up to the number of sensors installed. When two position sensors are installed 180 degrees apart, on a single piston pressure gage, the user may select whether to read position information from only one sensor or to read both sensors and average the readings. The averaging procedure can virtually eliminate any variation in indicated position resulting from run-out in the rotating mass platters.

Support for RTD Temperature Sensors

Input circuitry is available for use with platinum resistance temperature sensors (2 sensors in the dual channel unit). Generally, a temperature probe is installed in the piston pressure gage near the cylinder to provide a measurement of the piston/cylinder temperature. This information can be used to calculate a correction factor for the piston's effective area, when the highest available accuracy is required.

Support for 2456-VAC Vacuum Sensor Option

Input connectors are available for use with a vacuum sensor (2 sensors in the dual channel unit). This information is easily accessible to the user and allows for the generation of a correction factor.

Choice of Measurement Units

The user can select from a variety of engineering units for each of the displayed measurements.

Choice of Operating Voltage and Power Cord

The Ruska 2456 utilizes a power supply which will accept AC voltages ranging from 85 to 250 VAC and between 47 to 63 Hz. The power receptacle accepts the standard IEC-320 power connector, allowing the use of any nation's standard power cord. This power supply setup is very versatile and eliminates the need to select the required operating voltage.

Serial Interface

An RS-232 serial interface allows the Ruska 2456 to connect to the serial port of any standard PC.

Non-Volatile Memory

All of the user's calibration coefficients are stored in a non-volatile semiconductor memory, and are restored when the system is powered on.

Accessories and Options

The standard single channel Ruska 2456 PGM has capabilities of measuring two float position indicators, one RTD, one vacuum gauge, and a Laboratory Environment Monitor.

The Ruska 2456 Dual Channel PGM has capabilities of measuring two pairs of float position indicators, two RTDs, two vacuum gauges, and a Laboratory Environment Monitor.

The PGM is supplied with the number of position sensors specified by the user, a power cord specified by the user, WinPrompt software and a user's manual. Before the PGM can be used, the correct number and appropriate position and temperature sensors must be installed on the piston pressure gauges and connected to the PGM. These items are normally ordered for a specific piston pressure gauge, since the mountings generally differ according to the type of gauge used.

Air Density Interface

An optional air density module is available for use with the PGM. It connects to the PGM's rear panel, and can furnish data on the ambient pressure, temperature, and humidity. This data is normally used in correcting for the air buoyancy effects acting on the mass platters.

Maintenance

The Ruska 2456 contains no user serviceable parts and is virtually maintenance free. The float position, vacuum sensor, and temperature calibrations are the only routines necessary to keep the system operating within specifications, unless the unit is equipped with an auxiliary barometric pressure sensor. This is often referred to as the simulated absolute option. If your unit is equipped with this option, it will require periodic calibration.

Do not attempt to correct an internal problem. Instead, contact Fluke and report the problem. When contacting Fluke, be prepared to furnish the serial number and version of the Ruska 2456 software as well as the version of the WinPrompt software. The revision level of the software within the Ruska 2456 is displayed under the “2456 Status” window. Upon startup, this window is minimized at the bottom of the screen.

Setup

As with the installation of ANY piston pressure standard, the gauge and gauge monitor 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 conditioner vents, heaters and exterior windows. Drafts due to air handlers and personnel traffic are also undesirable. To prepare the system for operation, use the following guide to make the connections between the various system components.

⚠ Warning

Turn off the power of the Ruska 2456 and PC before making any connections.

All connections are made to the rear panel of the Ruska 2456 PGM. If a sensor is not present in your system, disregard that step.

Install all sensors on the piston pressure gauge per the manufacturer's recommendations.

Vacuum Gauge

Connect the vacuum sensor cable to the port on the PGM labeled "VACUUM GAUGE".

Float Position Sensors

Connect the float position sensor cable(s) to the BNC connections labeled "FLOAT POSITION SENSORS 1 & 2". If only one sensor is used, connect it to the #1 BNC connector.

Platinum Resistance Thermometer (PRT)

Connect the PRT to the port labeled "TEMP. SENSOR".

Computer Communications Connection

Connect the PC with a standard 9 pin serial cable. ATTACH TO THE CONNECTION LABELED "HOST COMPUTER, RS-232". If the instrument is a dual channel PGM, you must connect two serial cables to the host computer. At the host computer, the serial interface is configured as follow:

Baud	9600
Parity	None,
Bits	8
Stop bits	1

Air Density Module/Laboratory Environmental Monitor

⚠ Caution

Do not attempt to connect a ADM (Air Density Module) to the back of the Ruska 2456 if it has a 9 pin connector.

⚠ Caution

Do not attempt to connect a LEM (Laboratory Environmental Monitor) to the back of the Ruska 2456 if it has a 25 pin connector.

Inspect the "AIR DENSITY MODULE" port on the back of your Ruska 2456.

If the "Air Density Module" port has a 9 pin connector (DB-9S), your Ruska 2456 is configured for use with the LEM module.

If the "Air Density Module" port has a 25 pin connector (DB-25S), your Ruska 2456 is configured for use with the ADM module.

The LEM is a newer, more accurate version of the ADM. The ADM communicates with analog signals, the LEM communicates with digital signals (RS-485).

Do not attempt to use a 9 to 25 adapter to make this connection. This change will require a change in internal cabling of the Ruska 2456.

If your Ruska 2456 is not configured for the environmental device you would like to use, please consult Fluke for retrofit information.

Verify that the power is turned "OFF" prior to connecting or disconnecting your environmental device.

If connecting an ADM, attach the Air Density Module to the port labeled "AIR DENSITY MODULE". Use the "ADM Cable" provided with the Air Density Module.

If connecting a LEM, first verify that the LEM is set for RS-485 communications. Attach the LEM to the port labeled "AIR DENSITY MODULE". Use the 9 pin communications cable provided with the LEM. The LEM will receive power from the Ruska 2456. The AC adaptor which is shipped with the LEM is only required for stand-alone applications of the LEM.

Power Supply

The Power Supply in the PGM is capable of accepting most standard AC voltage sources. These ratings include all values between 85 and 250 VAC between 47 and 63 Hz. There are no settings required of the user to specify the input voltages. The PGM should not be operated at voltages outside the range of 85 to 250 VAC.

Power Connector / Fuse

The back panel provides a standard IEC-320 fused connector which accepts most nation's standard power cord. The fuse is 250 VAC nominal, 1 Amp, slow blow fuse. This fuse holder will accept either a U.S. style or European style fuse.

Power Up

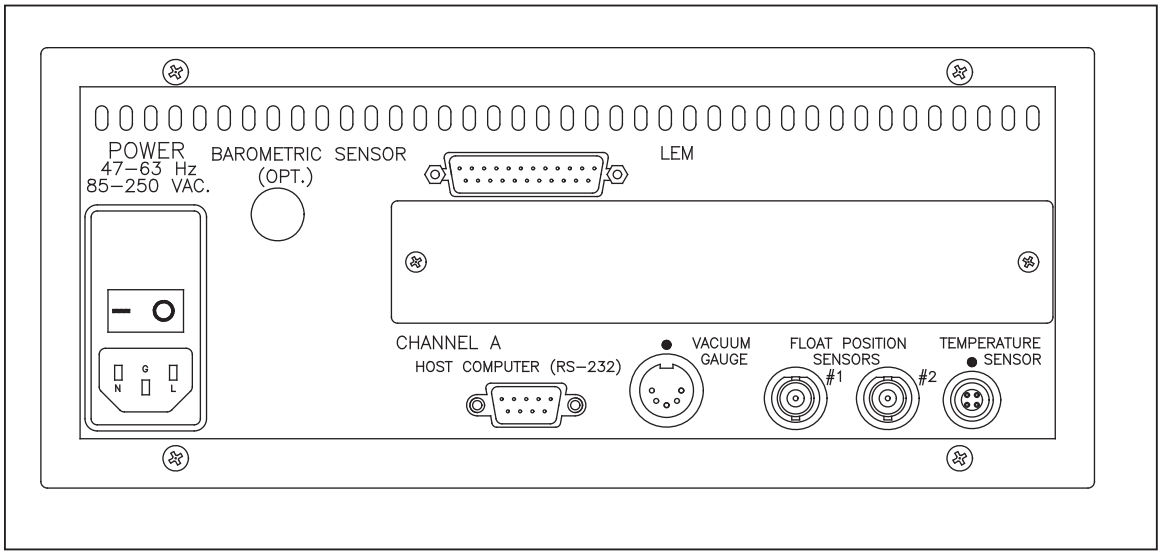
Verify that the power switch on the back panel is in the OFF position, which is designated by the numeral zero.

With the power cord disconnected at both ends, plug the power cord into the back panel connector and then into an acceptable power outlet.

Turn on the PGM by flipping the rocker switch to the ON position.

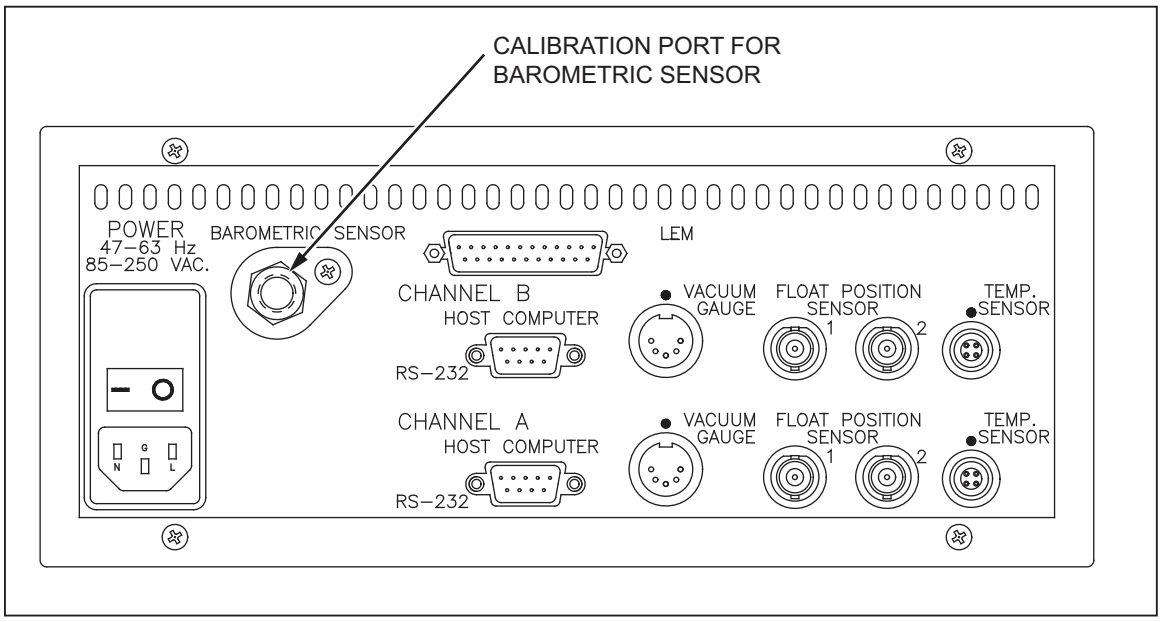
⚠ Warning

Turn off the power of the Ruska 2456 and PC before making any connections.



gmc02.eps

Figure 1. Rear View - Single Channel Ruska 2456



gmc06.eps

Figure 2. Rear View - Dual Channel Ruska 2456 with Optional Barometric Reference Sensor for Simulated Absolute Calibrations

Preparation and Operation

For best results, first read and understand the WinPrompt manual.

Please be advised of the following notes while reading the WinPrompt manual.

The 2455 DFPI was the predecessor to the Ruska 2456 PGM, when the software manual refers to the DFPI, it is also referring to the PGM.

The WinPrompt software is also used with the Ruska 2465A Autofloat System. In the AutoFloat application, the software has the capability to control the Ruska 2465 gauge through the Ruska 2465 AutoFloat controller. When using the software with the Ruska 2456, please disregard any references to the automated functions e.g. "vent", "float weights", "rotation sensing", etc.

Preparing to Perform a Calibration

With the PGM and the host computer switched on, activate the WinPrompt software.

If sensors are not "turned on" go to the "Remote Acquisition" menu under "Setup" on the main tool bar (see the WinPrompt manual, Chapter 6, Setup Remote Acquisition). Change the appropriate sensor inputs from "constant" to "Data Acquisition". For Float position, be sure to specify whether there are one or two float sensors in use.

Switch the computer display to show the Ruska 2456 status window. This window will be minimized at the bottom of the screen on startup. Verify all sensors are indicating properly. This includes verification that the correct calibration coefficients are loaded for each sensor. For help with this step, see Chapter 6 of the WinPrompt manual.

To calibrate the sensors connected to your Ruska 2456 PGM, please see Chapter 4, Calibration, of this manual.

Input piston/cylinder data and mass set data as described in the WinPrompt manual, Chapter 2, Getting Started.

Operation

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. The user pressurizes the system and establishes the proper piston float and rotation. 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. For a list of the DDE commands, see Appendix C of the WinPrompt User's Manual.

Calibration

The Ruska 2456 Piston Gauge Monitor (PGM) 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 PGM. 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.

All sensors are calibrated without disassembly of the PGM. Some of the sensors are calibrated separate from the PGM. Other sensors and sensor circuits are calibrated in situ. The in situ calibration routines are accessed from the Ruska 2456 Status program. The Ruska 2456 Status program is activated when the PGM driver is installed from the WinPrompt Driver menu. The Ruska 2456 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 Chapter. Operation of the Ruska 2456 Status program is presented in Chapter 9 of the WinPrompt User's Manual.

In Situ Sensor and Circuit Calibrations

Float Position Sensor

It is recommended that the Float position sensors be recalibrated monthly and re-zeroed weekly.

The calibration procedure for the Float Position Sensors varies slightly depending on the instrument the PGM is monitoring.

PGM Connected to a Ruska 2465 Pneumatic Gauge

The float position calibration is performed using the three calibration spacer rings found in the Ruska 2465 setup kit. This kit should contain two pieces each of the 2465-87-1 and one of the 2465-87-2. The 2465-87-1 is 0.508 cm (0.2 inches) thick and the 2465-87-2 is 0.254 cm (0.1 inches) thick. Using different combinations of these 3 rings, the user is able to establish five different float positions.

PGM Used with Gauges Other Than the Ruska 2465

The float position calibration is performed using the four plastic calibration spacers and FPI disk found in the TBD kit. This kit comes with the 2456. The kit contains two spacers with a nominal thickness of 0.63 cm (0.25 inches), one spacer with a nominal thickness of 0.32 cm (0.12 inches), and one spacer with a nominal thickness of 0.16 cm (0.06 inches). It also has a metal target disk that the sensor can read.

Because these spacers are of nominal thickness, their actual thickness must be measured and recorded prior to use. Measure the thickness of each of the plastic calibration spacers and make note of the thickness.

Measure the spacers and fill out the following work sheet*

Table 2. Spacer Thickness Worksheet

Technician:	**Date:**

Spacer	**Nominal Thickness Cm (in)**	**Actual Measured Thickness Units: _____**
RED	0.15 (0.06)	_____
CLEAR	0.30 (0.12)	_____
BLUE #1	0.60 (0.24)	_____
BLUE #2	0.60 (0.24)	_____

It is recommended that these measurements be checked on a 5 years cycle.

*These spacers are shipped from the factory with a protective film on the large faces of the spacer, be sure to remove and discard that film prior to measuring the spacers.

Float Position Calibration for a Gauge with 0.63 CM (0.25 Inches) of Travel

Begin by completing the following work sheet. This worksheet calculates the five calibration points and spacer combinations to achieve these points.

Table 3. Worksheet Calculations of 5 Calibration Points - 0.63 CM (1/4 Inch) Travel

Technician:		**Date:**	
Point	**Nominal Calibration Points Cm (in)**	**Spacer Combination for Nominal Calibration Points**	**Sum of Disk Measurements Units = _____**
#1	0.30 (0.12)	CLEAR DISK _____	= _____
#2	0.45 (0.18)	RED DISK + CLEAR DISK _____ + _____	= _____
#3	0.60 (0.24)	BLUE DISK #1 _____	= _____
#4	0.75 (0.30)	BLUE DISK #1 + RED DISK _____ + _____	= _____
#5	0.90 (0.36)	BLUE DISK #1 + CLEAR DISK _____ + _____	= _____

Adjust the float position sensor such that it is 0.30 cm +/-0.05 cm (0.12 +/- 0.02 inches) below the bottom mass platter when that platter is in it's lowest (un-pressurized) position.

Remove the bottom mass platter from the gauge.

If the gauge is equipped with two float position sensors, first calibrate one, then repeat the calibration for the second. After both are calibrated set the software to average their values.

1. Activate the Calibrate item on the Ruska 2456 Status Window menu, select FPI, select the 5-Point calibration button.
2. Change the value in the Actual field to that listed for point #1 in the travel calculation work sheet. Place the clear spacer on top of the float position sensor, place the metal FPI calibration disk on top of the clear calibration disk and press OK.
3. Change the value in the Actual field to that listed for point #2 in the travel calculation work sheet. Remove the FPI calibration disk from the float sensor and stack the red calibration spacer on top of the clear spacer. Reinstall the metal FPI Calibration Disk. Press OK.
4. Change the value in the Actual field to that listed for point #3 in the travel calculation work sheet. Remove the FPI calibration disk and the two spacers from the float sensor. Place the blue calibration spacer on the float position sensor. Reinstall the metal FPI Calibration Disk. Press OK.

5. Change the value in the Actual field to that listed for point #4 in the travel calculation work sheet. Remove the FPI calibration disk from the float sensor and stack the red calibration spacer on top of the blue spacer. Reinstall the metal FPI Calibration Disk Press OK.
6. Change the value in the Actual field to that listed for point #5 in the travel calculation work sheet. Remove the FPI calibration disk and red spacer from the float sensor. Stack the clear calibration spacer on top of the blue spacer. Reinstall the metal FPI Calibration Disk. Press OK.
7. Press OK on the Float Position dialog box. Verify that the FPI indication is correct by retrying spacer combinations of the calibration spacer combination. If not, repeat sequence 1 through 7.

After FPI has been calibrated, perform FPI zeroing procedure as described below.

Float Position Calibration for a Gauge with 1.2 CM (0.5 Inches) of Travel

Begin by completing the following work sheet. This worksheet calculates the five calibration points and spacer combinations to achieve these points.

Table 4. Worksheet Calculation of 5 Calibration Points - 1.3 CM (1/2 Inch) Travel

Technician:		Date:	
Point	**Nominal Calibration Points Cm (in)**	**Spacer Combination for Nominal Calibration Points Units: _____**	**Sum of Disk Measurements Units: _____**
#1	0.30 (0.12)	CLEAR _____	= _____
#2	0.60 (0.24)	BLUE #1 + RED _____ + _____	= _____
#3	0.90 (0.36)	BLUE #1 + CLEAR + RED _____ + _____ + _____	= _____
#4	1.20 (0.48)	BLUE #1 + BLUE #2 + RED _____ + _____ + _____	= _____
#5	1.50 (0.60)	BLUE #1 + BLUE #2 + CLEAR + RED _____ + _____ + _____ + _____	= _____

Adjust the float position sensor such that it is 0.15 cm +/-0.05 cm (0.06 +/- 0.02 inches) below the bottom mass platter when that platter is resting on the lower travel stop (un-pressurized position).

Remove the bottom mass platter from the gauge.

If the gauge is equipped with two Float position sensors, first calibrate one, then repeat the calibration for the second. After both are calibrated set the software to average their values.

1. Activate the Calibrate item on the 2456 Status Window menu, select FPI, select the 5-Point calibration button.
2. Change the value in the Actual field to that listed for point #1 in the travel calculation work sheet. Place the clear spacer on top of the float position sensor, place the metal FPI calibration disk on top of the clear calibration disk and press OK.
3. Change the value in the Actual field to that listed for point #2 in the travel calculation work sheet. Remove the FPI calibration disk from the float sensor and place the Blue #1 and red spacers on top of the float position sensor. Reinstall the metal FPI Calibration Disk. Press OK.
4. Change the value in the Actual field to that listed for point #3 in the travel calculation work sheet. Remove the FPI calibration disk from the float sensor. Place the Clear calibration disk on top of the Red and Blue #1 calibration spacers. Reinstall the metal FPI Calibration Disk. Press OK.
5. Change the value in the Actual field to that listed for point #4 in the travel calculation work sheet. Remove the FPI calibration disk from the float sensor. Remove the clear calibration spacer from the float sensor. Stack the Blue #2 calibration spacer on top of the Blue #1 and Red calibration spacers. Reinstall the metal FPI Calibration Disk. Press OK.
6. Change the value in the Actual field to that listed for point #5 in the travel calculation work sheet. Remove the FPI calibration disk from the float sensor. Stack the clear calibration spacer on top of the Red, Blue #1 and Blue #2 calibration spacers. Reinstall the metal FPI Calibration Disk. Press OK.
7. Press OK on the Float Position dialog box. Verify that the FPI indication is correct by retying spacer combinations of the calibration spacer combination. If not, repeat sequence 1 through 7.

After FPI has been calibrated, perform FPI zeroing procedure as described below.

Float Position Zero Procedure Ruska 2485

On the Ruska 2485, mid-float is defined as 0.125 inches above the bottom of travel. To perform the zero adjustment for the float position sensor(s), we would do as follows:

1. Install the piston/cylinder assembly and sleeve weight (hanger mass) and mass platter #2.Verify that the sleeve & mass platter are resting on the lower travel stop.
2. Activate the Calibrate item on the Ruska 2456 Status Window menu, select FPI, then select the Zero button. Change the value in the Actual field to -0.125 inches. Press OK on the Float Position dialog box.

3. Verify that the FPI indication is correct by floating the weights to the top of travel. At the top of travel, the reading should be approximately 0.13 inches. Next, float the weights at mid-float (0.0 inches). The Mid-float position should roughly correspond to the mid-float scribe line on the rotation sleeve. De-pressurize the gauge and bring the weights down until they are resting on the lower travel stop. The reading should be -0.125 inches. If the reading does not correspond to these points to within +/- 0.030 inches, repeat steps 1 through 3.

Float Position Zero Procedure, General (the First Time)

1. Activate the Calibrate item on the Ruska 2456 Status Window menu, select FPI, then select the Zero button. Pressurize the system and float the bottom mass platter. Adjust the float position of the mass platter until it corresponds to the Mid-float line on the column. Verify that the value in the Actual field is 0.00. Press OK on the Float Position dialog box.
2. Carefully pressurize the system until the P/C & masses are against the upper travel stop. In the chart below, make note of the Upper float position reading displayed on by the software.
3. Lower the system pressure until the masses are resting on the lower travel stop. In the chart below, make note or the Lower float position displayed by the software.

Table 5. Chart for Recording Float Position

Gauge #1		
Technician:	Date:	Gauge S/N:
Reading at Upper travel stop:		Units:
Reading at Lower travel stop:		Units:

Gauge #2		
Technician:	Date:	Gauge S/N:
Reading at Upper travel stop:		Units:
Reading at Lower travel stop:		Units:

Gauge #3		
Technician:	Date:	Gauge S/N:
Reading at Upper travel stop:		Units:
Reading at Lower travel stop:		Units:

Gauge #4		
Technician:	Date:	Gauge S/N:
Reading at Upper travel stop:		Units:
Reading at Lower travel stop:		Units:

This data will be useful when recalibrating the Float Position Sensors in the future.

Float Position Zero Procedure the Subsequent Times

1. Activate the Calibrate item on the Ruska 2456 Status Window menu, select FPI, then select the Zero button. The bottom mass platter should be in place and resting on the lower travel stop. Verify that the value in the Actual field is the same as indicated on the “Reading at Lower Travel Stop” on the chart dialog box. If it is not, key this value in. Press OK on the Float Position dialog box.
2. Carefully pressurize the system until the P/C & masses are against the upper travel stop. Verify that the float position reading displayed agrees with the value from the chart of the “Reading at Upper Travel Stop”. If it does not agree, within +/- 0.012 cm (.030 inches), repeat the instructions in the section “Float Position Zero Procedure, General”.

Temperature Circuit

The PGM includes an electronic circuit for measuring the temperature of the deadweight gauge. This circuit must be calibrated periodically to ensure continued accuracy of the temperature data. The temperature circuit is calibrated using precision external resistors. Refer to Chapter 9, Temperature, of the WinPrompt User's Manual for details on the calibration operations.

Precision external resistors are available as an option from Ruska to facilitate calibration of the PGM 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, these connections are shown in Figure 3. It is recommended that the temperature circuits be recalibrated on a yearly cycle.

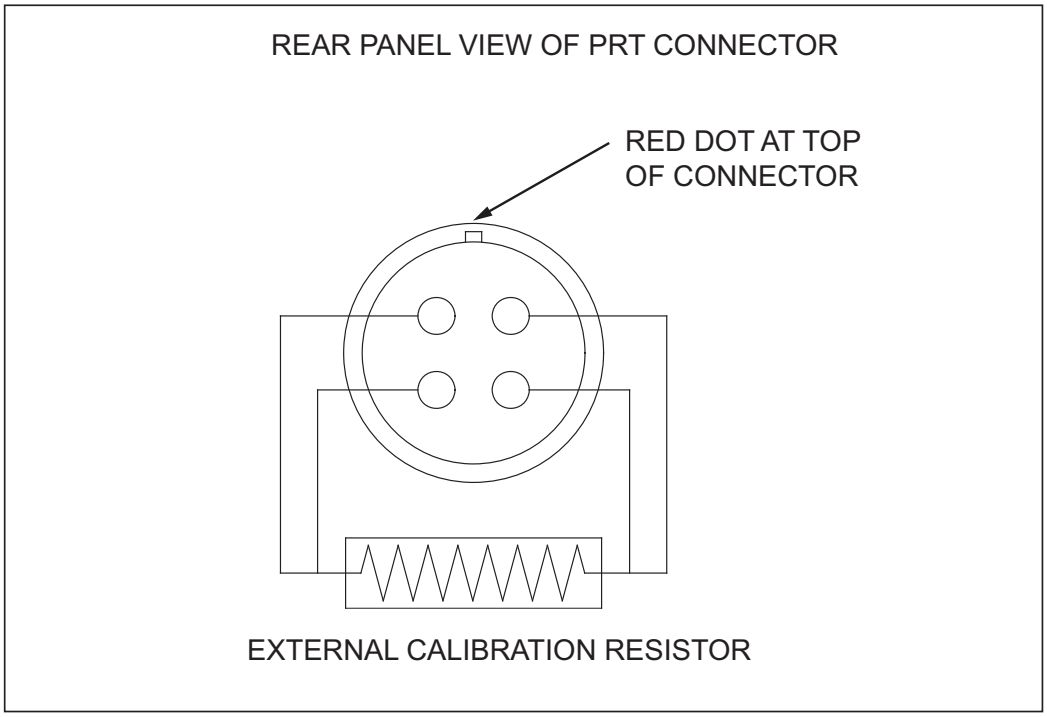


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Figure 3. Connections to Rear Panel PRT Connector

Vacuum Circuit

The PGM 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 vacuum data. The vacuum circuit is calibrated using a precision external D.C. voltage. Refer to Chapter 9, Vacuum, of the WinPrompt User's Manual for details on the calibration operations. Connect the external voltage source as shown in Figure 4. It is recommended that the Vacuum circuits be recalibrated on a yearly cycle.

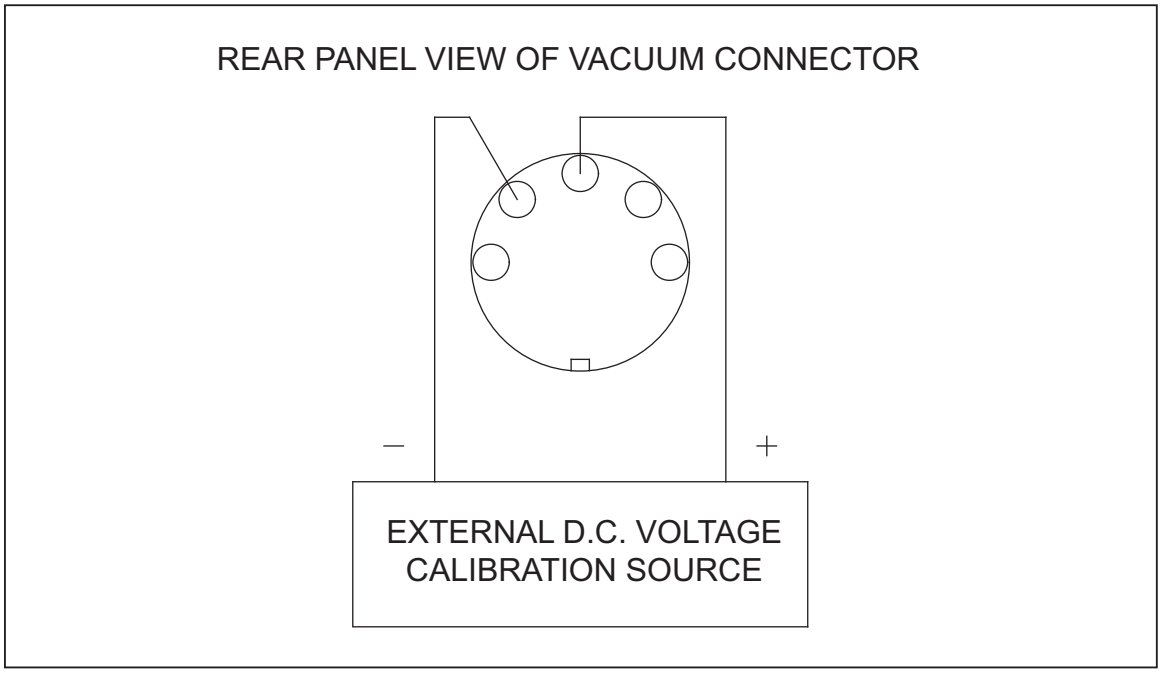

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Figure 4. Connections to Rear Panel Vacuum Connector for Vacuum Circuit Calibration

Vacuum Sensor and Electronic Module

The vacuum sensor and control module are calibrated as a set. The sensor and electronic module are connected to the PGM after the vacuum circuit has been calibrated as described above. If adjustments to the vacuum sensor and electronic module are required, they are performed using the potentiometer in the end of the control module. It is recommended that the Vacuum sensor and electronic module be recalibrated on a yearly cycle.

Independent Calibrations

PRT Temperature Sensor

The temperature sensor is a conventional 4-wire, 100 ohm PRT, and is calibrated separate from the PGM. 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 PGM memory via the Ruska 2456 Status program. Refer to Chapter 9, Temperature, of the WinPrompt User's Manual for details on the calibration operations. Refer below to Figure 5 for the proper pin configuration to measure the PRT resistance. It is recommended that the PRT(s) be recalibrated on a yearly cycle.

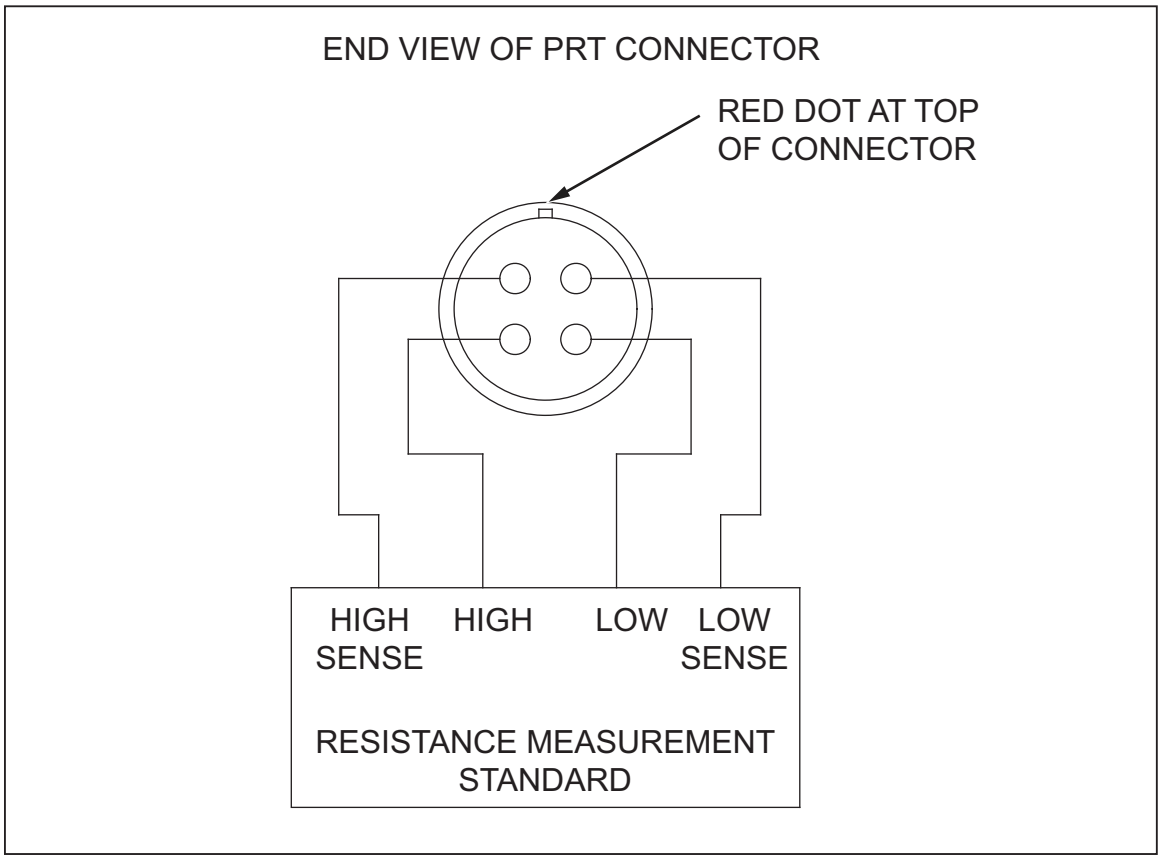

Figure 5. Connections to PRT for Resistance Calibration

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 ºC (+/-0.5 ºC) and 28 ºC (+/-0.5 ºC), and should be known to +/-0.1 ºC. 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 Chapters 9, Air Density Measurement, Ambient Temperature (applies only to 2455-ADM), Ambient Pressure (applies only to 2455-ADM) and Humidity (applies only to 2455-ADM) of the WinPrompt User's Manual for details on the calibration operations. It is recommended that the Air Density Module be recalibrated on a yearly cycle.

Laboratory Environmental Monitor

The Laboratory Environmental Monitor is the newer version of the Air Density Module. Please consult the Laboratory Environmental Monitor Manual for information regarding its calibration.

Float Position Calibration Example for a Ruska 2485

Spacer Measurements

Table 6. Spacer Measurements

Spacer	Nominal Thickness Cm (in)	Actual Measured Thickness Units: Inches
RED	0.15 (0.06)	0.061
CLEAR	0.30 (0.12)	0.116
BLUE #1	0.60 (0.24)	0.211
BLUE #2	0.60 (0.24)	0.206

Table 7. Calculation of 5 Calibration Points for Piston with .63 cm (1/4 Inch) Travel

Point	Nominal Calibration Points Cm (in)	Spacer Combination for Nominal Calibration Points	Sum of Disk Measurements Units: = Inches
#1	0.30 (0.12)	CLEAR DISK 0.116	= 0.116
#2	0.455 (0.18)	RED DISK + CLEAR DISK 0.061 + 0.116	= 0.177
#3	0.60 (0.24)	BLUE DISK #1 0.211	= 0.211
#4	0.75 (0.30)	BLUE DISK #1 + RED DISK 0.211 + 0.061	= 0.272
#5	0.90 (0.36)	BLUE DISK #1 + CLEAR DISK 0.211 + 0.116	= 0.327

Adjust the float position sensor such that it is 0.30 cm +/-0.05 cm (0.12 +/- 0.02 inches) below the bottom mass platter when that platter is in its lowest (un-pressurized) position.

Remove the bottom mass platter from the gauge.

If the gauge is equipped with two Float position sensors, first calibrate one, then repeat the calibration for the second. After both are calibrated set the software to average their values.

1. Activate the Calibrate item on the Ruska 2465 Status Window menu, select FPI, then select the 5-Point calibration button.
2. Change the value in the Actual field is set to 0.116 inches. Place the clear spacer on top of the float position sensor, place the metal FPI calibration disk on top of the clear calibration disk and press OK.
3. Change the value in the Actual field is set to 0.177 inches. Remove the FPI calibration disk from the float sensor and stack the red calibration spacer on top of the clear spacer. Reinstall the metal FPI Calibration Disk. Press OK.
4. Change the value in the Actual field is set to 0.211 inches. Remove the FPI calibration disk and the two spacers from the float sensor. Place the blue calibration spacer on the float position sensor. Reinstall the metal FPI Calibration Disk. Press OK.
5. Change the value in the Actual field is set to 0.272 inches. Remove the FPI calibration disk from the float sensor and stack the red calibration spacer on top of the blue spacer. Reinstall the metal FPI Calibration Disk. Press OK.
6. Change the value in the Actual field is set to 0.327 inches. Remove the FPI calibration disk and red spacer from the float sensor. Stack the clear calibration spacer on top of the blue spacer. Reinstall the metal FPI Calibration Disk. Press OK.
7. Press OK on the Float Position dialog box. Verify that the FPI indication is correct by retying spacer combinations of the calibration spacer combination. If not, repeat sequence 1 through 7.

Float Position Zero Procedure

On the Ruska 2485, mid-float is defined as 0.125 inches above the bottom of travel. To perform the zero adjustment for the float position sensor(s), we would do as follows:

1. Install the piston/cylinder assembly and sleeve weight (hanger mass) and mass platter #2. Verify that the sleeve & mass platter are resting on the lower travel stop.
2. Activate the Calibrate item on the Ruska 2456 Status Window menu, select FPI, then select the Zero button. Change the value in the Actual field to 0.125 inches. Press OK on the Float Position dialog box.
3. Verify that the FPI indication is correct by floating the weights to the top of travel. At the top of travel, the reading should be approximately 0.13 inches. Next, float the weights at mid float (0.0 inches) this position should roughly correspond to the mid-float scribe line on the rotation sleeve. De-pressurize the gauge and bring the weights back down until they are resting on the lower travel stop. The reading should be -0.125 inches. If the reading does not correspond to these points to within +/- 0.030 inches, repeat steps 1 through 3.

Use of the Universal FPI & RTD Kit

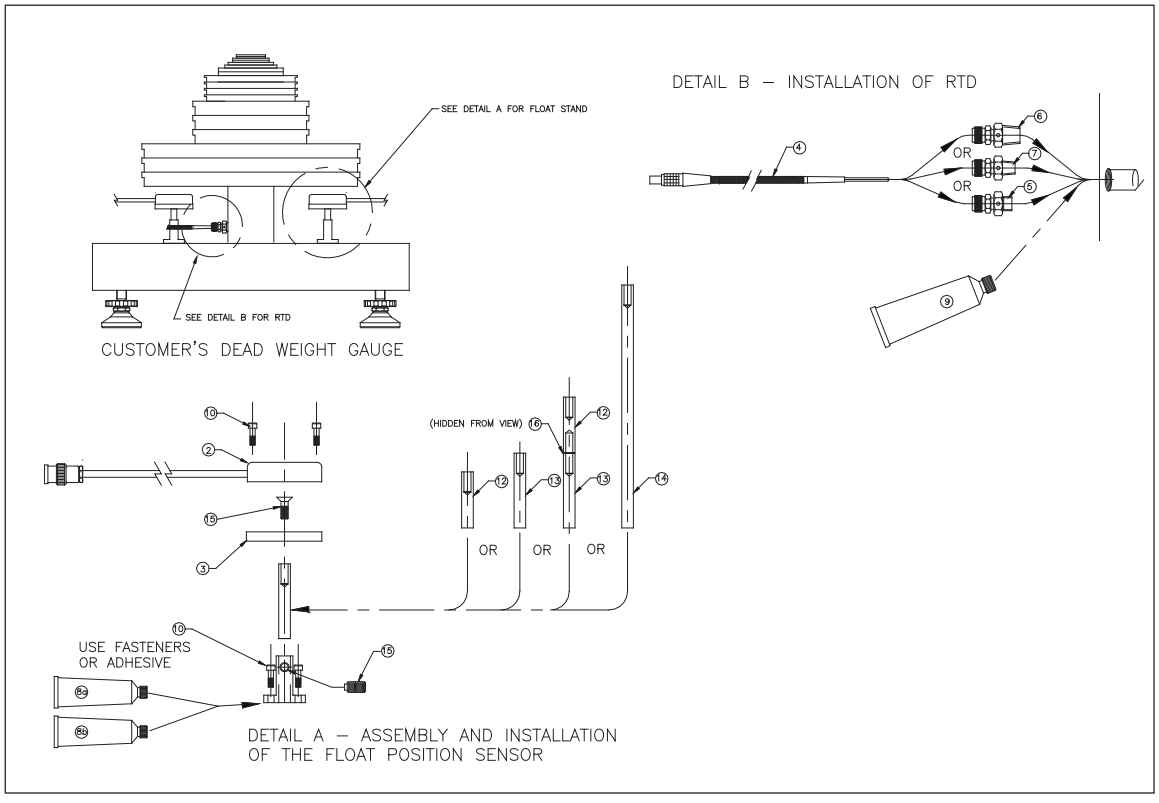

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Figure 6. Universal Kit Float Position Indicator and RTD