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FLUKE®
Calibration

RUSKA Series 3990

Manual Pressure Control Packs

Users Manual

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Introduction

This manual contains operation and routine and preventive maintenance instructions for the RUSKA Series 3990-801 (1000 psi maximum working pressure) and 3990-803 (3000 psi maximum working pressure) manufactured by Fluke. This section of the manual provides general information about the 3990-801 and 3990-803 Manual Pressure Control Packs and presents its features and options.

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

Safety Summary

The following are general safety precautions that are not related to any specific procedures and do not appear elsewhere in this publication. These are recommended precautions that personnel must understand and apply during equipment operation and maintenance to ensure safety and health and protection of property.

Compressed Gas

Use of compressed gas 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.

Do Not Service or Adjust Alone

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

⚠Warning

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

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 Manual Pressure Control Packs.

Symbols used on the RUSKA Series 3990 and in this manual are explained in Table 1.

Table 1. Symbols

Symbol	Description
⏚	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.

General Information

The 3990-801 and 3990-803 Manual Pressure Control Packs are typically used in conjunction with the Gas Lubricate Deadweight Piston Gauge (DWG) to establish highly accurate pressures. Precise control of output pressure is achieved by the incorporation of RUSKA's 3893-801 Precise Pressure Controller into the design of the 3990-801 and 3990-803. Detailed information about the Precise Pressure Controller is available the Precise Pressure Controller section of this manual.

Standard Equipment

The 3990-801 and 3990-803 are self-contained pressure control devices. All other pneumatic system components and connections must be provided by the customer. Select components, such as the RUSKA 2465A-754 Gas Piston Gauge, are available from Fluke Calibration and will be used when describing the correct operation of the 3990-801 and 3990-803 Manual Pressure Control Packs.

Features

The following features are standard on all 3990-801 and 3990-803 Controllers:

- Precise control of pressure and vacuum
- All pressure and vacuum parts located on the back panel
- Dial type test pressure gauge, located on front panel
- Large, easy to use pressure adjustment knob
- Single valve switching positive gauge to vacuum (negative gauge) mode

Theory of Operation

This portion of the manual will describe the correct pneumatic system configuration required for use of the 3990-801 and the 3990-803 in each of their operational modes. In general, the DWG regulates a differential pressure between the top and bottom of the piston that is proportional to the weight load on the piston. Depending on the reference pressure, the test port pressure is commonly referred to as Gauge or Absolute.

Gauge Mode

If one of the pressures acting on the piston is ambient barometric pressure, the pressure generated at the opposite end of the piston is referred to as gauge mode pressure. The gauge mode pressure may be either positive or negative relative to the ambient barometric reference pressure.

Positive Gauge Mode

If the top of the piston is exposed to ambient barometric pressure, the pressure at the bottom of the piston is used as a test pressure. The test pressure must be greater than ambient pressure, and is referred to as a positive gauge pressure.

Vacuum (Negative Gauge) Mode

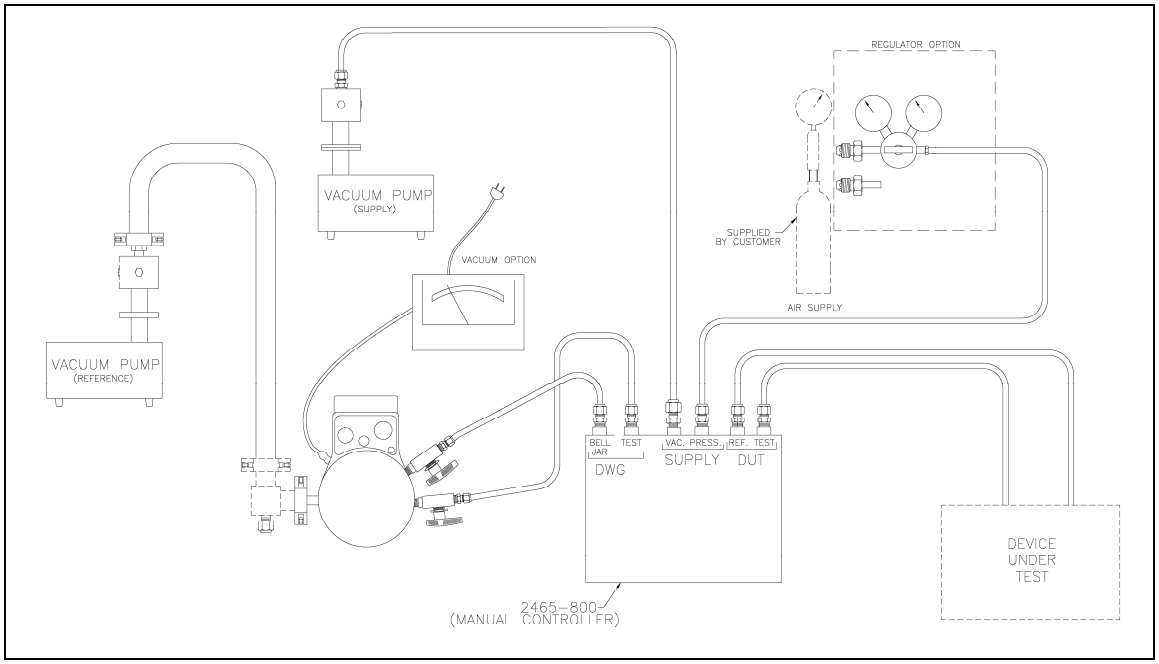
If the bottom of the piston is exposed to ambient barometric pressure, the top of the piston is used as test pressure. The test pressure must be lower than ambient pressure, and is referred to as a negative gauge or vacuum mode pressure. In practice, the bottom of the 3990-801 DWG piston is connected to the reference port of the device under test, and both the 3990-801 and the device under test are totally isolated from ambient pressure. Thus, the test port pressure is not truly a negative gauge mode pressure. Rather, it is a negative differential pressure referenced to a pressure that is very close to ambient, typically within about 0.25 kPa (0.036 psi) of current barometric pressure. Since both the DWG and the device under test are referenced to the same near-ambient pressure, the device under test responds only to differential pressure across the DWG piston.

Absolute Mode

If the bottom of the piston is used to regulate the test pressure and the top of the piston is exposed to a stable vacuum — a low absolute pressure typically less than about 25 Pa (200 mTorr) — the test pressure at the bottom of the piston is referred to as an absolute pressure. Technically, the piston regulates a positive differential pressure referenced to a low absolute pressure. In practice, the device under test has no accessible reference port, so the reference pressure acting on the top of the piston must be taken into account. Typically, the reference pressure is added to the differential pressure across the piston to determine the absolute pressure applied to the device under test. The piston reference pressure is typically measured using a thermopile, pirani or diaphragm gauge, depending on the intended reference pressure and the desired uncertainty in the measurement of the reference pressure.

Connections

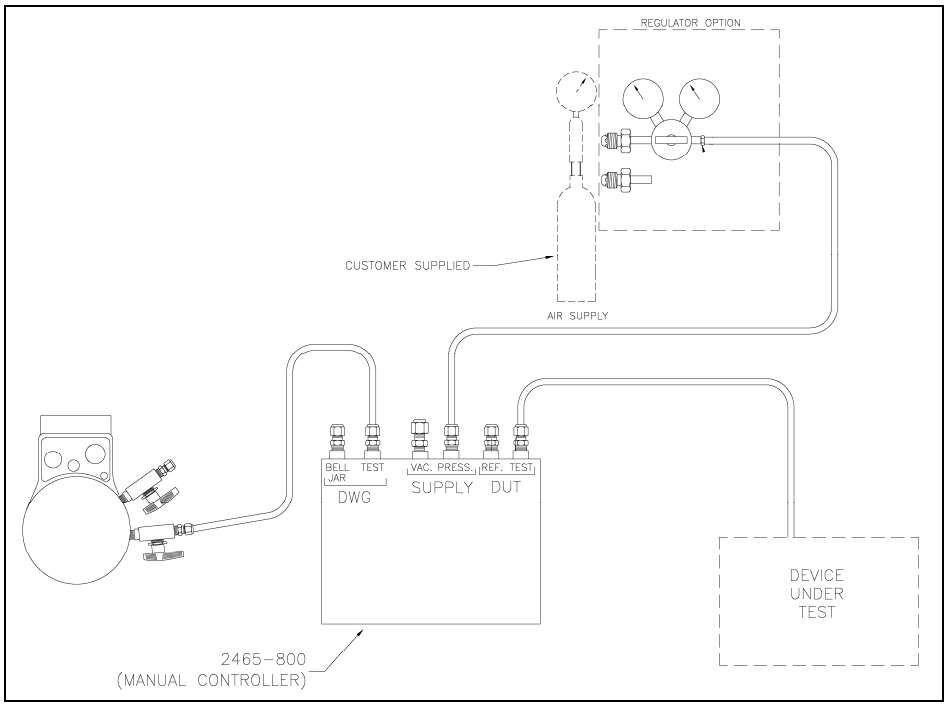
Refer to Figures 1, 2 and 3 to make pneumatic setup plumbing connections, or for optional connections and mode considerations, between the RUSKA Series 3990 DWG, the manual controller and the device under test. If the application does not require all modes of operation, some connections may not be required. The optional are identical below.



gmy01.bmp

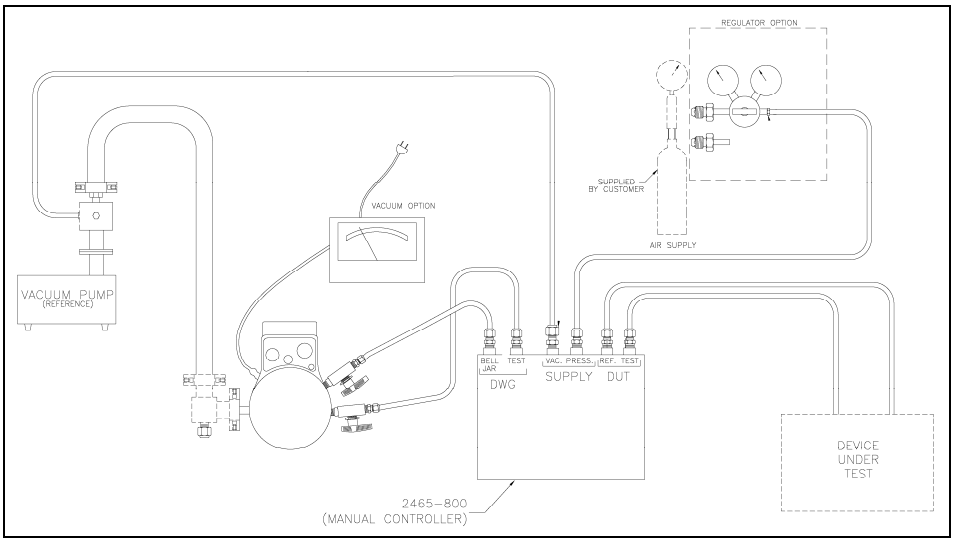
Figure 1. Recommended Setup for Operation in Positive and Negative Gauge and Absolute Modes Using Two Vacuum Pumps

1. As shown in Figure 2, no vacuum pumps are required if operation is limited to positive gauge mode.
2. For negative gauge and absolute mode operation the Supply Vacuum Pump can be omitted if the Supply Vacuum line is connected to the Reference Vacuum Pump. However, this can result in delays due to the additional load on the Reference Vacuum Pump when the Vacuum Supply valve is opened to decrease the pressure in the test port. Refer to Figure 3 for the single vacuum pump setup.



gmy02.bmp

Figure 2. Optional Setup for Positive Gauge Mode Only



gmy03.bmp

Figure 3. Optional Setup for Operation in Positive and Negative Gauge and Absolute Modes Using One Vacuum Pump

3. Reference Vacuum Pump isolation valve (such as part number 88-1038) is required only for negative gauge mode operation. However, it is highly beneficial in the absolute mode, especially when only one vacuum pump is used. The isolation valve allows the bell jar to be vented to atmosphere (as when changing masses) without deactivating the vacuum pump. Leaving the vacuum pump active allows the bell jar to return to a stable vacuum more quickly. In the single vacuum pump absolute mode configuration, the isolation valve allows the test port pressure to be decreased below ambient pressure while the bell jar is vented.

4. The Device Under Test — Reference Port and DWG Bell Jar connections are required only for negative gauge mode operation. However, it is highly beneficial in the positive gauge mode at reducing the effects of air drafts in the immediate region of the DWG, provided that the bell jar is mounted on the DWG and that the Reference Vent valve is open.

Preliminary Operation

1. Verify that all the necessary plumping connections have been made according to the diagrams in Figures 1, 2, or 3, as appropriate.
2. Verify that correct piston is installed in the DWG and that the appropriate masses have been loaded. Install the DWG Bell Jar as required.
3. Set the mode valve to the desired mode Gauge/Absolute or Vacuum (Negative Gauge).
    a. Verify that the Reference Vent and Test Port Vent valves are open.
    b. Verify that the Pressure Supply and Vacuum Supply valves are closed.
    c. Verify that the Equalizer knob for the Pressure Adjuster is in the open position (pulled out).
4. Adjust the regulator on the pressure supply to approximately 350 kPa (50 psi) greater than the desired test port pressure.
5. If sub-atmosphere pressures will be generated in the test port activate the Supply Vacuum Pump. If a vacuum isolation valve is included in the system configuration, close it before activating the vacuum pump.
6. If operating in the absolute mode, it may be advantageous to evacuate the reference chamber and pressure system for several hours (such as over night) prior to beginning calibration. This will improve the evacuation time after reapplying vacuum to the bell jar after the weight load has been changed.

Positive Gauge Mode Operation

Please refer to Figures 1, 2, or 3, as appropriate.

1. Verify that the mode valve is set to Gauge/Absolute.
2. Close the Test Port Vent and Vacuum Supply valves and carefully open the Pressure Supply valve to increase pressure in the test port.
    a. Adjust the Pressure Supply valve to achieve the desired rate of change in pressure.
    b. Close the Pressure Supply valve once the pressure is close to the target value or the piston begins to float.
    c. Push to close the Equalize valve and rotate the Pressure Adjuster knob to adjust the final pressure and float position.

3. For subsequent pressure changes:
   a. Pull to open the Equalize valve.
   b. Carefully open the Pressure Supply valve (to increase pressure) or the Test Port Vent valve (to decrease pressure).
   c. Close the Pressure Supply or Test Port Vent valve once the pressure is close to the target value or the piston begins to float.
   d. Push to close the Equalize knob and rotate the Pressure Adjuster knob to adjust the final pressure and float position.
4. If the Pressure Adjuster must be turned too many rotations to establish a floating pressure:
   a. Pull to open the Equalize valve.
   b. Open the Pressure Supply or Test Port Vent valve to bring the pressure closer to the target value.
   c. Push to close the Equalize knob and rotate the Pressure Adjuster knob to adjust the final pressure and float position.
5. If the Pressure Adjuster knob will not rotate, it is probably at the end of its stroke. In this case:
   a. Pull to open the Equalize valve and rotate the Pressure Adjuster knob in the opposite direction about 10 to 20 turns.
   b. Push to close the Equalize valve and rotate the Pressure Adjuster knob to adjust the final pressure and float position.

Vacuum Mode (Negative Gauge) Operation

Please refer to Figures 1, 2, or 3, as appropriate.

1. Verify that the mode valve is set to Vacuum (Negative Gauge).
2. Verify that the bell jar is mounted on the deadweight gauge.
3. Close the Test Port Vent valve and carefully open the Vacuum Supply valve to decrease pressure in the test port and in the DWG bell jar.
   a. Adjust the Vacuum Supply valve to achieve the desired rate of change in pressure.
   b. Close the Vacuum Supply valve once the pressure is close to the target value or the piston begins to float.
   c. Close the Reference Vent valve.
   d. Push to close the Equalize valve and rotate the Pressure Adjuster knob to adjust the final pressure and float position.
4. If the Pressure Adjuster must be turned too many rotations to establish a floating pressure:
   a. Pull to open the Equalize valve.
   b. Open the Reference Vent valve, then use the Vacuum Supply or Test Port Vent valve to bring the pressure closer to the target value.
   c. Close the Reference Vent valve, push to close the Equalize knob and rotate the Pressure Adjuster knob to adjust the final pressure and float position.

5. If the Pressure Adjuster knob will not rotate, it is probably at the end of its stroke. In this case:
    a. Pull to open the Equalize valve.
    b. Open the Reference Vent valve, then rotate the Pressure Adjuster knob in the opposite direction about 10 to 20 turns.
    c. Close the Reference Vent valve, push to close the Equalize valve and rotate the Pressure Adjuster knob to adjust the final pressure and float position.

Absolute Mode Operation

Please refer to Figures 1, 2, or 3, as appropriate.

1. Verify that the mode valve is set to Gauge/Absolute.
2. Activate the Reference Vacuum Pump and, if applicable, open the vacuum isolation valve between the Reference Vacuum Pump and DWG bell jar evacuation port.
    a. Close the Test Port Vent valve and carefully open the Pressure Supply Valve (to increase pressure) or the Vacuum Supply valve (to decrease the pressure).
    b. Adjust the Pressure Supply or Vacuum Supply valve to achieve the desired rate of change in pressure.
    c. Close the Pressure Supply or Vacuum Supply valve once the pressure is close to the target value or the piston begins to float.
    d. Push to close the Equalize knob and rotate the Pressure Adjuster knob to adjust the final pressure and float position.
3. For subsequent pressure changes:
    a. Pull to open the Equalize valve
    b. Carefully open the Pressure Supply valve (to increase the pressure), the Test Port Vent valve (to decrease the pressure if the test port pressure is greater than ambient air), or the Vacuum Supply valve (to decrease pressure if the test port pressure is less than ambient).
    c. Close the Pressure Supply, Vacuum Supply or Test Port valve once the pressure is close to the target value or the piston begins to float.
    d. Push to close the Equalize knob and rotate the Pressure Adjuster knob to adjust the final pressure and float position.
4. If the Pressure Adjuster must be turned too many rotations to establish a floating pressure:
    a. Pull to open the Equalize valve and use the Pressure Supply, Vacuum Supply or Test Port Vent valve to bring the pressure closer to the target value.
    b. Push to close the Equalize knob and rotate the Pressure Adjuster knob to adjust the final pressure and float position.
5. If the Pressure Adjuster knob will not rotate, it is probably at the end of its stroke. In this case:
    a. Pull to open the Equalize valve and rotate the Pressure Adjuster knob in the opposite direction about 10 to 20 turns.
    b. Push to close the Equalize valve and rotate the Pressure Adjuster knob to adjust the final pressure and float position.

Maintenance

The RUSKA Series 3990-801 and 3990-803 Manual Pressure Control Packs require no periodic maintenance. Refer to the Precise Pressure Controller section of this manual for considerations regarding the integrated Precise Pressure Controller.

Precise Pressure Controller

A RUSKA 3893-801 Precise Pressure Controller is incorporated into the design of the 3990-801 and 3990-803 Manual Pressure Control Packs. The Precise Pressure Controller allows fine pressure adjustment from low absolute pressures up to 21 MPa (3000 psi). Pressure adjustments as precise as 1.7 Pa (0.00025 psi) can be achieved.

Automatic Equalizing

If excess differential pressure builds up across the piston of the Precise Pressure Controller, the by-pass valve will open to equalize pressure on both sides of the piston. Normally, this will occur at a differential pressure of about 0.7 MPa (100 psi). If a larger or smaller differential is desired, adjust the slotted nuts, located on each end of the push-pull stem of the by-pass valve. A special tool for this purpose is provided with the instrument.

Note

It is advisable to exercise the by-pass valve stem after long periods of inactivity. This will prevent sticking, which could result in a larger differential pressure required for automatic equalization.

Maintenance

The Precise Pressure Controller requires no periodic maintenance when used with clean gas. Should any of the O-ring seals fail, overhaul can be accomplished in the field.

Table 2. Service Kit - 3893-801-40801

Description	Quantity	Part Number
O-ring	2	54-704-013
O-ring	4	54-704-004
O-ring	2	54-704-005
O-ring	6	54-704-006
O-ring	4	54-704-011
O-ring	2	54-704-128
O-ring	2	54-704-214
Washer	2	3891-001-04
Backup Ring	4	54-266
Lubricant	1 oz Tube	45-325
Adjusting Tool	1	3891-001-10

Cleaning

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

Table 3. Specifications

Specifications	Model 3990-801	Model 3990-803
Output Pressure Range	VAC to 7 MPa (1000 psi)	VAC to 21 MPa (3000 psi)
Approximate Resolution*	1.7 Pa (0.00025 psi)	1.7 Pa (0.00025 psi)
Supply Pressure	7 MPa (1000 psi)	21 MPa (3000 psi)
Temperature Range	-5 ºC to 50 ºC	-5 ºC to 50 ºC
Test Pressure Gauge Range	0 – 7 MPa	0 – 21 MPa
Electric Power Required	None	None
Connections	1/4” NPT	1/4” NPT
Size	17-1/8” X 10-1/4” X 8”	17-1/8” X 10-1/4” X 8”
Weight	About 40 lbs	About 40 lbs

*Will vary with total system volume and pressure.