RUSKA 7350

High Pressure Gas Controller/Calibrator

Users Manual

Table of Contents

Appendices

List of Tables

List of Figures

General Information

Introduction

This manual contains operation and routine and preventive maintenance instructions for the RUSKA 7350 High Pressure Gas Controller/Calibrator manufactured by Fluke. This portion of the manual provides general information about the RUSKA 7350 and presents its features and options.

General Information

The RUSKA 7350 uses transducers to provide the precise measurement of pressure. During normal operation, the RUSKA 7350 performs in either measure mode or control mode.

In control mode, the RUSKA 7350 simultaneously measures and controls pressure. Control mode is commonly used in the calibration and testing of pressure gauges, transducers, pressure switches, and production pressure instruments.

In Measure mode the RUSKA 7350 measures pressure. Typically, measure mode finds applications in research laboratories, testing of gauges and transducers.

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.

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.

AC Main Plug, Switch, and Power Cord

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 High Pressure Gas Controller/Calibrator.

Symbols used on the High Pressure Gas Controller/Calibrator and in this manual are explained in Table 1-1.

Table 1-1. 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.
C E	This equipment meets the requirements of all relevant European safety directives. The equipment carries the CE mark

Features

The following features are available on all RUSKA 7350s.

Mercury-Free

All components in the RUSKA 7350 are mercury-free.

NIST Traceability

All RUSKA 7350s are calibrated per ANSI/NCSL Z-540-1-1994 using RUSKA deadweight gauges that are directly traceable to the National Institute of Standards and Technology (NIST). All instruments are provided with a NVLAP accredited calibration certificate.

Power Supply

The RUSKA 7350s are either 100 – 120VAC, 1PH, 50/60 HZ or 220 – 240VAC, 1PH, 50/60 HZ.

Measure While Control

The RUSKA 7350 simultaneously digitally displays the commanded pressure, the actual pressure, and the difference between the two. A bar graph indicates how close the actual pressure is to the commanded pressure, as well as how close the commanded pressure is to the RUSKA 7350's full scale pressure.

Friendly Display

The RUSKA 7350's color active matrix TFT display combines a bright, low-glare readout with a wide viewing angle. During normal operation, the measured pressure is easily visible from a distance of 10 feet (3 meters).

Adjustable Pressure Display

The pressure display may be adjusted to show one decimal greater than or less than the default resolution.

Ease of Operation

An intuitive, menu-driven interface makes the RUSKA 7350 easy to use. Frequently used selections, such as the units of measure, are stored in memory each time the RUSKA 7350 powers up.

Easily Programmable

The RUSKA 7350's powerful microprocessor provides the basis for smart electronics. With a few simple keystrokes, the user set limits on the system pressure, create unique units of measure, program a test sequence, and more.

Attractive Desktop Packaging

A sturdy aluminum case houses all of the RUSKA 7350's pneumatics, electronics, and user controls. With the optional rack mount kit, this standard 19" EIA chassis fits easily into a rack mount system.

Power-On Self Test

Upon power-up, the RUSKA 7350 quickly tests its hardware and software. After the RUSKA 7350 completes this test, the user can select more extensive self-tests for the pneumatics and electronics.

Ease of Calibration

A four-point calibration can be performed either remotely or entirely from the front panel. No disassembly is required, and there are no potentiometers to tune.

Automatic Zero Adjust

At the user's request, the RUSKA 7350's software automatically performs the zero adjustment, with no potentiometers to tune.

Automatic Head Correction

The RUSKA 7350 automatically corrects for head pressure between the RUSKA 7350 and the device under test (DUT), taking into account the density of the test gas.

Choice of Medium

The Pneumatic RUSKA 7350 can be used with any dry, clean nitrogen as the pressure medium.

Choice of Display Units

Standard units include inches of mercury at 0 °C and 60 °C, kiloPascals, bars, pounds per square inch, inches of water at 4 °C, 20 °C, and 25 °C, kilograms per square centimeter, millimeters of mercury, centimeters of mercury at 0 °C, and centimeters of water at 4 °C. Altitude and airspeed units include feet, meters, knots, and kilometers/hour. In addition to these predefined units, four user-defined units are programmable.

Communications Interface

The RUSKA 7350 includes standard RS-232 serial and IEEE-488 interfaces. The user's computer communicates with the RUSKA 7350 through the Standard Commands for Programmable Instruments (SCPI) protocol. *The RUSKA 7350 can also be configured to accept existing software written for the RUSKA Series 6000 DPG.*

Standard Equipment & Options

A standard pneumatic RUSKA 7350 comes with this manual, a power cord, a grease gun and grease. The standard pneumatic RUSKA 7350 is fully functional, but the following options are also available.

IEEE-488 Interface: All models of the RUSKA 7350 have an IEEE-488 (GPIB) card. The user's computer communicates with the RUSKA 7350 through the Standard Commands for Programmable Instruments (SCPI) protocol. In addition, software written for the Series 7000 CALIBRATOR and Series 6000 DPG is fully compatible with the RUSKA 7350.

Additional Power Cords: Additional power cords are available for most countries of the world.

Table 1-2. RUSKA 7350 - Options List

Option	Part Number
Communication Software	Contact Fluke
User's Manual	3952249
Power Cord, USA and Canada	284174
Power Cord, Central Europe	769422
Power Cord, India	782771
Power Cord, Japan	3898323
Power Cord, Australia/New Zealand	658641
Battery	2135249

Chapter 2
Theory of Operation

Introduction

The RUSKA 7350's power supply, electronics, pneumatics, and sensor combine to form a complete, stand-alone, measure and control instrument. This portion of the manual breaks the RUSKA 7350 down into its component modules (Figure 2-1) and provides a general discussion of each.

Power Supply

The RUSKA 7350 is set up as either a 120 – 130 VAC, 50/60 Hz or 220 – 240 VAC, 50/60 Hz single phase as required by customer. Check label next to power supply inlet.

Electronics Section

The RUSKA 7350's electronics section consists of the Back Plane Board, the Microprocessor Board, the 76XX Interface Board, the Option Board, the IEEE interface, and the Front Panel consisting of display and key pad.

Back Plane Board

The Microprocessor Board, the 76XX Interface Board, the Option Board, and the IEEE Board plugs into the Back Plane Board.

The four voltages produced by the Power Supply are distributed to the Back Plane Board, where they are conditioned to produce four additional voltages of +5 VDC, -5 VDC, +12 VDC, and -12 VDC for analog use. The resulting seven DC voltages are then used either directly or indirectly throughout the entire RUSKA 7350.

Microprocessor Board

All of the RUSKA 7350's software resides in nonvolatile, programmable, read-only memory (Flash EPROM) on the Microprocessor Board, which plugs directly into the Control Board. This software contains all of the instructions that operate the RUSKA 7350, as well as the conversion factors that the RUSKA 7350 uses to translate the detected pressure into the units selected by the user. These factors are given in Table 2-1.

Data that is subject to change after the RUSKA 7350 leaves the factory is held in electrically erasable, programmable, read-only memory (EEPROM) on this Board. This includes the current units of measure, the coefficients from the zeroing process, the current pressure medium, and the conversion factors for the four user-defined units of measure.

When the RUSKA 7350 powers up, its software is loaded into random access memory (RAM), which is also on the Microprocessor Board. At the same time, the values stored in EEPROM on the Board are restored to memory.

Another important component on the Microprocessor Board is the lithium battery, which continuously updates the RUSKA 7350's date and time, even when the unit is powered down.

The Sensors, Front Panel, the pump expansion and compression limit switches communicate with this board through cables. The Processor Board also supports the RS-232 serial interface, which allows the user's computer to communicate with the RUSKA 7350.
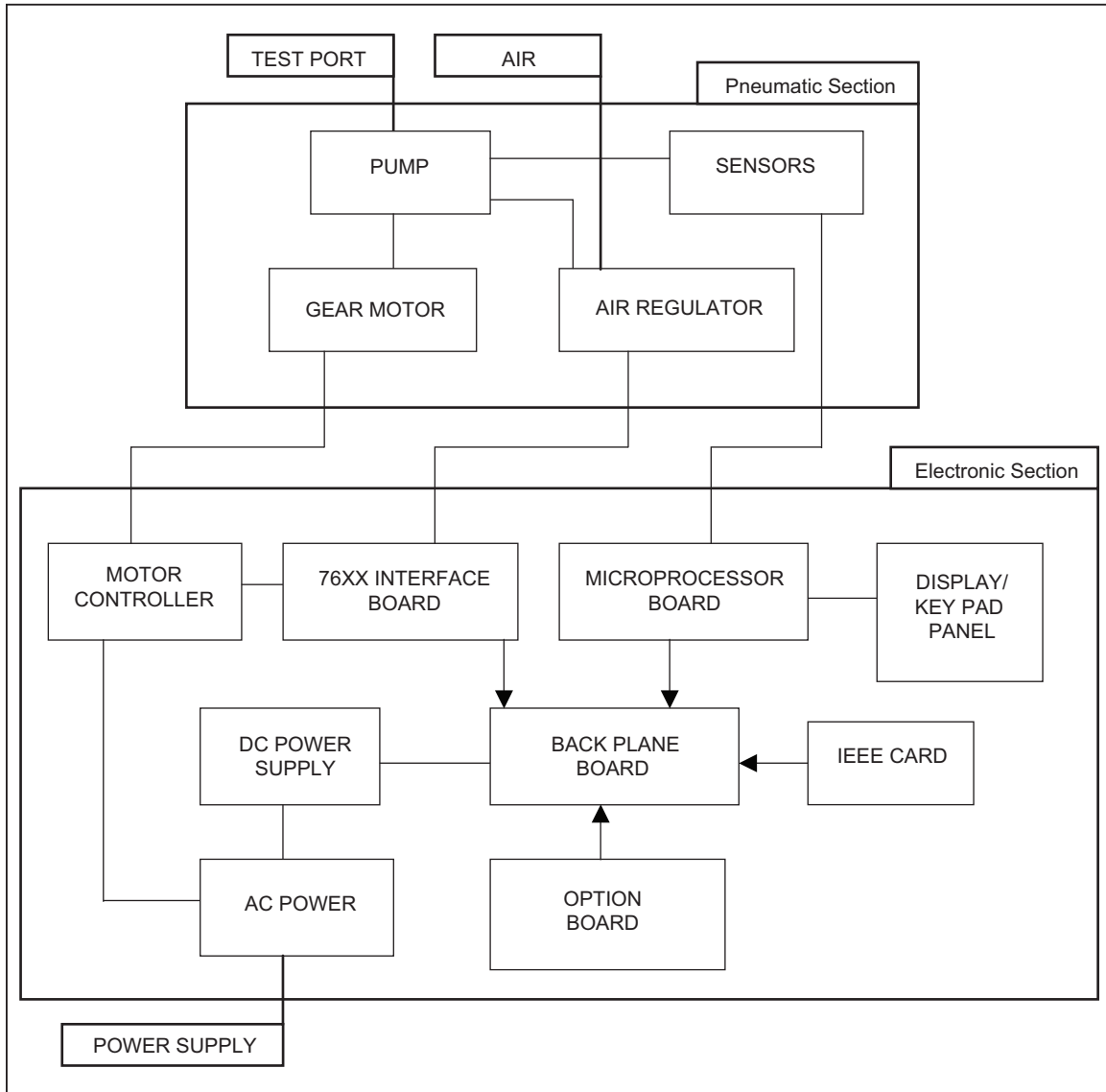
gld01.eps

Figure 2-1. RUSKA 7350 Block Diagram

Table 2-1. Conversion Factors

Symbol	Description	Conversion Factor
inHg	inches of mercury (0 °C)	= kPa x 0.2952998
inHg	inches of mercury (60 °C)	= kPa x 0.296134
kPa	kiloPascals	= kPa x 1.0
bar	bars	= kPa x 0.01
psi	pounds per inch^2	= kPa x 0.1450377
cmH_2O	centimeters of water (4 °C)	= kPa x 10.19744
inH_2O	inches of water (4 °C)	= kPa x 4.014742
inH_2O	inches of water (20 °C)	= kPa x 4.021898
inH_2O	inches of water (25 °C)	= kPa x 4.024108
kg/cm^2	kilograms per cm^2	= kPa x 0.0101972
mmHg	millimeters of mercury (0 °C)	= kPa x 7.500605
cmHg	centimeters of mercury (0 °C)	= kPa x 0.7500605
knots	airspeed knots	per NASA TN D-822
km/hr	kilometers per hour	= knots x 1.852
feet	feet of altitude	per MIL-STD-859A
meters	meters of altitude	per MIL-STD-859A
user1	user defined	= kPa x User defined
user2	user defined	= kPa x User defined
Pa	user defined (Pascals)	= kPa x 1000.0
%FS	user defined (percent of full scale)	

IEEE-488 Interface

The RUSKA 7350's IEEE-488 (GPIB) Interface Card, which plugs directly into the
Back Plane Board, provides the RUSKA 7350 with an IEEE-488 Interface. This interface
allows the user to automate the measurement and control processes.

Front Panel

The Microprocessor Board interprets all input from the Front Panel. The Front Panel
contains the active matrix TFT color display, rotary knob and rubberized keys used to
operate the RUSKA 7350.

Motor Controller

This motor controller controls the speed of the motor driving the pump in the pneumatic
section of the 7350. The motor controller receives its analog signal (+/-10VDC) from the
76XX Interface Board and in turn runs the motor at variable speed. The controller can be
configured with jumpers for either 115 VAC or 230 VAC power supply.

76xx Interface Board

This board interfaces and conditions the pump position signal. The board interfaces these signals between the electronic and pneumatic module. This board also provides a 0 – 10 VDC signal to 0 – 100 psi electronic pneumatic regulators and the motor controller.

Pneumatic Module

The pneumatic section shown in Figure 2-2 houses components that control and accurately measure pneumatic pressure.
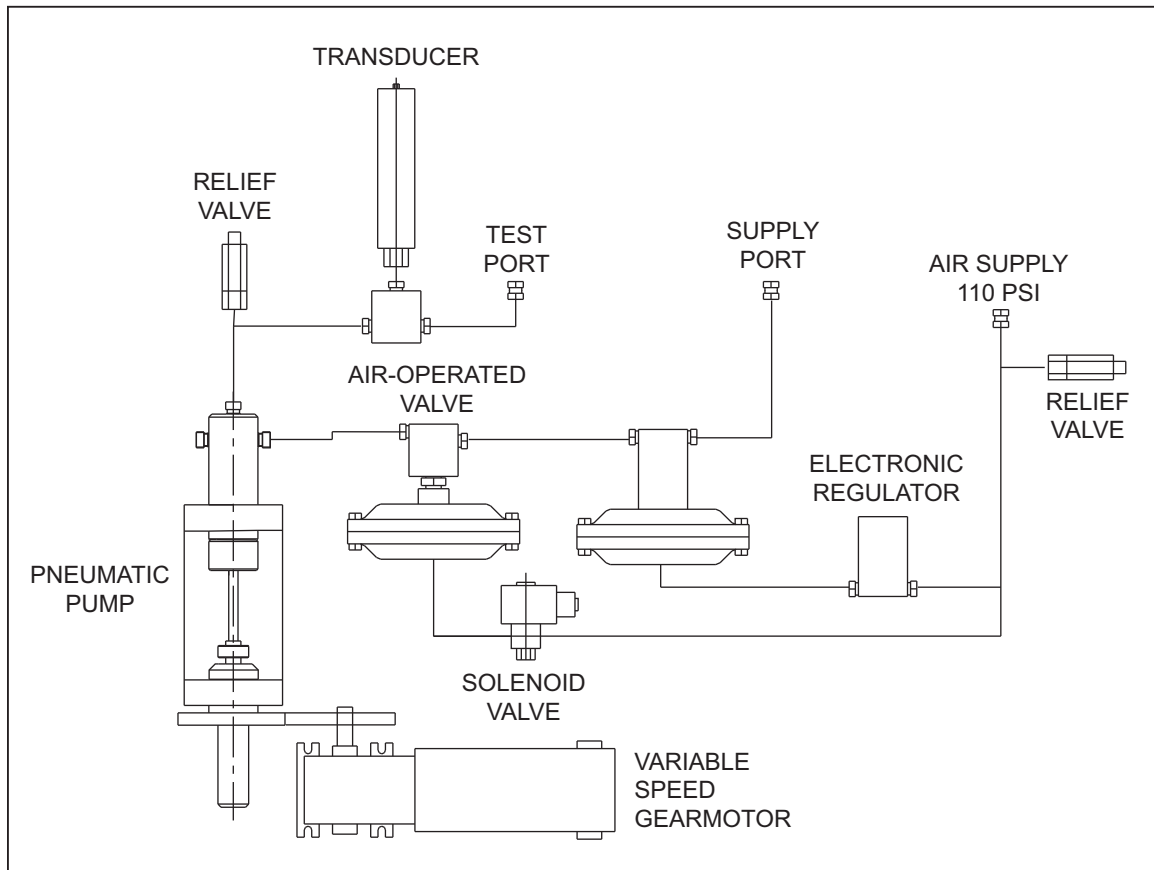
gld02.eps

Figure 2-2. Pneumatic Diagram

Pneumatic Pump

The pneumatic pump is a positive displacement pump that precisely varies the system pressure by compressing and expanding system gas. The pump is driven by a variable speed gear-motor. The pump has a position sensor that tracks the position of the pump plunger. It has two travel limit switches at each end of its stroke.

Gearmotor

The variable-speed gear motor drives the pneumatic pump. The gear box on the motor reduces the motor speed.

System Valve

The system valve isolates the pump and system from the gas supply regulators. It is a high pressure air-operated valve. This valve has a diaphragm operator that requires a minimum of 60 psi of air pressure to close the valve. The air is supplied to this valve through a three-way normally-open solenoid valve.

Electronics Regulator

The electronics regulator supplies a 0 – 100 psi air signal for the dome regulator. The electronics regulator is driven by a 0 – 10 VDC signal from the interface board.

Dome Regulator

The dome regulators, which are self-relieving, "rough" in the commanded pressure. The precise pressure is then achieved by the pump after closing the system valve.

System Transducer

The system transducer accurately measures (accuracy is specified as purchased, 0.01% minimum) the controlled pressure. This transducer should be calibrated at a regular interval to maintain its stated accuracy.

Test Port

The device under test is connected to this port. This port is a 1/8 NPT female.

Drive Air-Supply Port

The supply air is connected to the drive-air supply port. The supply air should be 100 – 110 psi (7 – 7.5 bar). The pneumatic side is protected by a relief valve set at 120 psi. (8.3 bar). This port is a 1/4 NPT female connection.

Gas Supply Port

The clean, dry gas supply is connected to this port. The gas pressure should be 10% above the full scale pressure of the controller. This port is a 1/8 NPT female connection.

Installation

Introduction

This portion of the manual discusses initial installation for the RUSKA 7350. Installing the RUSKA 7350 is a relatively simple process of unpacking the RUSKA 7350, powering it up, and then using the front panel to configure the system.

Unpacking the RUSKA 7350

Carefully unpack all components, checking for obvious signs of damage. In addition to any nonstandard items ordered with the RUSKA 7350, the shipment should contain at least the following items:

- RUSKA 7350
- power cord, and this user's manual
- grease gun and grease

If necessary, report any shipping damage to the freight agency. Remove masking tape, strings, and packing materials from all components. If possible, save the packing materials for future use.

Finally, install the Calibrator in a location that meets the requirements listed in Table 3-1.

Note

The RUSKA 7350 should not be subjected to mechanical shocks during installation or use. It should be mounted on a rigid bench or in a sturdy 19 inch rack. Although the zeroing process will compensate for a slightly unlevel mounting; the RUSKA 7350 should be mounted to within 5° of level.

Table 3-1. General Specification and Parameters

Parameter	Value	Model
Operating Humidity Range	5% to 95% RH	all
Operating Temperature Range	5 °C to 50 °C	all
Storage Humidity Range	None[1]	all
Storage Temperature	-20 °C to 70°C	all
Power Requirements	100 – 120 VAC or 220 – 240 VAC	all
Warm Up Period	30 minutes	all

⚠ **Caution**

If there is any condensation, the RUSKA 7350 must be thoroughly dried before power is applied.

Cautions

The following cautions should be heeded at all times to insure safe operation of the RUSKA 7350.

⚠⚡ **Warning**

Never operate the unit with the cover removed. The power supply has internal voltages near 400 volts.

Never apply more than 110% of the unit's full scale pressure range to the test port. Never try to control while a pressure source is connected to the test port.

Avoid thermal and mechanical shock to the instrument. This will affect performance and require re-zeroing.

Powering Up the RUSKA 7350

1. First, plug the power cord supplied with the RUSKA 7350 into the power connector on the RUSKA 7350's back panel.

   Note

   Grounding for the RUSKA 7350 is provided through the power cord.

2. Next, plug the power cord into a receptacle rated for either 100 – 120 VAC or 220 – 240 VAC (check name plate). If a different power cord is necessary for your receptacle, consult Table 1-1 for available power cords.

3. Finally, turn on the RUSKA 7350 by flipping the POWER switch on the back panel. The MEASURE screen will appear on the color display, and the front panel will be fully operational.

Pneumatic Connections

Pneumatic connection to the RUSKA 7350 is straightforward. The following sections discuss each port.

Drive Air Supply Port

The air supply port must be connected to a well regulated source of dry shop air. Air supply should be 100 – 110 psi (7 – 7.5 bar). Supply port is a 1/4 NPT female connection.

Test Port

The test port is designed to control a wide range of volumes. Any leaks on the test port will cause measurement errors. For best results, a volume of approximately 3 in^3 (50 cc) is recommended. The test port is 1/8 NPT female.

Gas Supply Port

The gas supply port should be connected to a clean, dry gas supply with a pressure of 110% of full scale pressure. The port is 1/8 NPT female.

Chapter 4
Local Operation

Local Operation

This section of the manual describes operation of the Calibrator using the front panel. The local interface (front panel) consists of a color TFT display, a rotary knob and a set of keys. The display shows the system status and menu options. The keys are grouped according to function.
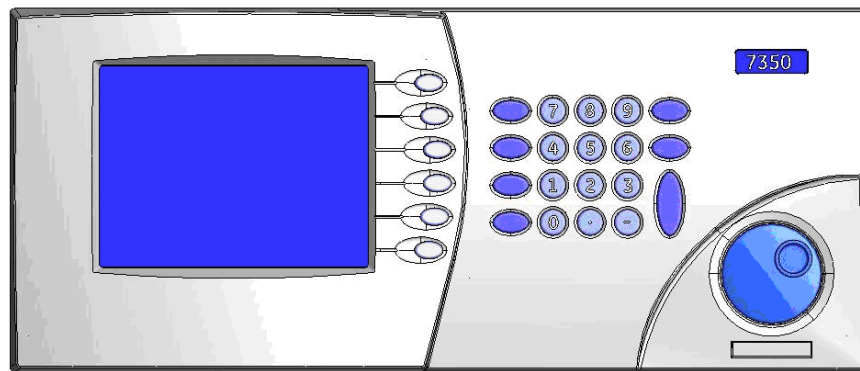
gld03.bmp

Figure 4-1. RUSKA 7350 Front Panel

Numeric Keypad

This includes the number keys, the decimal point [.], and the change sign key [-]. The UNITS key changes between units of measure, MODE changes between modes of operation such as gauge and absolute, MEASURE is used to place the unit into measure mode. CLEAR key will clear the numeric entry field. The ENTER key accepts the entered number or confirms a command.

Function Keys

These are the six keys that run vertically beside the display. The label shown in the display beside each key identifies their function. These functions will change based on which screen you are operating. For ease of communication, throughout the manual we refer to these keys as [F1] through [F6]. We consider the top key to be F1 and the bottom F6.

Rotary Knob

The rotary knob selects a field for editing and is used for small pressure changes (pressure jog) at the main menu.

Cancel, Previous

These keys are used to stop, undo, or exit the current operation. The CANCEL key returns all edited fields on the current entry screen to their original values. It also stops the current program sequence or calibration process. The PREVIOUS key exits the current menu and returns to the previous menu.

Figure 4-2 is a menu tree showing the relationship between all the menus in the system. Refer to it for selections available under the menu. To move to a lower menu, press the function key with the correct label. To move towards the Main Menu, press the PREVIOUS key. In the Main Menu screen, the [F2] key places the unit in Control mode, ENTER must be pressed to actually enter the Control mode. The [F3] key places the unit in Vent mode. This opens the test port to atmosphere and rapidly reduces the pressure, ENTER is required to confirm the operation. The [F5] key places the unit either the step or the jog mode and the rotary knob is then used to set the control set-point by the correct step or jog amount. To go to one of the menus, press the [F6] key.

Menu Item	Description
Control	➤ Places the system in Control Mode
Vent	➤ Vents system pressure to atmosphere
Step/Jog	➤ Toggle between step and jog mode
Menu	➤ Enter Sub Menus
Setup	➤ Enter Set-up menu
Limits	➤ Set pressure limits, control band, access code
User	➤ Set step size, head corr., filter & display digits
Units	➤ Set User-D efined units of measure
Remote	➤ Set baud, parity, data & stop bits, GPIB address
System	➤ Set date, time, reset & view software version
Calibrate	➤ Enter calibration menu
Zero	➤ Zero sensor
Calibrate	➤ Perform or edit calibration
Edit	➤ Edit calibration coefficients
Sensor	➤ Select sensor
Program	➤ Enter Program Menu
Run	➤ Run program test sequence
Delete	➤ Delete a saved program
Config	➤ Change the configuration of a program (Limit, etc)
Edit	➤ Edit program (set-point, tolerance, dwell, etc)
Name	➤ Change program name
Test	➤ Enter test menu
Pump	➤ Display pump parameters
Sweep	➤ Sweep pressure between points (# cycles)
Self	➤ Perform self -test
Remote	➤ Display IEEE-488 remote status
Serial 1	➤ Display RS-232 serial remote status
Shop1	➤ Display solenoid status
Display	➤ Display sensor readings and pump position
Blank	➤ Screen saver

gld32.eps

Figure 4-2. Menu Tree

Tutorial

To begin the tutorial, first verify that the Calibrator is powered-up and that the pneumatic connections have been completed. The Calibrator should display a screen similar to the one shown below. (The right hand side of the display should show the options). At power up, there may be errors relating to the default settings. If an error message is displayed in red at the bottom of the screen, press [F6], then press PREVIOUS. If multiple errors exist, you will need to press the [F6] key multiple times to clear all of the errors.
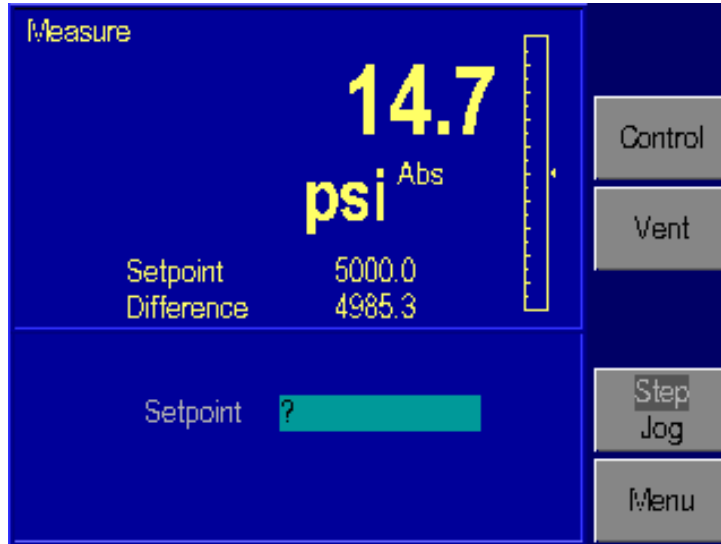
gld04.bmp

Figure 4-3. Main Menu

Figure 4-3 shows the Main Menu. It is at the top level of the menu tree (see Figure 4-2) and all descriptions in this manual start from this point. The double sized numbers in the top center of the display shows the current measured pressure (0.00 psi diff). The upper left corner shows the current mode of the Calibrator (MEASURE, CONTROL or VENT). The right side of the screen shows a bar graph displaying the current pressure relative to a user-configurable full-scale value. Below the pressure is the pressure control set-point; below this is the difference between the set-point and the actual value. Below this is a numeric scratchpad for entering a new set-point value. The highlighted label on the right hand side of the screen displays the current assignments of the function keys [F1] through [F6] that are located beside the display.

1. Change the pressure units. The units are changed by selecting the UNITS key on the keypad.
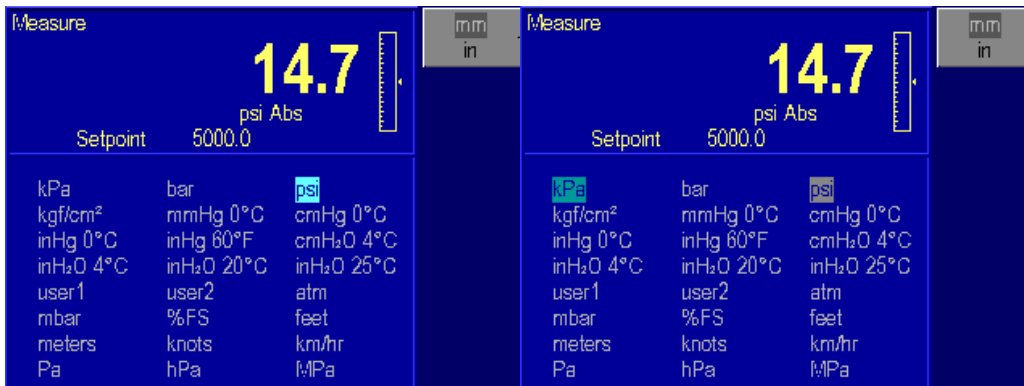
gld05.bmp & gld06.bmp

Figure 4-4. Units - Menu

2. Use the rotary knob located to the right of the display to move the highlight bar to the desired unit.

Note

The highlighted curser initially shows the current unit of measure. When the rotary knob is moved, the current unit remains highlighted in a gray color, and the new unit is highlighted in a light blue color.

3. When the unit desired is highlighted, press the **ENTER** key on the far right side of the front panel, under the numeric keypad. The display will return to the **Main** screen with the current units.

The second part of this tutorial uses the Calibrator to generate pressure. The pressure supply must be connected and the test port must be connected to a closed volume, in accordance with Chapter 3, Pneumatic Connections section.

4. From the Main Menu, use the numeric keypad to enter the starting pressure. The pressure is entered in the units set in the previous exercise. As the pressure is entered, each digit will be displayed in the numeric scratchpad (the highlighted box in the lower section of the display). If a mistake is made, press the CLEAR key (found in the numeric keypad), and the numeric scratchpad will be cleared.
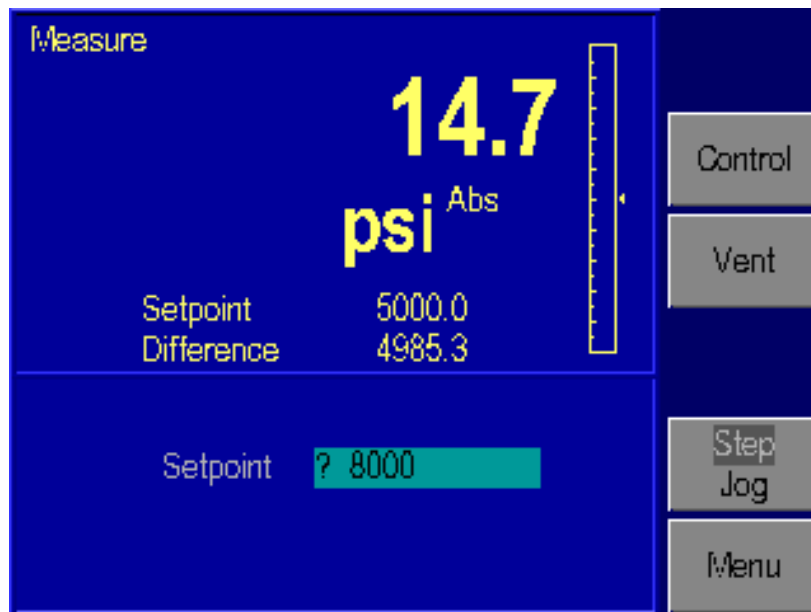
gld07.bmp

Figure 4-5. Main Menu - Entering Pressure

5. When the entry is correct, press the ENTER key. The scratchpad will be cleared and the value will appear as the new set-point.

6. Now that the starting pressure is entered, enter Control mode. Press Control [F2]. The CONTROL label will be highlight, and the message "Press Enter to Confirm" will appear below the scratch pad. Notice that the upper left corner still shows MEASURE. The Calibrator stays in Measure mode until the change is confirmed.
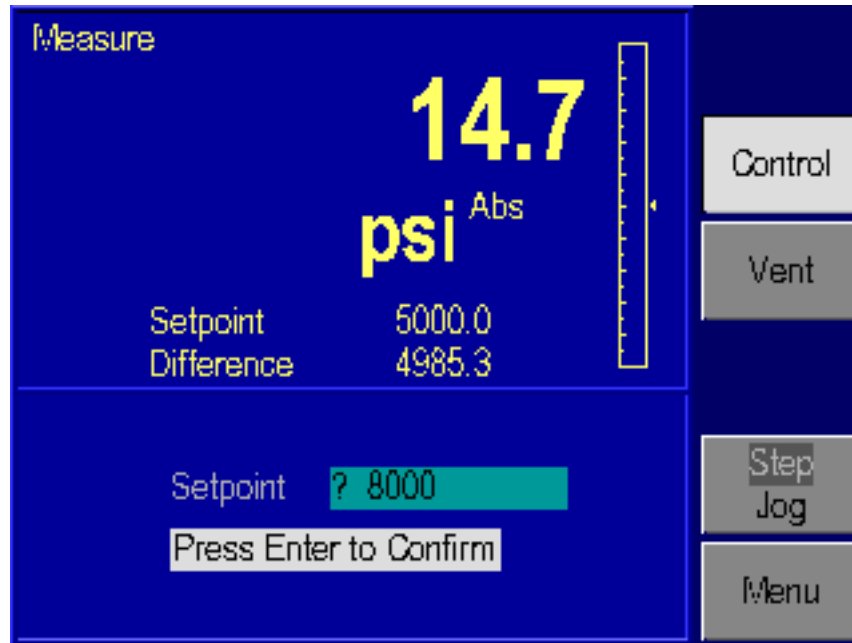
gld08.bmp

Figure 4-6. Main Menu - Control Mode

7. Press ENTER to confirm the mode change. The upper left corner will change to CONTROL, and the pressure will start moving towards the set-point.

8. After the pressure is stabilized, assure that the word Step is highlighted in the Step/Jog [F5]. The Step/Jog [F5] key toggles between Step and Jog, to switch between these modes, press the function key 5 [F5]. In addition to using the keypad to enter a pressure set-point, you can also use the step function. Using the rotary knob, rotate the knob clock-wise to increase the set-point, or counter clock-wise to decrease the controller set-point. The scratchpad will be updated with a new set-point. The step size defaults to 10% of full scale. This step size is user defined and can be changed in the Menu | Setup | User menu.

9. Press ENTER to accept the new set-point. The Calibrator will move to the new set-point.

10. Press Measure key which is located in the key-pad. The Calibrator will change to Measure mode. No confirmation is necessary to leave Control mode.

Selecting Language

The RUSKA 7350 Calibrator can operate in a variety of different languages. To select a different language, press the Mode key two times MODE, MODE. The current language will be highlighted. Use the rotary knob to highlight a new language and hit the ENTER key to select that language.

Selecting Mode of Operation

The RUSKA 7350 Calibrator normally operates in Absolute mode but also supports Tare mode for calibration of Gauge mode sensors. As an option for increasing accuracy by limiting range, the RUSKA 7350 Calibrator may be ordered with Triple Ranging.

Tare Mode

Press the **Mode** key then press **Tare** [**F3**] to turn on Tare mode. The current pressure reading will be stored as the tare offset and the pressure reading will be zeroed. Press **Tare** [**F3**] again to turn off Tare mode.

Triple Range (Optional)

When Triple Ranging is enabled the currently selected range will be displayed below the current pressure. To change to a different range make sure the pressure is below 100 psi (700 kPa). Then press the **Mode** key and then press **Range** [**F5**] until the correct range is displayed. If the current pressure range is exceeded the range will automatically change to the highest range until manually changed.

Main Menu

The Main Menu displays the measured pressure in double-sized numbers. Below the pressure reading is the current unit of measure and mode (Tare or Absolute). The Main Menu can always be reached by repeatedly pressing PREVIOUS. The RUSKA 7350 is designed such that all of the commonly used functions are accessible by a direct key on the key pad or from a top level function key. Less commonly used set-up type functions are accessible through the menu function key.
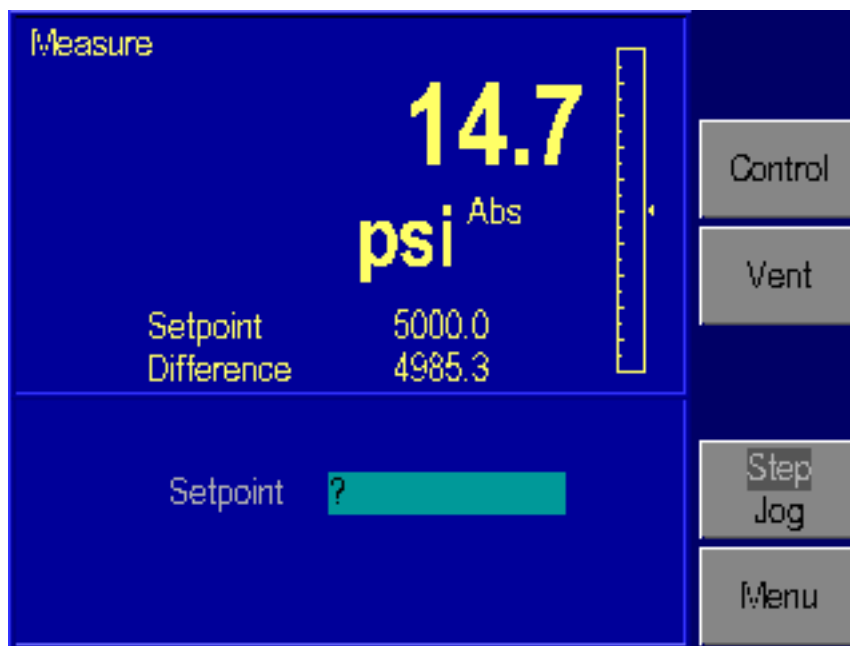
gld09.bmp

Figure 4-7. Main Menu

Controlling Pressure

The Control [F2] function key is used to place the Calibrator into the Control Mode. A pressure set-point should be entered into the Calibrator prior to placing the unit into the control mode. This is to assure that the operator is aware of the set-point valve prior to entering into the control mode.

Setting the Pressure Set-Point

The pressure set-point is the destination of the pressure control algorithm. It should be set before entering Control mode. The pressure set-point is set to zero at power-up or whenever a pressure error occurs.

1. The pressure set-point is set from the Main Menu. (Press PREVIOUS until the Main Menu appears.)

2. Use the numeric keypad to enter the new pressure set-point in the current pressure units.

3. Press ENTER to accept the entry or press CLEAR to clear the numeric scratchpad.

Note

The set-point can also be changed using either the Step or the Jog function.
Please see Chapter 4, Step/Jog.

Entering/Exiting Control Mode

1. The Control mode is set from the Main Menu. (Press PREVIOUS until the Main Menu appears.)

2. Press CONTROL [F2] to enter Control mode. ENTER must be pressed to confirm entry into Control mode.

3. Press MEASURE key found in the keypad to exit Control mode. No confirmation is necessary.

Vent

The Vent [F3] function is used to rapidly vent the pressure in the system to atmosphere.

Step/Jog

In addition to entering the pressure set-point through the key-pad, the pressure set-point can be changed using either the step or the jog functions. The Step function is used primarily when the operator is taking pressure steps in equal pressure increments. The size of the pressure step is user defined. The Jog function is most often used when calibrating mechanical gauges such as a dial gauge and the operator wishes to change the pressure until the mechanical gauge indicates a cardinal point. The operator can then read the higher resolution Calibrator to determine the actual pressure value when the mechanical gauge is indicating a cardinal point. The Step/Jog [F5] key toggles between Step and Jog, to switch between these modes, press the function key 5 [F5].

Stepping

Assure that the word Step is highlighted in the Step/Jog [F5]. Using the rotary knob, rotate the knob clock-wise to increase the set-point, or counter clock-wise to decrease the controller set-point. The scratchpad will be updated to a new set-point. The step size defaults to 10% of full scale. Press ENTER to accept the new set-point.

Setting Step Size

From the Main Menu, press Menu [F6]│Setup [F2│User [F2]. Using the rotary knob, move the cursor to highlight Step Size. Enter the desired step size in the current pressure units and press ENTER.

Jogging

Assure that the word Jog is highlighted in the Step/Jog [F5]. From the Main Menu, the pressure set-point can be modified by rotating the rotary knob clockwise to increase pressure and counterclockwise to decrease pressure. Each increment or decrement will change the pressure in the least significant digit. Continually rotating the rotary knob, the pressure will continue to change until the rotation is stopped.

Menu

The menu key is used to access the less commonly accessed configuration type functions. This accesses the Setup, Calibration, Program, Test and Display functions.
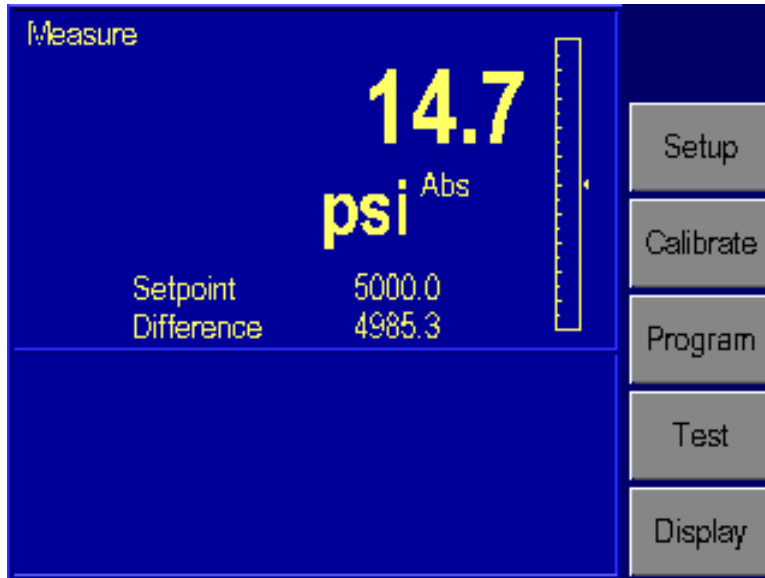
gld10.bmp

Figure 4-8. Menu

Menu | Setup

Setup is used to configure the system. It includes setting all of the limits, user parameters, user-defined units of measure, remote interface and system setup.
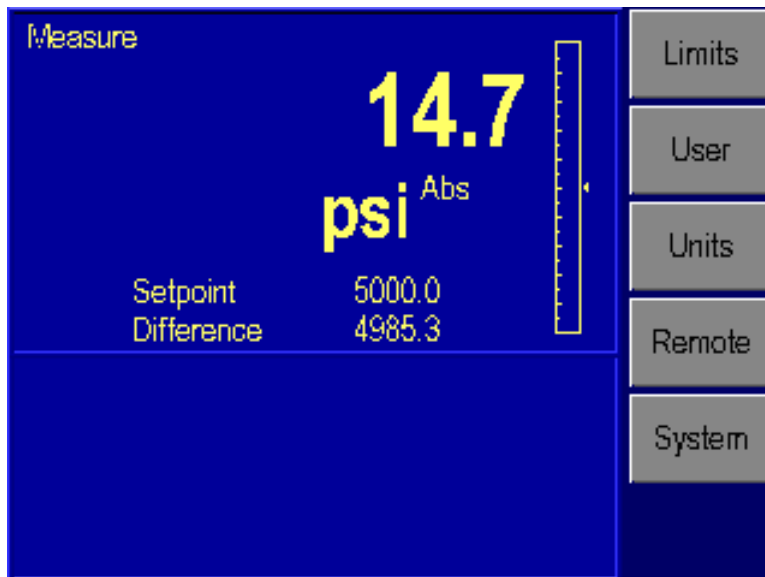
gld11.bmp

Figure 4-9. Menu | Setup | Menu

Menu | Setup — Limits

The Menu | Setup | Limits menu is used to setup all of the limits in the system. The pressure limits can be used to protect the device-under-test (DUT) from overpressure.

gld12.bmp

Figure 4-10. Menu | Setup | Limits - Menu

High Limit

High limit is the user-defined Maximum pressure limit. This is often set just over the full-scale pressure of the device under test (DUT) in order to protect the DUT. The Calibrator will then prevent the pressure from exceeding the high limit. If the user enters a value greater than the user defined limit, the unit will not accept the value and it will generate an error code informing the user that they have entered a set-point that is greater than the high pressure limit. In control mode, if for any reason the pressure exceeds the user defined limit, it will change into the measure mode and again display an error message to the operator informing them of the error that occurred.

This value can be edited using the rotary knob to highlight the High Limit. Then enter the new value using the keypad. This will show up in the scratch pad on the lower portion of the screen. Press the Enter key and the value for the high limit will be updated to the value that was typed into the scratchpad.

Low Limit

User defined Minimum pressure limit. This is the same as the high limit except it is to protect the DUT from low pressure limits.

Auto Vent

User defined maximum pressure that the Calibrator can reach prior to venting the test port to atmosphere.

Control Band

There are two common pressure control approaches that are available with the RUSKA 7350 Calibrator. One of the most common control styles is an Active controller where the controller remains operative and holds the pressure at a commanded set-point. This allows the system to hold the pressure at a set-point within the control stability specification (See Appendix A). In addition to possible leaks in a system, following a pressure step, the pressure in the system changes due to temperature effects. When operating an Active control system, the controller continuously monitors any pressure variances in the system and compensates for these effects to hold the pressure at the set-point. The benefit of the Active control is that it can maintain the pressure at the commanded set-point even when there are slight leaks in the system or the system is not thermally stable.

The second approach is to control the pressure in the system to a set-point and then to shut-off the Active controller. We describe this as a Passive control mode. Following a pressure step and the controller becomes passive, the pressure will continue to change in the system due to thermal effects. However these thermal effects will stabilize over time. Once the system has thermally stabilized, pressure measurements can be made in the system without any "pressure noise" injected into the system as a result of having an Active controller in the system. The result would be that the controller would not add any additional uncertainty to the pressure measurement since it would be inactive during the measurement process. For this method, pressure will not be at a cardinal set-point.

When the Control Off Band and Control On Band are set to zero, the Calibrator operates in the Active control mode. Setting a Control On and Off Band, places the Calibrator in the Passive control mode.

The Control On and Off Band provides a tolerance around the pressure set-point in the current unit of measurement. The Controller will control the pressure to the commanded set-point. Once the actual pressure is within the user defined +/- Control Off Band tolerance, the controller will shut off. The pressure will remain at this level, only changing by the thermal influences or leaks in the system. The controller will remain off until it reaches the +/- Control On Band limit. The controller will then re-activate and control the pressure back to the Control Off Band tolerance. This mode of operation removes any added uncertainty in the measurement system due to the controller since the controller is Passive during the high accuracy pressure measurements.

As an example, if a 100 psi (690 kPa) full scale Calibrator was set-up with the Control Off Band at 0.001 psi (0.007 kPa) and the Control On Band set to 0.005 psi (0.035 kPa). This would place the Calibrator in a Passive control mode. If the Calibrator was placed into the control mode with a pressure set-point of 10 psi (69 kPa), it would control up to the 10 psi (69 kPa) value. Once it reached a pressure of 9.999 psi (68.993 kPa) the active control would turn off. Due to the thermal effects caused by pressurizing the system, the pressure will start reducing in the system. Once the pressure reaches 9.995 psi (68.965 kPa) the active controller would automatically turn on and control the pressure back to 9.999 psi (68.993 kPa) and then turn off. After a few cycles, the system will thermally stabilize and the pressure will hold between the Control On and Control Off Bands.

Slew Rate

User defined maximum pressure rate of change. The Calibrator is designed to control with minimum overshoot into a wide variety of external volumes at its highest slew rate. Therefore, in most applications it is recommended that the slew rate be set at its maximum rate value. This provides the highest speed control without jeopardizing overshoot or control stability properties. The only application where the operator may wish to slow down the slew rate (control speed) is in applications where the device under test could be damaged by high rate of pressure change. The Calibrator control algorithm tries to limit the rate of pressure change to the slew rate. On Calibrator's will full scale pressures ranges less than 10 psi (70 kPa), it is common to reduce the slew rate to less than 25% of full scale to improve on control overshoot characteristics.

Slew Limit

The slew limit is used by the system to assure that the slew rate is not exceeded. If the slew rate is exceeded, the Calibrator will change from the control mode to the measure mode and it will generate an error message to the operator.

Access

The test access password allows the user to protect access to Calibrator configuration and programs. If the test access password is set to any number other than zero (factory default), it is *required* before the user is allowed to change the limits, control parameters or programs.

Note

It is recommended that the access password be recorded and filed in a secure location.

Menu | Setup — User

The Menu | Setup | User menu is used to setup all of the user specific configurations. This includes setting the control step size, range of bar-graph, pressure gas head, display pressure filter, display resolution digits, and audible key click.

gld13.bmp

Figure 4-11. Menu | Setup | User - Menu

Step Size

In addition to entering the pressure set-point by the key-pad, the pressure set-point can be changed using the step function. The step function is used primarily when the operator is taking pressure steps in equal pressure increments. The size of the pressure step is user defined. From the Main Menu, press Menu [F6], Setup [F2], and then User [F2]. Using the rotary knob, move the cursor to highlight Step Size. Enter the desired step size in the current pressure units and press ENTER.

Bar Graph Maximum

The bar graph on the Main Menu screen can be scaled to match the device under test by setting the full scale value of the bar graph.

Ready Tolerance

A Ready indication is generated when in control mode and the measured pressure is reading within this ready tolerance value. When running an internal program, the ready indicator is shown when the measured pressure is within the tolerance stored in the program.

Gas Head Pressure Correction

The term "head height" refers to the vertical distance between the sensing element in the device under test and the Calibrator's pressure reference plane. Once the user inputs the head height and selects air or nitrogen, the Calibrator automatically corrects for head pressure.

1. The Pressure Reference Line on the Calibrator is defined as the underline bottom of the color display where the display and the front panel join. This provides the *reference plane* against which the device under test (DUT) pressure is measured.

2. Determine the vertical distance between the Calibrator Pressure Reference Line and the reference plane of the device under test.

3. Press the Unit key found in the keypad and press in/mm [F1] to select either inches (in) or millimeters (mm) for the head height entry.

4. The head height is set from the Menu | Setup | User. From the Main Menu (press PREVIOUS until the Main Menu appears), press Menu [F6⎮Setup [F2]⎮User [F2].

5. Press Medium [F3] to select either "Air" or "Nitrogen". The selected units will be highlighted.

6. Press Position [F4] to select if the position of the Device Under Test is either "Above" or "Below" the 7350. The selected units will be highlighted and appear in the Gas Head description.

7. Use the rotary knob to highlight the label "Gas Head".

8. Use the numeric keypad to enter the height in the selected unit.

9. Press ENTER to accept the entry.

Atmosphere

The nominal barometric pressure value for the location that the Calibrator is utilized should be entered for atmosphere. On tare mode instruments, this number is used to calculate the density of the test port pressure medium and to correct for head pressure variances between the reference port of the Calibrator and the DUT.

Pressure Filter

The Pressure Filter is used to adjust the degree to which the front display pressure value is filtered. A value of four (4), is the default value. As the value increases, the filtering level increases, however, the display update rate reduces. Typical filter values would range between 1 to 10.

Changing the Number of Decimals

Each unit has a default number of decimal places used for pressure display. This may be adjusted up or down by one decimal place.

1. The decimal digits are set from the Menu | Setup | User. From the Main Menu (press PREVIOUS until the Main Menu appears), Menu [F6│Setup [F2]│User [F2].

2. Turn the rotary knob until the label "Display digits" is highlighted.

3. Turn the rotary knob further until the desired number of digits from the default resolution is highlighted (-1, 0, +1), and then press the ENTER key to select.

Key Click

The Calibrator can be configured to emit a "clicking" sound each time a key is pressed.

1. The key "click" is set from the Menu | Setup | User. From the Main Menu (press PREVIOUS until the Main Menu appears), press Menu [F6│Setup [F2]│User [F2].

2. Turn the rotary knob to highlight "Key click" and then highlight either On or Off.

3. Press the ENTER key to select.

Menu | Setup — Units

In addition to the standard units of measure provided by the Calibrator, four user-defined units are available. To create a user-defined unit, the user enters a name that is one to ten characters long and a *conversion factor* that is a multiple of kiloPascals (kPa).

For example, using the information from Table 2-1, the conversion factor for millitorr or one micron of mercury at 0 °C is calculated as follows.

$$mTorr = kPa \ x \ \frac{1000 \ mTorr}{1 \ Torr} \ x \ \frac{1 \ Torr}{1 \ mmHg \ 0°C} x \ \frac{1 \ mmHg \ 0°C}{0.0193377 \ psi} \ x \ \frac{0.1450377 \ psi}{1 \ kPa}$$

thus the conversion factor simplifies to $mTorr = kPa \ x \ 7500.6180$
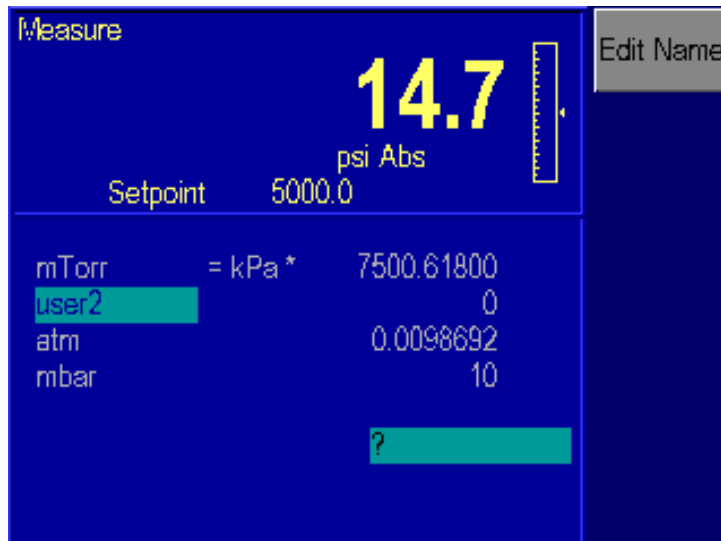
gld14.bmp

Figure 4-12. Menu | Setup | Units - Menu

1. The pressure units are defined from the Menu | Units | Define. From the Main Menu (press PREVIOUS until the Main Menu appears) press Menu [F6⎢Setup [F2] ⎢ Units [F3].

2. Use the rotary knob to highlight the desired user-defined unit, and then select the Edit Name [F1] function key.

3. The following sequence is used to change the name of the selected unit.

    a. Use the < [F4] or > [F5] key to highlight the desired character in the matrix.

    b. Use the rotary knob to change the character.

    c. Repeat steps a and b until the desired name is entered. Press the Clear key to start over.

    d. Press the Done [F6] key when the name change is completed.
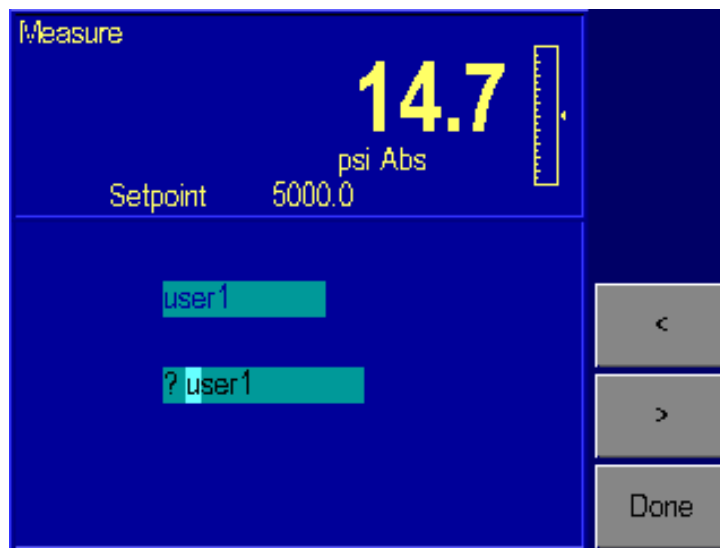
gld15.bmp

Figure 4-13. Menu | Setup | Units | Edit Name - Menu

4. Use the rotary knob to highlight the desired user-defined unit that has just been renamed.

5. Use the numeric keypad to enter the conversion factor and press ENTER to accept.

6. Press PREVIOUS three times to return to the Main Menu. The new unit definition may now be selected using the Units key.

Menu | Setup — Remote

The Menu | Setup | Remote screen is where the remote communication interface is set-up.
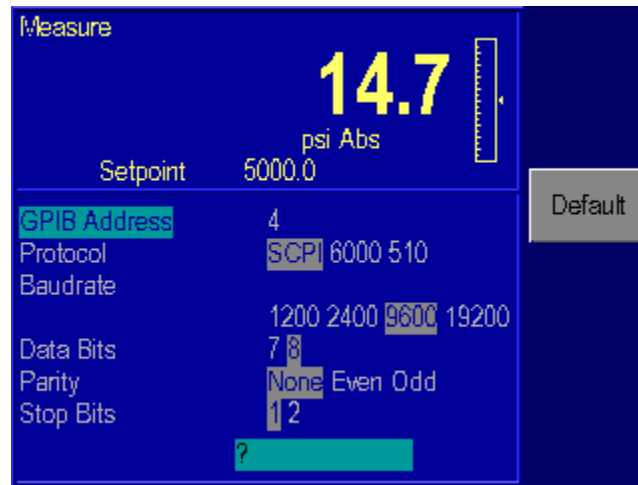
gld16.bmp

Figure 4-14. Menu | Setup | Remote - Menu

GPIB Address

Sets the IEEE-488 interface address.

Protocol

The Protocol defines which protocol should be used by the remote interface. The options are Standard Communication for Programmable Instruments (SCPI) which is the standard interface, 6000 to emulate the Series 6000 pressure controller, and 510 to emulate the Model 510 pressure controller. When using the SCPI interface, the RUSKA 7350 will emulate the 7010 and 7215 series controllers.

Serial Interface Set-Up

The operator can set-up the Baud Rate, Data Bits, Parity, and Stop Bits for the Serial Interface.

Menu | Setup — System

The System Menu identifies the Software release version that is being operated in the Calibrator. It also stores and allows the operator to edit the Date and Time.
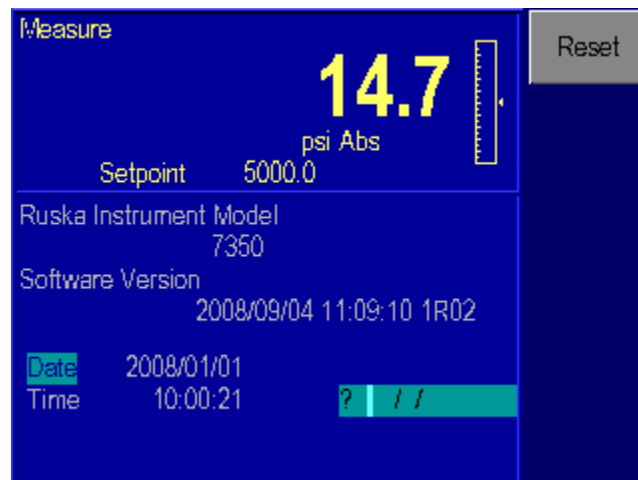
gld17.bmp

Figure 4-15. Menu | Setup | System - Menu

4-15

Date/Time

The Calibrator's system clock is continuously updated. If the date or time requires editing, the following applies;

1. The date and time are set from the Setup | System | Menu. From the Main Menu (press PREVIOUS until the Main Menu appears), press Menu [F6] | Setup [F2] | System [F5].

2. To set the system date, turn the rotary knob until Date is highlighted. Use the numeric keypad to enter the current four-digit year, month, and day (yyyymmdd). All digits must be entered. Press ENTER to accept.

3. To set the system time, turn the rotary knob until Time is highlighted. Use the numeric keypad to enter the current hour, minute, and second (hhmmss). All digits must be entered. Press ENTER to accept.

Reset

The Reset [F1] command is used to re-boot the Calibrator.

To reset the system, from the Main Menu (press PREVIOUS until the Main Menu appears), press Menu [F6] | Setup [F2] | System [F5] | Reset [F1].

Menu | Calibrate

The Menu | Calibrate command is used to perform the calibrations on all of the sensors utilized by the Calibrator. The RUSKA 7350 can be completely calibrated using the front panel interface. It does not require any external computer or software in order to perform a successful calibration. It also has the capability of being calibrated remotely through either the RS232 or IEEE-488 interface. The RUSKA 7350 will guide the operator through a menu driven calibration procedure identifying the pressures that should be supplied by a standard. Following the calibration procedure, the RUSKA 7350 calculates and saves its own coefficients. The calibration coefficients are date stamped so the user can easily identify the last time the instrument went through a full calibration, when the coefficients were last edited or when the Calibrator was re-zeroed.

The calibration section in the RUSKA 7350 can be password protected to prevent any unauthorized entry into the calibration section of the system. Please refer to Chapter 6, Maintenance, of the manual for more detailed information regarding the calibration of the RUSKA 7350.

Calibration Password

The calibration password allows the user to protect access to Calibrator calibration constants and the calibration procedure. If the calibration password is set to any number other than zero, it is *required* before the user is allowed to calibrate the Calibrator or manually change the calibration constants.

Note

It is recommended that the access password be recorded and filed in a secure location.

1. The calibration password is set from the Calibration Menu. From the Main Menu (press PREVIOUS until the Main Menu appears), press Menu [F6] | Calibrate [F3] | Menu | Calibrate | Edit.

2. Press the Access [F4] key. If there is a password in the system other than 0, then you must enter the current valid password into the RUSKA 7350 before it will allow you to modify the password.

3. Use the numeric keypad to enter the new calibration password. Setting the calibration password to zero allows free access to Calibrator calibration and constants. Press ENTER.

4. Press Yes [F4] to acknowledge changing the calibration password. Press No [F5] to reject changing the calibration password.

Menu | Program — Storing A Sequence in Memory

Consider an exercise that requires the Calibrator to start at 30 psi, increase to 50 psi, then decrease to 20 psi. Test sequences like this may be stored in the Calibrator's memory as a program.

One benefit of storing a sequence in memory is that the user does not have to command each pressure separately every time a multipoint test or calibration routine is performed. Another benefit is that the user can specify a tolerance for each set-point pressure. Once a tolerance is set, the dwell timer will start counting down instead of waiting until the pressure is at the exact set-point to start the dwell timer. This gives the user a time advantage compared to manual mode operation and provides a degree of automation without the use of an external computer.

Note

The Calibrator can store up to 1,000 program steps that may be divided among a maximum of 20 named programs.

Preparing to Program

Before entering a test sequence, consider the items discussed below.

Program Name

Valid program names range from one to eight characters in length and can include numbers, upper case letters, and the /, %, and # symbols. For example, Exer#14 and %FS test are both valid names.

Configuration

Since a program will depend on the current setup of the Calibrator (the current configuration is stored with the program) the user should set the units, limits, control parameters, etc., to the desired values before creating a program.

Number of Set-points

Before entering the sequence, the user should determine the number of upscale and downscale set-points required to complete the exercise.

Set-point Pressure and Tolerance

Each set-point in the program requires both a pressure and a tolerance, in the current units of measure. For example, one set-point might require a tolerance as low as 0.05 psi (0.35 kPa), whereas another set-point in the same program could be satisfied with a tolerance as high as 5 psi (0.35 kPa).

Dwell Time

Once the pressure is within the specified tolerance, the Calibrator starts a timer that runs for a user-defined number of seconds. This is referred to as *dwell time*. As long as this timer is running, the Calibrator will remain at the designated set-point unless the *max time* (see below) elapses. When the *dwell time* expires, the Calibrator will proceed to the next step. Typically the *dwell time* should be set to a value less than the *max time*.

Usually *dwell time* has a value of a few seconds, but a value of 0 can be used to create a pause in the program. When the *dwell time* is set to zero, the Calibrator switches to manual control once it is within the tolerance value of the set-point pressure. The user must then press a key on the front panel to continue the program.

MaxTime

The *max time* is the maximum time in seconds including the *dwell time* that the Calibrator can spend on one step of the program. After the *max time* elapses, the Calibrator will automatically proceed to the next set-point in the program, even if the current set-point has not been achieved. Thus, the *max time* selection limits the amount of time that the Calibrator can spend on any one set-point. Typically the *max time* should be set to a value greater than the *dwell time*. If the *max time* is set to zero, the Calibrator will attempt to achieve the set-point indefinitely (i.e. the *max time* function is disabled).

Mode of Entry

If the upscale portion of the desired pressure step sequence and the downscale portion of the sequence both have the same highest and lowest set-points and consist of evenly spaced steps, the <Auto> option can be used to automatically generate the program. However, if any part of the sequence includes unevenly spaced steps, or the starting and ending set-points are not the same, each step must be programmed individually. In the example given at the beginning of the section Menu | Program – Storing a Sequence in Memory, each step must be programmed individually since the starting set-point is 30 psi and the ending set-point is 20 psi.

Detailed instructions for entering these items are given in the sections that follow.

Entering a New Program

To program the Calibrator, use the keys on the front panel to change values on the Calibrator's program editing screen. Instructions for entering each step of a new program are included below.

1. Ensure that the units, limits, and control parameters have been set to the desired values.

2. The program is entered from the Program Menu. From the Main Menu (press PREVIOUS until the Main Menu appears), press Menu [F6] | Program [F4].

gld18.bmp

Figure 4-16. Menu | Program - Menu

3. Use the rotary knob to highlight "new".

4. Press Edit [F4]. Since "new" was highlighted, the Calibrator will create a new program and give a default name of NAMEnn, where nn is a two digit number. The Program editing screen will appear, displaying the first step.
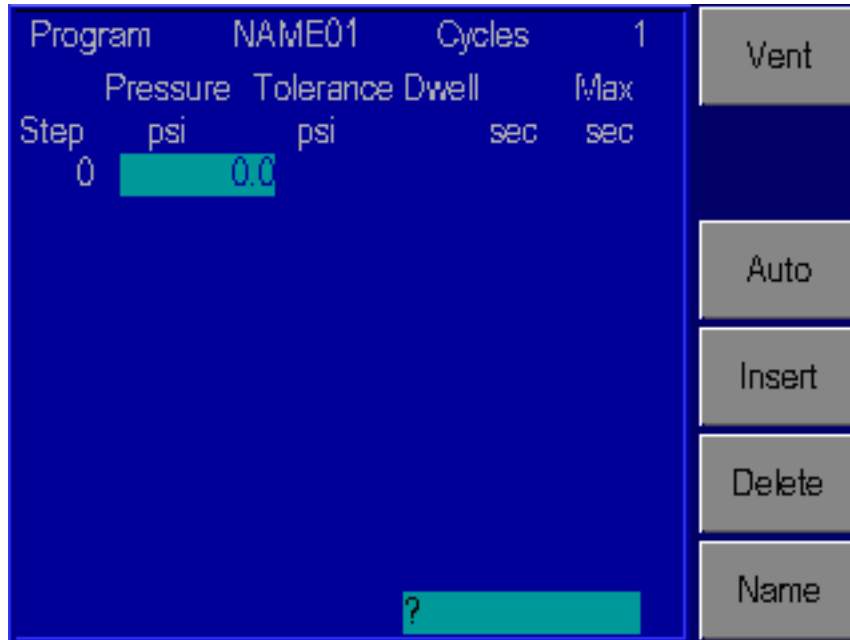
gld19.bmp

Figure 4-17. Menu | Program | Edit - Menu

5. Using the numeric keypad, enter the values for Pressure, Tolerance, Dwell time, and Max time, pressing ENTER after each value. The rotary knob may be used to skip fields.

6. At the 0 step, enter the next pressure and the Calibrator will automatically insert a new pressure step.

7. Repeat steps 5 and 6 until the test sequence is complete. The Tolerance, Dwell time and Max time will default to the value programmed in the first program step, and only need to be changed if a different value is desired for a particular step.

8. It is often suggested that the last point in a calibration program is to vent the pressure to atmosphere. This can be achieved by selecting the VENT function key as the pressure set point.

Note

You can use the vent as a set-point at any point in the program. The dwell and max time function with vent just as they would at a controlled set-point.

9. When all steps have been entered, press PREVIOUS to return to the Named programs screen. See section, Chapter 4, Changing the Name of a Program, section for creating a user-defined program name.

Automatically Generating a Program

For the Calibrator to automatically generate a program, the user must input the first set-point pressure, the last set-point pressure, and the number of steps in between, as well as the dwell time, max time and tolerance common to all set-points.

1. Ensure that the units, limits, and control parameters are set to their desired values.

2. The program is entered from the Program Menu. From the Main Menu (press PREVIOUS until the Main Menu appears), press Menu [F6] | Program [F4].

3. Use the rotary knob to highlight "new". If these steps are used on an existing program, all program steps will be deleted and replaced with the automatically generated program.

4. Press Edit [F4]. Since "new" was highlighted, the Calibrator will create a new program and give a default name of NAMEnn where nn is a two digit number. The Program editing screen will appear, displaying the first step.

5. Press Auto [F3].
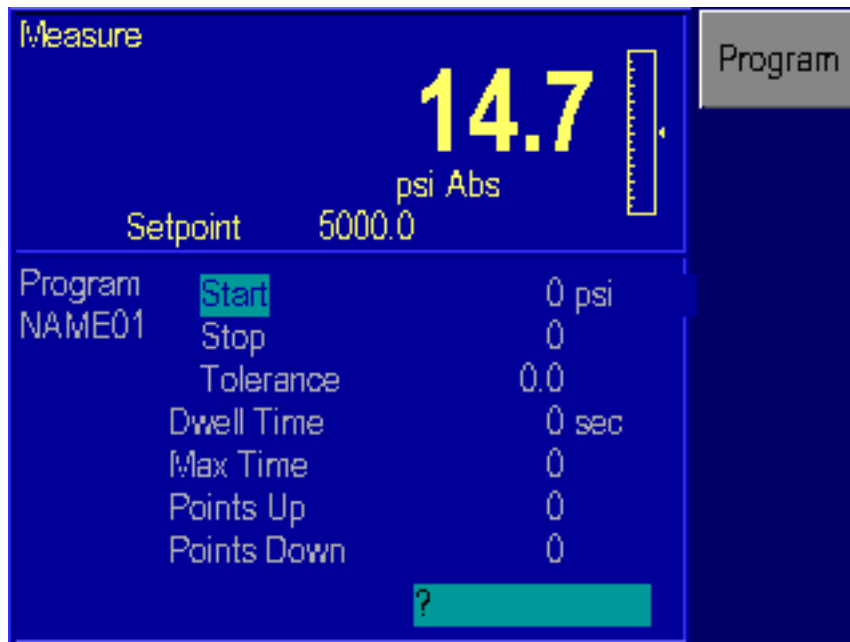
gld20.bmp

Figure 4-18. Menu | Program | Edit | Auto - Menu

6. Using the numeric keypad, enter the values for Start, Stop, Tolerance, Dwell time, Max time, number of pressure Points up, and number of pressure Points down, pressing ENTER after each value. The rotary knob may be used to skip fields.

7. Press Program [F1]. The program will be generated and the display will show the first step.

8. Press the Name [F6] key to edit the name of the program. See next section, Chapter 4, Changing the Name of a Program, for creating a user-defined program name.

Changing the Name of a Program

1. The name of an existing program is changed from the Program Menu. From the Main Menu (press PREVIOUS until the Main Menu appears), press Menu [F6] | Program [F4]. In addition to changing the name of an existing program, a new program may be initiated by selecting new and performing the same steps as outlined to change the name of a program.

2. Use the rotary knob to highlight the current name. (For a new program name, select "new".)

3. Press Edit [F4]. The program editing screen will appear, displaying the first step.

4. Press Name [F6].
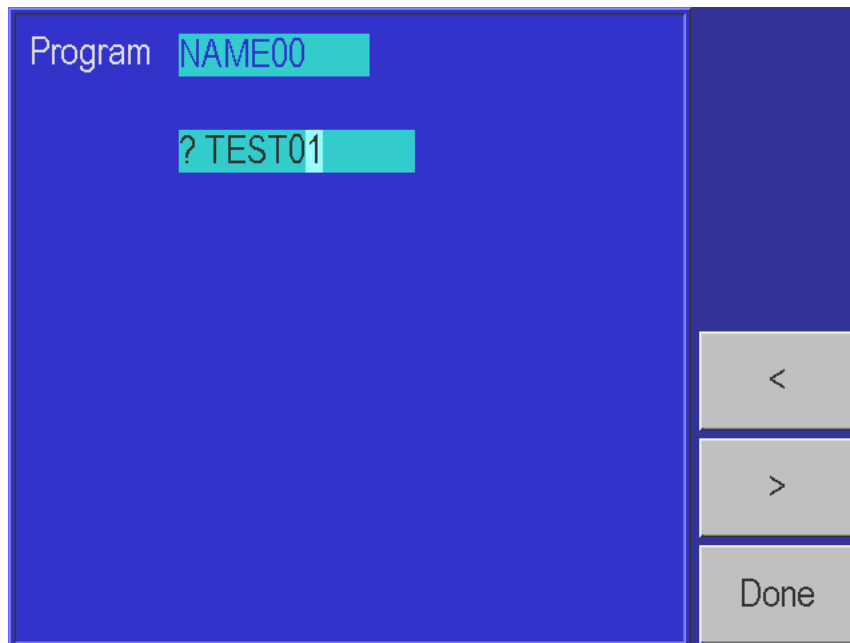
gld21.bmp

Figure 4-19. Menu | Program | Edit | Name - Menu

5. Use the < [F4] and > [F5] keys to highlight a character.

6. Turn the rotary knob to select the character from the character set.

7. To correct a mistake, press Clear [F4] and return to step 5.

8. Repeat steps 5 and 6 until the name is complete.

9. Press Done [F6] to store the contents of the scratchpad as the new name of the program.

Changing an Existing Program

Instructions for changing an existing sequence are given below. Both manually and automatically generated programs may be edited.

1. Programs are changed from the Program Menu. From the Main Menu (press PREVIOUS until the Main Menu appears), press Menu [F6] | Program [F4].

2. Use the rotary knob to highlight the name of the program.

3. Press Edit [F4]. The program editing screen will appear as a table showing all of the steps.

gld22.bmp

Figure 4-20. Menu | Program | Edit - Menu

4. The rotary knob can be used to move through the program and highlight the value you wish to edit. Use the keyboard to enter a new value. This value will show up in the scratch pad located at the bottom of the window. Press Enter to accept the edited value.

5. To add a step to the program, first move to the step after the new step. For example, to insert a step between steps 3 and 4, move to step 4. Press Insert [F4].

6. To delete a step in the program, first move to the step to be deleted, then press Delete [F5].

7. When all changes have been made, press PREVIOUS to return to the Named Programs screen. The Calibrator automatically saves the changes that were made in the program.

Changing the Configuration Stored with a Program

1. Programs are configured from the Program Menu. From the Main Menu (press PREVIOUS until the Main Menu appears), press Menu [F6] | Program [F4].
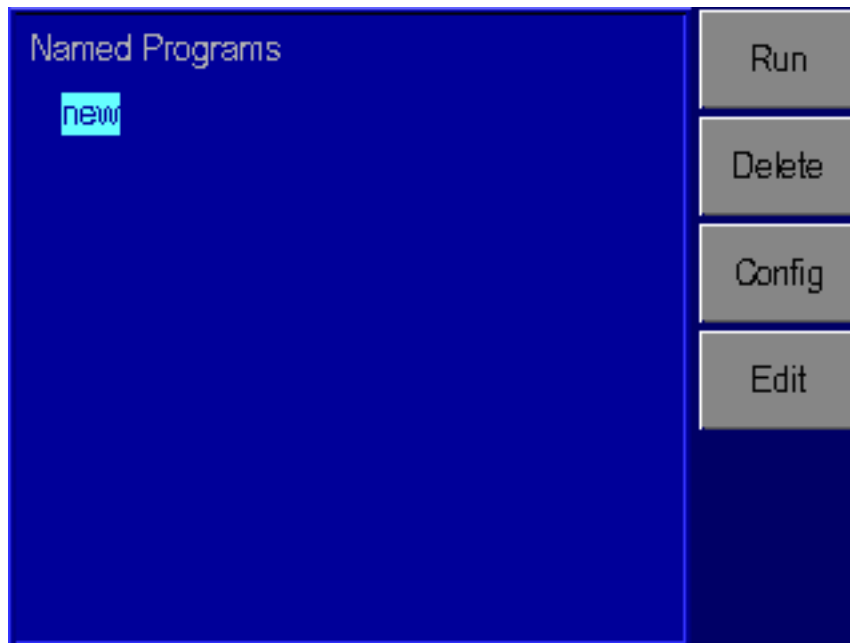
2. Use the rotary knob to highlight the name of the program.

3. Press Config [F3]. The configuration screen will appear.

4. Press Recall [F2]. The Calibrator will be set to the configuration stored with the program.
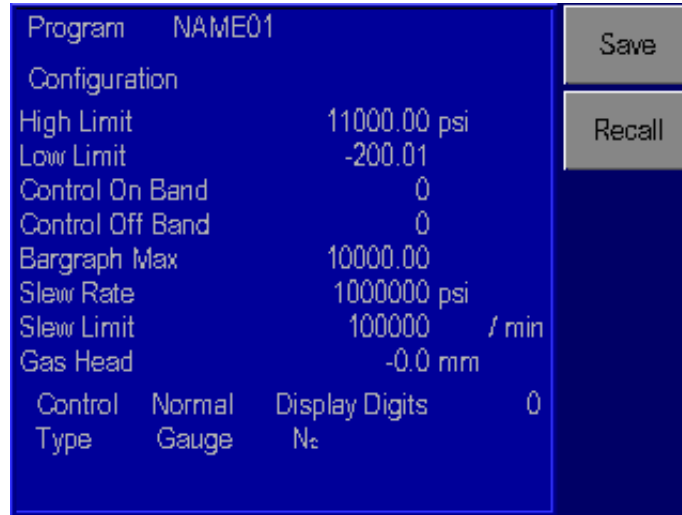
gld23.bmp

Figure 4-21. Menu | Program | Config - Menu

5. Press PREVIOUS until the Main Menu appears.

6. Press Setup [F2] | Limits [F1]. Change the desired parameters using the normal procedures.

7. Return to the Main Menu by pressing PREVIOUS three times.

8. Press Menu [F6] | Program [F4].

9. Use the rotary knob to highlight the name of the program.

10. Press Config [F3] | Save [F1]. The configuration of the Calibrator will be changed to the current settings and stored in the program's configuration.

Running a Program

1. Programs are run from the Program Menu. From the Main Menu (press PREVIOUS until the Main Menu appears), press Menu [F6] | Program [F4].

2. Use the rotary knob to highlight the name of the program.

3. Press Run [F1]. The program run screen will appear. "Stop" will be highlighted, showing that the program is not currently running.
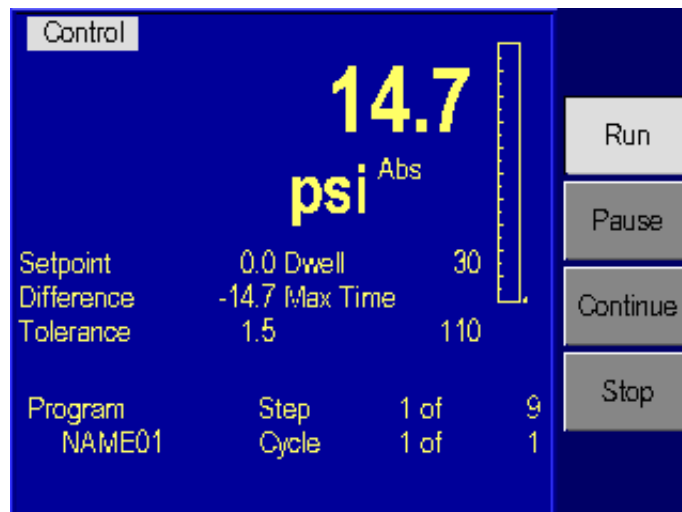
gld24.bmp

Figure 4-22. Menu | Program | Run - Menu

4-23

4. Press Run [F2]. The configuration of the Calibrator stored with the program is restored, the pressure set-point is set to the pressure value in the first step, and the Calibrator is placed in Control mode. "Run" will now be highlighted and the program will proceed through its steps.

5. To pause the program, press Pause [F3]. "Pause" will now be highlighted and the Calibrator will continue controlling to the current set-point. The Calibrator will maintain control of the current set-point until further instructions from the operator. Press Continue [F4] to resume the program.

6. To stop the program, press Stop [F5]. The program will stop running but the Calibrator will continue controlling to the current set-point.

Menu | Test

The Menu | Test section of the system is used to perform a number of the diagnostic and tuning functions that are available with the RUSKA 7350.
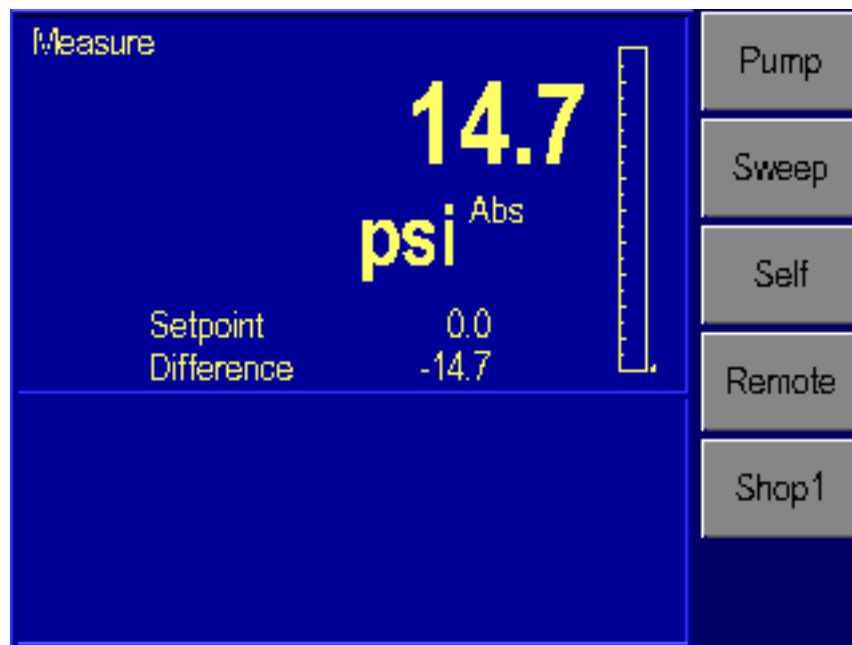
gld25.bmp

Figure 4-23. Menu | Test - Menu

Menu | Test — Sweep Test

The sweep function can be used to automatically exercise the elastic sensing element of the device under test prior to performing a calibration. For the Calibrator to perform the sweep test, input the high and low set-point pressures, the pressure control tolerance, the dwell time at set-point, and the number of cycles to perform.

1. Ensure that the units, limits, and control parameters are set to their desired values.

2. The sweep test is entered from the Sweep Test Menu. From the Main Menu, (press PREVIOUS until the Main Menu appears), press Menu [F6], then Test [F5], and then Sweep [F2].

3. Enter the high and low pressure points, the control tolerance, dwell time, and the number of cycles.
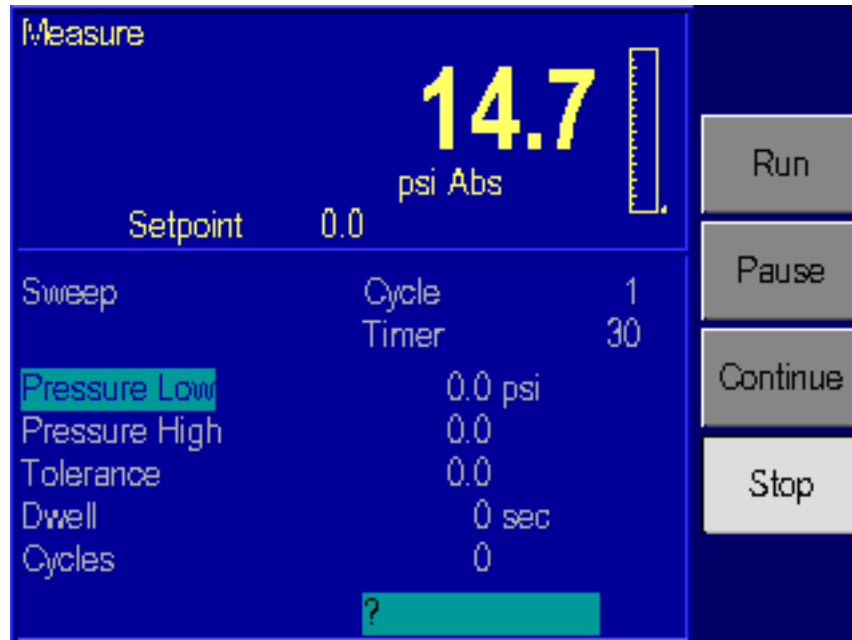
gld26.bmp

Figure 4-24. Menu | Test | Sweep - Menu

4. Press Run [F2] to initiate the test.

5. To pause the program, press Pause [F3]. Pause will now be highlighted and the Calibrator will continue controlling to the current set-point. The Calibrator will maintain control of the current set-point until further instructions from the user. Press Continue [F4] to resume the program.

6. To stop the program, press Stop [F5]. The program will stop running but the Calibrator will continue controlling to the current set-point.

Menu | Test — Self Test

The Calibrator can perform electrical and pneumatic self test to assist in trouble shooting potential problems. Please refer to Chapter 6, Maintenance, for more details.

Note

In order to perform a pneumatic self test, the supply port must be connected to a properly set supply pressure and the test port not open to atmosphere. For absolute units, a vacuum supply must also be connected to the exhaust port.

Menu | Test — Remote Test

The Menu | Test | Remote section of the system is used to perform a number of the diagnostic functions on the remote interface. It can be used to display the transmitted and received messages that are sent across the interface. This can be a powerful tool to assist in identifying the source of communication problems.

The Menu | Test | Remote menu displays information from the IEEE-488 interface. Pressing the Serial 1 [F2] or Serial 2 [F3] keys will display information from the serial ports.

gld27.bmp & gld28.bmp

Figure 4-25. Menu | Test | Remote - GPIB Menu & Menu | Test | Remote | Serial 1 - Menu

Menu | Test — Shop1

The Menu | Test | Shop1 menu of the system is used to display the current status of the various valve positions in the system. This menu is primarily used for diagnostics and will be discussed further in Chapter 6, Maintenance.

gld29.bmp

Figure 4-26. Menu | Test | Shop1 - Menu

Menu | Display

The Menu | Display is used to conveniently monitor most of the sensor output parameters. It is primarily used for troubleshooting.
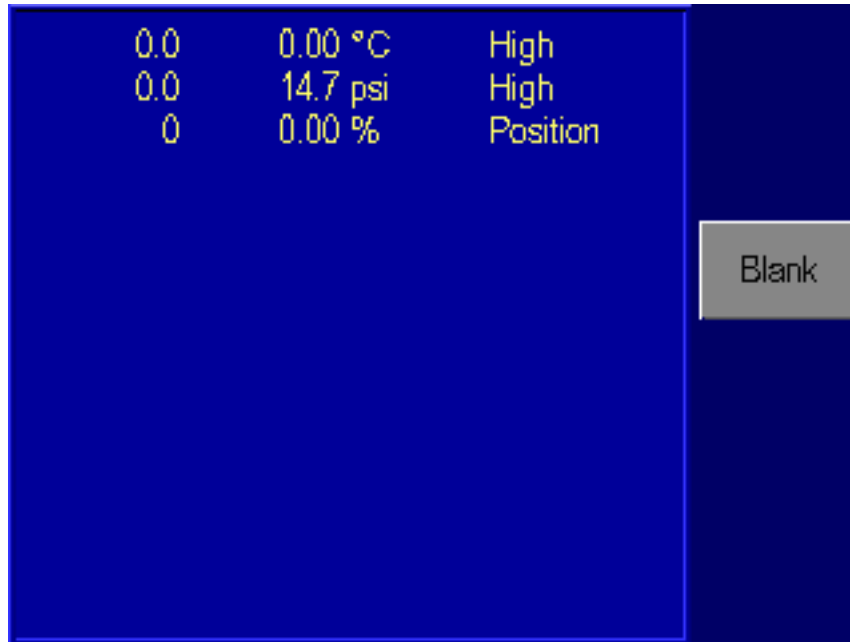
gld30.bmp

Figure 4-27. Menu | Display - Menu

Menu | Display — Blank

This is used as a screen saver in the RUSKA 7350.

Remote Operation

Remote Operation

The RUSKA 7350 can be operated remotely by a computer. Three interfaces are supported; IEEE-488, RS-232, and RS-485. All three interfaces support Standard Commands for Programmable Instruments (SCPI).

The IEEE-488 interface additionally supports emulation of a Single Channel Interface Panel (Models 6005-701 and 6005-761). The IEEE-488 interface conforms to the following standards.

ANSI/IEEE Std 488.1-1987	IEEE Standard Digital Interface for Programmable Instrumentation
ANSI/IEEE Std 488.2-1987	IEEE Standard Codes, Formats, Protocols, and Common Commands
SCPI 1991.0	Standard Commands for Programmable Instruments

Capabilities

IEEE-488

The following identification codes define the interface capabilities of the RUSKA 7350. Their meaning is described in the IEEE-488 standard.

SH1	Source Handshake, Complete Capability
AH1	Acceptor Handshake, Complete Capability
T5	Talker
L3	Listener
SR1	Service Request, Complete Capability
RL1	Remote-Local, Complete Capability
PP0	Parallel Poll, No Capability
DC1	Device Clear, Complete Capability
DT0	Device Trigger, No Capability
C0	Controller, No Capability

The optional IEEE-488 interface is installed next to the processor board. The interface is identified by the IEEE-488 standard connector on the back panel of the unit.

> *Note*
>
> *Do not change any jumpers or switch settings on the IEEE-488 interface board. The IEEE-488 address is set by the Menu / Setup / Remote screen.*

RS-232

The RS-232 interface supports standard serial operation from a computer to a single RUSKA 7350. RS-232 supports the IEEE-488.2 and SCPI commands. The RUSKA 7350 allows the following port setups.

Baud Rate:	1200, 2400, 9600, or 19200
Data Bits:	7 or 8
Parity:	Even, Odd, or None
Stop Bits	1 or 2
Handshaking	XON/XOFF

The RS-232 connection is a DB-9P connector found on the back panel of the RUSKA 7350. It is located on the processor board directly above the DB-25S connector. The following pins are used; all other pins are reserved.

Pin #	Direction	Signal	
2	In	RXD	Receive Data
3	Out	TXD	Transmit Data
5	——	GND	Ground
7	Out	RTS	Request to Send

Remote/Local Operation

In local mode, the RUSKA 7350 is operated manually through the front panel. Chapter 4, Local Operation, covers local operation. The RUSKA 7350 always powers up in the local mode. In remote mode, the RUSKA 7350 is operated by a computer connected to an interface. Most functions that can be performed in local mode can also be performed remotely.

Remote mode does not automatically disable local operation. The remote interface may be active while local operations are being done. In cases where full remote control is required the following methods may be used.

1. Issue a Local Lockout (LLO) interface message via the IEEE-488 interface. The RUSKA 7350 will disable the local keyboard until the Go To Local (GTL) interface message is received or the REN (Remote Enable) line is unasserted. This method cannot be used on the serial interfaces.

2. Issue the SCPI command "SYSTEM:KLOCK O" to lock the local keyboard. The RUSKA 7350 will disable the local keyboard until the command "SYSTEM:KLOCK OFF" is received.

3. Issue the SCPI command "DISPLAY:ENABLE OFF" or "DISPLAY:TEXT <string>". These commands will disable the local display in addition to locking the keyboard. The command "DISPLAY:ENABLE ON" will restore the local display and keyboard operation.

Local operation may also be restored by powering the RUSKA 7350 off and back on.

Configuration

The remote interface is configured using the local interface before the remote is connected. The parameters needed varies with the interface used.

IEEE-488	Address, Protocol
RS-232	Baud Rate, Data Bits, Parity, Stop Bits
RS-485	Address, Baud Rate, Data Bits, Parity, Stop Bits

To configure the remote interface follow these steps:

1. The remote interface is configured from the Setup Remote Menu. From the Main Menu (press Prev. until the Main Menu appears) press Menu [F6] │ Setup [F2] │ Remote [F4].

2. Use the knob to highlight the desired parameter.

3. Use the numeric keypad to enter the address. The ENTER key must be pressed to change any parameter.

4. Repeat steps 2 and 3 to set all parameters needed.

Device Messages

SCPI Command Format

SCPI mnemonics have two forms: long and short. The short form is all in capital letters. The long form is the entire mnemonic. Commands may use either the short form or the entire long form. No other forms are accepted. SCPI ignores case: uppercase and lowercase are equivalent.

A SCPI command is made by following the command tree as presented in the command summary. Each level adds a mnemonic to the command separated by colons. Mnemonics enclosed in square brackets are optional and may be omitted.

Some mnemonics are followed by an optional numeric suffix. If omitted, the suffix defaults to 1.

Multiple commands may be placed in a single message separated by semicolons. Each command starts at the same level of tree where the last command stopped unless the command starts with a colon. The first command in a message and any commands starting with a colon start of the root of the command tree. IEEE 488.2 commands may occur between SCPI commands without affecting the tree level.

Command parameters are separated from the command name by one or more spaces. Multiple parameters are separated by commas. SCPI accepts numeric parameters with optional sign, decimal point, and exponent. OFF is equivalent to zero and ON is equivalent to one. Floating point numbers are rounded to the nearest integer for commands accepting integer values only.

A message is terminated by a Line Feed (hexadecimal 0A). Carriage Returns, Tabs, and other control characters are ignored.

SCPI Response Format

Only commands ending in a question mark have responses. Multiple values from a single command are separated by commas. Responses from different commands in the same message are separated by semi-colons. The response message is terminated by a Line Feed (hexadecimal 0A).

Integer responses are returned as one or more digits. Boolean values (ON and OFF values) are always returned as numbers with zero for OFF and one for ON. Floating point values are returned in the format "+d.ddddddddE+dd".

ANSI/IEEE 488.2-1987 Command Summary

*CLS	Clear Status
*ESE?	Event Status Enable Query
*ESE <number>	Event Status Enable
*ESR?	Event Status Register
*IDN?	Identification
*OPC?	Operation Complete Query (Returns 1)
*OPC	Operation Complete
*RST	Reset
*SRE?	Service Request Enable Query
*SRE <number>	Service Request Enable
*STB?	Status Byte Query
*TST?	Self-Test Query
*WAI	Wait (No operation)

SCPI Command Summary

The current value associated with a SCPI command may be read by appending a question mark to the command. For example CALC:LIM:UPP? will return the current upper pressure limit.

MEASure	
[:PRESsure]?	returns current pressure reading
:POSITION?	returns pump position (%)
CALCulate	
:LIMit	
:LOWer <number>	get/set low pressure limit
:SLEW <number>	get/set slew rate limit
:UPPer <number>	get/set high pressure limit
:VENT <number>	get/set auto-vent limit
:TARE	
:VALue <number>	get/set tare value
:STATe ON/OFF	set tare using current pressure
CALibration	
[:PRESsure]	
:Data	
:POINts ?	number of calibration constants
:VALue<n>?	returns cal constants label, value
:VALue<n> <number>	set calibration constant
:CALibration	
:POINts?	number of calibration points
:VALue?	Nominal calibration point
:VALue<n> <number>	perform calibration point
:ZERO	performs zero calibration
:VALUE <number>	sets zero value
:INITiate	enter zero calibration mode
:INITiate?	returns status for cal, press, temp, ref
:RUN	start zero calibration
:STOP	abort zero calibration
:POSition	
:DATA <number>, <number>	sets C0, C1 position
:DATA?	reads C0, C1
:VALue <number>	sets first calibration point
:VALue 2 <number>	sets second calibration point

```
          :MODE?                              calibration edit enabled?
          :MODE ON¦OFF¦1¦0                    enable calibration edit
                                              (Cal. button required)

DISP
   :ENABle ON¦OFF¦1¦0                         turns front panel display on/off
   :TEXT <string>                            displays message on front panel
   :BGRaph <number>                          sets bar graph maximum
OUTPut
   :STATe ON¦OFF¦1¦0                          off=MEASure, on=CONTrol
   :STATe?                                    returns 0=Measure or 1=Control
   :MODE MEASure¦CONTrol¦VENT                 sets mode
   :MODE?                                     returns mode string
PROGram
   :CATalog?                                  returns list of defined programs
   [SELected]
      :DEFine <program block>                 Define program
                                              press1, toler1, dwell1, max1, press2,
                                              toler2, ..
      :DEFine?                                read program definition
      :DELete
         [:SELected]                          deletes current program
         :ALL                                 deletes all programs
      :NAME <program name>                    select current program
      :STATe RUN|PAUSe|STOP|CONTinue          set program state
      :STATe?            `                    read program state
      :CONFigure
         :RECall                              restore saved configuration
         :SAVE                                save current configuration
SENSE
   [:PRESSure]
   [:RESolution] <number>                     set pressure display resolution
         :AUTO <boolean>|ONCE                 return to default resolution
      :MODE?                                  returns ABSOLUTE or TARE
      :RANGE
         [:UPPer]                             returns RUSKA 7350 full scale value in
   units
         :LOWer                               returns 0
      :REFerence
         [:HEIGht] <number>                   set head height
         :SGRavity <numbers>                  set specific gravity
[SOURCE]
   [:PRESsure]
   [:LEVel]
         [:IMMediate]
            [:AMPLitude] <number>             sets pressure setpoint
            [:AMPLitude]?                     read pressure setpoint
      :MODE FIXed|LIST                        set source parameter set
      :TOLerance <number>                     specifies output tolerance
      :SLEW <number>                          set slew rate
      :CONTrol <number>                       set control band
```

:LIST		
:PRESsure <number> [,<number>]		set list of pressure values
:POINts?		returns number of points defined
:DWELl <number> [,<number>]		specifies dwell times
:POINts?		returns number of dwell times
:TOLerance <number> [,<number>]		specifies tolerances
:POINts?		returns number of tolerances
:DIRection UP|DOWN		direction to go through list
:COUNt <number>		number of times to go through list
STATus		
:OPERation		
[:EVENT]?		read/clear operation event register
:CONDition?		read operation condition register
:ENABle <number>		set operation enable mask
:QUEStionable		
[:EVENT]?		read/clear questionable event register
:CONDition?		read questionable condition register
:ENABle <number>		set questionable enable mask
:PRESet		reset condition flags
SYSTem		
:DATE <year>,<month>,<day>		set system date
:ERRor?		returns <error#,"descr;info">
		or 0,"No Error"
:KLOCk ON|OFF|1|0		lock keyboard
:TIME <hour>,<minute>,<second>		set system time
:VERSion?		returns 1991.0
:LANGuage "6000"|"SCPI"		set interface protocol to 6000 or SCPI
:PRESet		reset system
TEST		
:ELECtronic?		perform electronic self-test
UNIT		
:DEFine<n> <name>,<number>		define a unit
:LENGth MM|IN		set length units for head height
[:PRESsure] <unit name>		set pressure units

Example SCPI Commands

To request the current pressure reading, all of the following commands are equivalent:

:MEASURE:PRESSURE?

 :measure:pressure?
 :MeAsUrE:pReSsUrE?
 :meas:pres?
 :measure?
 :meas?
 MEAS?

To set the control pressure setpoint to 50, all of the following commands are equivalent:

SOURCE:PRESSURE:LEVEL:IMMEDIATE:AMPLITUDE 50
SOUR:PRES:LEV:IMM:AMPL 50.0
PRESSURE +50
PRES 50

SCPI Status Registers

Status Byte Register (STB), Service Request Enable Register (SRE)

Bit 7   Operation Status Summary. Set when an event enabled in OPER:ENABLE occurs.

Bit 5   EBS - Event status bit. Set when an event enabled in ESE occurs.

Bit 4   MAV - Message Available. Set when a response is ready to be sent.

Bit 3   Questionable Status Summary. Set when an event enabled in QUES:ENABLE occurs.

Bit 2   Error/Event Queue Not Empty.

Bit 1   Always 0.

Bit 0   Always 0.

Standard Event Status Register (ESR), Standard Event Status Enable Register (ESE)

Bit 7   Power-on. set at power-up.

Bit 6   User request. Always 0.

Bit 5   Command Error. Error in command syntax.

Bit 4   Execution Error. Error in command execution.

Bit 3   Device Dependent Error. Device error independent of commands.

Bit 2   Query Error. Output queue empty when request received.

Bit 1   Request Control. Always 0.

Bit 0   Operation Complete. Set for *OPC command.

Operation Status (OPER:EVENT, OPER:CONDITION, OPER:ENABLE)

Bit 0   Calibrating. Currently performing a calibration.

Bit 1   Settling. Waiting for control to stabilize.

Bit 2   Ranging. Always 0.

Bit 3   Sweeping. Always 0.

Bit 4   Measuring. The instument is actively measuring. Always 1.

Bit 5   Waiting for Trigger. Always 0.

Bit 7   Correcting. Currently performing a correction. Always 0.

Bit 8   Self-test in progress.

Bit 9   Always 0.

Bit 10 Always 0.

Bit 11 Always 0.

Bit 12 Always 0.

Bit 13 Instrument Summary bit. Always 0.

Bit 14 Program Running.

Bit 15 0.

Questionable Status (QUES:EVENT, QUES:CONDITION, QUES:ENABLE)

Bit 0   Voltage is questionable. Set when supply voltages are not within 5%.

Bit 1   Current is questionable. Always 0.

Bit 2   Time is questionable. Set when the clock has not been set.

Bit 3.   Temperature is questionable. Set when the oven temperature is not   within range.

Bit 5.   Phase is questionable. Always 0.

Bit 6   Modulation is questionable. Always 0.

Bit 7   Calibration is questionable. Set when the unit has not been calibrated.

Bit 8   Pressure is questionable. Set when the pressure is overranged.

Bit 9   Always 0.

Bit 10   Always 0.

Bit 11   Always 0.

Bit 12   Always 0.

Bit 13   Instument Summary bit. Always 0.

Bit 14   Command Warning. Set whenever a command ignores a parameter.

Bit 15. 0.

6005 Interface Panel Emulation

The RUSKA 7350 may be configured to emulate the IEEE-488 command set of the RUSKA Single Channel Interface Panel (Models 6005-701 and 6005-761). See the Interface Panel manual for a description of the protocol. The RUSKA 7350 emulation has the following differences:

1. The RUSKA 7350 is always in remote mode (Byte 0, Bit 2)
2. All TI strip outputs read as OFF (zero) and must be written as OFF.
3. No special functions are implemented.
4. Any message written to the RUSKA 7350 which starts with a colon as the first character is interpreted as a SCPI command.

To change from SCPI to Interface Panel Emulation via the remote interface, send the following message:

:SYSTem:LANGuage "6000"

To change from Interface Panel Emulation to SCPI via the remote interface, send the following message:

:SYSTem:LANGuage "SCPI"

Serial Operation

The RS-232 and RS-485 ports accept the same SCPI commands as the IEEE-488 port. The commands can be terminated by a carriage return (hexadecimal 0D) or a line feed (hexadecimal 0A). The responses are always terminated by a carriage return followed by a line feed.

The serial ports also support XON/XOFF. When the XOFF (hexadecimal 13) command is received, the RUSKA 7350 will stop transmitting. Transmission is restarted when the XON (hexadecimal 11) command is received.

When only one unit is attached, the Control-C (hexadecimal 03) command will clear the transmit and receive buffers and disable addressing. When addressing is disabled, the unit will respond to commands without being addressed.

When more than one unit is attached via the RS-485 multi-drop interface, an address sequence must be sent. The Data Link Escape (hexadecimal 10) command is sent followed by the address byte (hexadecimal 20 + unit address). This sequence will enable the address unit and disable all others. The Clear (hexadecimal 14) command may be used to clear the transmit and receive buffers without disabling addressing.

<div align="right">

Chapter 6
Maintenance

</div>

Introduction

Very little maintenance is normally required for the RUSKA 7350. The following sections discuss some of the suggested procedures.

Observing the RUSKA 7350's Full Scale Rating

Instructions for observing the RUSKA 7350's full scale rating are given below.

1. If necessary, press PREV. several times to return the display to the main screen.

2. Select Menu/Cal. The RUSKA 7350's full scale pressure rating (FS:) will appear on the screen, in the current units of measure.

3. Press PREV. to return to the previous screen.

Observing the Software Version Number

Follow the steps below to observe the RUSKA 7350's software version number.

1. If necessary, press PREV. several times to return the display to the Main Menu.

2. Select Menu│Setup│System. The software version number will appear on the screen.

3. Press PREV. to return to the previous screen.

Preventive Maintenance

Although the RUSKA 7350 is designed to be nearly maintenance free, occasional preventive maintenance is required to keep the RUSKA 7350's performance optimal.

Initiating the RUSKA 7350's Self Test

To test the RUSKA 7350's hardware, software, and pneumatics, follow the steps below.

1. If necessary, press PREV. several times to return the display to the Main Menu.

2. Select Menu│Test│Self│Electrical. The electronics self test will run and display the results.

Removing the RUSKA 7350's Cover

The RUSKA 7350 should be kept clean and completely assembled at all times. Operating the RUSKA 7350 without its cover affects the RUSKA 7350's thermal gradients and therefore reduces accuracy. If it becomes necessary to remove the RUSKA 7350's cover, follow the instructions below.

⚠ ⚠ **Warning**

The RUSKA 7350 should only be opened by qualified electrical/mechanical service technicians. Lethal voltages are present and exposed in the power supply and display.

1. Turn off the RUSKA 7350 and disconnect the power cord from the power supply.

2. Locate the 14 screws on back and side and two screws on top of cover that secure the cover to the chassis.

3. Unscrew these screws.

4. Remove the cover.

5. Replace the cover before resuming operation.

Processor Battery

The processor board uses a lithium battery to maintain time and date information. This battery has a varying life. If the instrument is left on 24 hours a day, it will last 5-10 years. If the instrument is stored, it will last one year. It is recommended to replace it every year. To do this, follow the instructions below:

1. Remove cover, see Chapter 6, Removing the RUSKA 7350's Cover section.

2. Remove the cover of electronic chassis located at the front right corner.

3. Remove processor card by removing one screw and rocking upward.

4. Remove battery, a round silver object, by carefully pulling on battery while holding card.

5. Plug in new battery (part no. 4-725).

6. Reassemble in reverse order.

7. The time and date may have to be re-entered. See subsection Chapter 4, Date/ Time section.

Calibration

To keep the RUSKA 7350 operating within its specified accuracy (Appendix A), the calibration procedure described below must be performed every year. Use appropriate DWG, such as Model 2475.

Note

The calibration procedure automatically generates coefficients which are stored in memory on the RUSKA 7350's Control Board (Chapter 2). If these constants are "lost" for any reason, the calibration procedure must be performed, regardless of the last calibration date. If the calibration coefficients are known, they may be restored to the RUSKA 7350 at any time by "editing the coefficients" (See Chapter 6, Editing the Coefficients section.)

Calibration Instructions — Single Sensor

To calibrate the RUSKA 7350, the user simply connects a calibration standard to the Calibrator's Test port then follows the 4-step calibration procedure on the Callibrator's display. The calibration procedures is a menu driven procedure that steps the user through the pressures that are required to calibrate each pressure range that is included in the Calibrator. The user generates the defined pressures utilizing an adequate standard to calibration the RUSKA 7350. The pressure steps will vary based on the pressure range and number of sub ranges that are included with the RUSKA 7350. Typically, for a single range instrument, the operator would be prompted to generate Atmosphere, 50%, 100%, and 50% of the Calibrator's full scale operating range of a sensor (See Chapter 6, Observing the RUSKA 7350's Full scale Rating). No disassembly is required and there are no potentiometers to tune.

Note

The uncertainty of the final calibration must include the uncertainty of the standard being used.

Preparation

- Verify that the calibration standard is connected to the TEST PORT.
- Verify that the RUSKA 7350 has been at stable operating temperature for *at least two* hours
- Verify that the RUSKA 7350 is in Measure mode (See Chapter 4, Local Operation).
- Verify and set the head pressure to zero in Menu│Setup│User.
- (Triple range only) Verify the range to be calibrated is selected. To change press the Mode│Range [F5].
- If desired, change the RUSKA 7350's units of measure (See Chapter 4) to match those of the calibration standard.
- To go to the Calibration screen, select MENU/CAL.

To begin the calibration process, press MENU│CALIBRATE│CALIBRATE. If the calibration access code is enables, enter it at the prompt. The Calibration, Step 1, screen will appear.

Note

To exit the calibration procedure before the calibration coefficients have been changed, press CANCEL any time during the procedure.

Step 1

1. To begin Step 1 of the calibration process, select Step 1. Enter the actual pressure applied and press ok.

2. Wait until the zero procedure completes. When the 7350 completes Step 1, the Calibration, Step 2, screen will appear.

Step 2

1. To begin Step 2, use the calibration standard to Apply the mid-point pressure requested by the RUSKA 7350. As pressure is to be applied into the Test Port, the Measured pressure on the RUSKA 7350's screen will change accordingly.

2. When the Measured pressure stabilizes, use the RUSKA 7350's numeric keypad and OK to enter the actual pressure applied by the calibration standard. Do not enter the Measured pressure reported by the RUSKA 7350. If necessary, use the CLEAR key to correct a mistake in the edit field. If the actual pressure applied is acceptable, the Calibration, Step 3, screen will appear.

Note

If the actual pressure is outside of the tolerance for the requested mid-point pressure, Error –222 Data out of range will occur. Acknowledge this error by selecting OK, then re-enter the actual pressure, repeating Step 2, number 1, if necessary.

Step 3

1. To begin Step 3, use the calibration standard to Apply the high-point pressure requested by the 7350. The Measured pressure on the RUSKA 7350's screen will change accordingly.

2. When the Measured pressure stabilizes, use the RUSKA 7350's numeric keypad and OK to enter the actual pressure reported by the calibration standard. Do not enter the Measured pressure reported by the RUSKA 7350. If necessary, use the CLEAR key to correct a mistake in the edit field. If the actual pressure applied is acceptable, the Calibration, Step 4, screen will appear.

Note

If the actual pressure applied is outside of the tolerance for the requested high-point pressure, Error –222 Data out of range will occur. Acknowledge this error by selecting OK, then re-enter the actual pressure, repeating Step 3, number1, if necessary.

Step 4

1. To begin Step 4, use the calibration standard to Apply the mid-point pressure requested by the RUSKA 7350. As pressure is to be applied into the Test Port, the Measured pressure on the RUSKA 7350's screen will change accordingly.

2. When the Measured pressure stabilizes, use the RUSKA 7350's numeric keypad and OK to enter the actual pressure applied by the calibration standard. *Do not enter* the Measured pressure *reported by the RUSKA 7350*. If necessary, use the CLEAR key to correct a mistake in the edit field. If the actual pressure applied is acceptable, the Calibration complete screen will appear.

Storing the Coefficients

Note

In addition to saving the calibration coefficients to the RUSKA 7350's memory, the user is advised to separately record the calibration coefficients and store this "backup" in a safe place.

Step 5

Calibration is complete. To exit the calibration procedure without storing the calibration coefficients in memory, press CANCEL. To store the calibration coefficients in memory, select DONE.

Step 6

Press PREV. to return to the main screen.

Once the calibration procedure is complete, the user is advised to record several pressure readings. If there are any significant errors at these points, then an error was probably made in generating one of the calibration pressures, and the calibration procedure should be repeated.

Editing the Calibration Coefficients

If the RUSKA 7350's memory is erased but the calibration coefficients are known, the user can restore the coefficients to the RUSKA 7350 by following the directions below.

⚠ **Caution**
Never randomly adjust the calibration coefficients. Only qualified personnel with valid backup data should be allowed to edit the coefficients. If the backup coefficients are questionable, perform the calibration procedure in its entirety.

1. Verify that the RUSKA 7350 is in Measure mode (Chapter 4, Local Operation).

2. To go to the Calibration screen, select MENU│CALIBRATE.

3. To edit the calibration coefficients, press the EDIT KEY. If the calibration access code is enabled, enter it at the prompt.

Note

To exit the calibration procedure before the calibration coefficients have been changed, press CANCEL any time during the procedure.

4. Use the arrow keys to highlight the coefficient.

5. Use the numeric keypad and ENTER key to enter a new value. To correct a mistake in the edit field, use the CLEAR key.

6. Repeat steps 4 and 5 until all four coefficients are correct.

Note

In addition to saving the calibration coefficients to the RUSKA 7350's memory, the user is advised to separately record the calibration coefficients and store this "backup" in a safe place.

7. To exit the editing procedure without storing the calibration coefficients in memory, press CANCEL. To store the calibration coefficients in memory, select OK.

8. Press PREV. to return to the main screen.

Once the calibration coefficients are input, the user is advised to record several pressure readings. If there are any significant errors at these points, then the calibration procedure should be performed.

Zeroing

The zero procedure may be performed by itself without requiring a full calibration.

- Verify ABS Mode.
- Verify that the RUSKA 7350's test port is open to atmosphere.
- Verify that the RUSKA 7350 has been at stable operating temperature for at least 30 minutes.
- Verify that the RUSKA 7350 is in Measure mode.

1. Enter the calibration screen by selecting MENU│CALIBRATE.

2. Select ZERO. The CAL button should not be pressed. If the CAL button is pressed, a full calibration will be selected.

3. Use the numeric keypad to enter the atmospheric pressure at the test port. Press OK when the measured pressure is stable.

4. Wait until the zero procedure completes. When the RUSKA 7350 completes the procedure, it will return to the CAL screen.

RUSKA 7350 Pump Lubrication

⚠ **Caution**

The threaded portion of the RUSKA 7350 pump spindle requires periodic lubrication. Failure to lubricate the pump spindle can cause premature failure of the pump spindle and nut resulting in permanent pump damage.

Approved Lubrications

Jet Lube AP-5 Grease (part number 45-342)

Jet Lube MP-50 Moly-paste

Frequency of Lubrication

The frequency of lubrication is dependant upon the frequency of instrument use. On a highly utilized system, the pump must be lubricated every other week. Also the pump should be lubricated any time that the pump shows signs of loss of lubrication along the face of the pump threads.

If a pump position error occurs, along with checking the condition of the pump and pump over-travel limit switches, please check the pump lubrication. An inadequately lubricated pump can sometimes be the cause of pump-position error detection by the system software.

Lubrication Procedure

The threaded portion of the pump plunger requires periodic lubrication. The pump may be lubricated by either injecting the lubricant through the grease fitting located on the left side of the instrument or by applying the grease directly to the threads of the pump plunger. Either way, the power to the system should be removed when applying the lubrication to the pump.

When applying grease directly to the pump, extend the pump plunger such that the majority of the threads are exposed. Using the lubrication provided with the system, or one of the lubrications noted in the approved lubrication list, disperse a generous amount of lubrication all along the threaded portion of the pump plunger.

⚠ **Caution**

Only the lubrication defined on the approved lubrication list above can be used. Substituting this lubrication can cause permanent damage to the pumping mechanism.

Fuse

The main fuse is a 6 AMP, 250V type 3AB-Slow blow (part number 3926870).

Cleaning

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

Chapter 7
Preparation for Storage and Shipment

Disconnection Instructions

⚠ Caution

The procedures given in this Chapter must be strictly adhered to in order to prevent damage to the instrument. Failure to follow these procedures will likely result in damage to the RUSKA 7350 during shipment. This damage is not covered by the carrier's insurance.

1. Relieve all pneumatic pressure from the RUSKA 7350.

2. Turn the RUSKA 7350 power switch to the off position.

3. Disconnect the power cable from the RUSKA 7350 power receptacle.

4. Disconnect all pneumatic lines and fittings from the RUSKA 7350's back panel.

5. Plug all ports.

Packing Instructions

The instructions below must be strictly followed in order to prevent damage to the instrument.

The main principle behind a successful shipment is that of minimizing shocks. This is accomplished by cradling the device within two boxes such that the RUSKA 7350 is restrained but still has resilience. The two most successful materials for this purpose are rubber foam and flexible polyurethane foams.

⚠ Caution

Styrofoam, poured "foam in place" mixtures, and other rigid foams are not suitable.

Even polyfoam or rubber foam should be cut into strips so that it will not present a large rigid surface to the RUSKA 7350.

Fluke has found that corrugated cardboard boxes provide the best packing. The boxes sometimes arrive damaged, but the contents are usually intact. A minimum of 3 inches of foam with at least an N95 impact rating should separate the inner surface of the inner box and any portion of the RUSKA 7350. The same is true for the inner and outer box.

⚠ Caution

Wood or metal boxes do not absorb shock when dropped and; therefore, are not recommended.

If the original packing and shipping materials were retained, use them for packing the RUSKA 7350. If the RUSKA 7350 is being packed for long-term storage (more than 30 days), place a desiccant bag inside the unit. In general, prepare the RUSKA 7350 for shipment as follows.

1. Fluke has an RMA procedure in place. Please contact the Customer Service Center to obtain an RMA number prior to returning any equipment to Fluke. Have the following information available when contacting Fluke:

   - the part number,
   - the serial number,
   - the purchase order number,
   - the billing and ship to address, and
   - the buyer's name and telephone number.

This information plus the RMA number must be attached to the unit when it is shipped to Fluke Calibration. There will be a minimal charge for inspection and/or evaluation of returned goods.

2. Enclose the RUSKA 7350 in plastic or any good water barrier material. Anti-static material is advisable.

3. Interior Carton (size 30 x 30 x 30 inches): Cover bottom and sides with no less than 3 inches of polyfoam. Use four strips 4" to 6" wide and 50" to 60" long. Arrange strips to cross each other inside carton. Cover sides and top, completely filling entire carton. Tape carton closed.

4. The Exterior Carton must be a double wall of corrugated or fiberboard box. Use four 3 x 3 x 84 inch strips of polyfoam crossing each other inside the carton. Place interior carton inside, making sure exterior carton is completely filled. Do not close the carton yet.

5. Inside the exterior carton, include the following:

   a. Statement of the problem or service needed. Be specific. Include the name and telephone number of a knowledgeable technician for consultation.

   b. The part number, serial number, return address, and purchase order number.

6. Seal the carton, using gummed tape.

7. Address the carton to:

FLUKE CALIBRATION
10311 WESTPARK DRIVE
HOUSTON, TX 77042
USA

8. Label the carton with the following labels: **THIS SIDE UP, HANDLE WITH CARE, DO NOT DROP**, and **FRAGILE**.

gld31.bmp

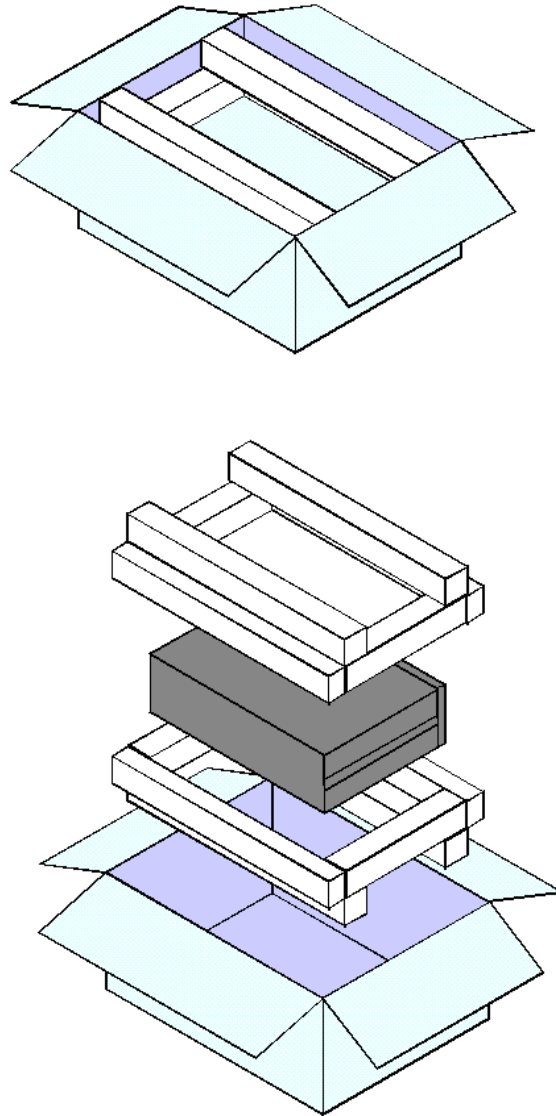**Figure 7-1. Packing the Calibrator**

Shipping Instructions

Fluke recommends using air freight for transportation. Surface transportation subjects the shipment to more frequent handling and much more intense shock.

Again, it is essential that the procedures mentioned in the packing instructions are strictly adhered to in order to prevent any shipping and handling damage to the instrument.

Appendix A
Summary of Specifications

Accuracy

Specifications of pressure transducer instrumentation can be divided into three categories: Input Specifications, General Specifications, and Performance Specifications. Each of these categories in turn consists of parameters which are usually specified by minimum and/or maximum numeric limits. Almost all of these parameters can have an effect on what is generally referred to as the instrument's "accuracy." Therefore, the accuracy of pressure instrumentation can be varied either beneficially or detrimentally by controlling the Input Specifications, operating within the General Specifications, or knowing the actual Performance Specifications.

For example, if Input Specifications have not been met for the line voltage, the unit may not have a catastrophic failure, but errors may be present in the transducer measurement. As another example, if the requirement for the Pressure Source Flow Capacity has not been met, the RUSKA 7350 may not be able to achieve a final steady state controlled pressure within the settling time specification. Finally, if the RUSKA 7350 is commanded to a pressure outside of the Applicable Control Pressure Range, the nonlinearity in the pressure output may be greater than that specified.

Performance Specifications give the user the most flexibility and control over his "accuracy claims." The term accuracy is defined by ISA-S37.1 as either the ratio of the error to the full-scale output (%FS) or the ratio of the error to the reading (%RDG). Note that the definition of accuracy is not the summation of some or even all of the possible error source maximum limits.

The true accuracy of an instrument is relative to the actual error introduced by the calibration transfer standard plus the actual error not eliminated from the instrument's indicated output. Therefore, an instrument's accuracy can be manipulated by introducing more or less actual error through the choice of a calibration standard; or its accuracy can be varied by the elimination of actual errors inherent in the instrument. For example, if an instrument has a known error due to being used in an attitude, or tilt, the %FS zero shift error can be eliminated by re-zeroing the instrument in the tilted position. Even %RDG sensitivity shifts can be eliminated mathematically or by controlling the attitude of the instrument during its calibration.

The key to eliminating an error is knowing its source and type along with its polarity and magnitude. Generally, the source is simple to detect and is represented by the specific parameter. The type is usually a function of the instrument's design and manufacturing process. Within a given instrument, an error can be either random or systematic, as well as random or systematic within the instrument's population. The user is free to consult Fluke for recommended methods of minimizing error source contributions.

In summation, total error can and should be managed by the control of the three general error sources: Input Specifications, which includes the user's chosen calibration standards; General Specifications, which includes the user's chosen processes; and Performance Specifications, which includes the user's chosen applications for the instrumentation. The parameters and value limits listed in the following specifications indicate the product line's general acceptance limits and are not a report of any unit's specific error contribution. Any parameter exceeding the specified limits should be considered in need of maintenance.

Specifications

Pressure Ranges	0-6000, 0-10,000 psia
Accuracy	0.01% FS
Resolution	0.001% FS or better
Control Stability	Typically 0.0075% FS
Control Response	20 – 90 seconds controlling into a 15 cu. in. volume depending on full scale range and increment step size
Control Range	300 – 3000, 600 – 6000, 1000 – 10,000 psia
Control Volume	3 in^3 (50cc) to 35 in^3 (570cc) all ranges
Overshoot	0.01% of Full Scale
Overpressure Protection	Relief valve set at 110% FS
Connections	Supply Pressure port: 1/8 NPT Test port: 1/8 NPT Drive Air Supply: 1/4 NPT
Display	Color active matrix TFT display
Pressure Medium (test and control gas)	Clean, dry, non-corrosive gas with a dew point of -40 °C and a particulate size <100 microns.
Gas Consumption	Zero at commanded pressure with a leak tight system
Pressure Supply	110 to 120 psi gas pressure for controller circuit. Test gas supply to be 110% higher than full scale pressure (may require an external booster system).
Recommended Recalibration Interval	1 year
Communications	Standard: RS-232 and IEEE-488
Dimensions	19" W x 24" D x 17" H (49 x 61 x 43 cm)
Weight	120 lbs

Electrical Power	100 – 120 VAC or 22 – 240 VAC, 50/60 HZ, single phase, 600 VA MAX (Separate part numbers for 115VAC and 230 VAC) Fuse 6AT-250V
Humidity	5 to 95% noncondensing
Temperature	Operating: 5 °C to 50 °C (40 °F to 122 °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)

Appendix B
Summary of Error Messages

Summary of Error Messages

Negative error numbers are from the Standard Commands for Programmable Instruments (Version 1991.0).

Table B-1. Summary of Error Messages

Value	Description and Corrective Action
0	No Error.
-103	Invalid Separator. Check punctuation in the SCPI command.
-104	Data Type. The type of parameter data is incorrect. Check for numeric versus string data.
-109	Missing Parameter. No valid parameter was found for the SCPI command.
-110	Command Header. The command name is not valid.
-113	Command Unknown. The command specified does not exist.
-114	Header Suffix. The numeric suffix for the command name is out of range.
-201	Remote Required. Remote command conflicted with local interface. Return local interface to main Menu.
-221	Settings Conflict. The command could not be executed due to the current state of the Calibrator. Some commands cannot be executed while a program, self-test, or calibration is in progress.
-222	Out of Range. The value is not within the valid range. For pressures, check your high and low limits.
-281	Cannot create program. Program memory is full.
-282	Illegal Program Name. The name specified is not valid or does not exist.
-284	Program Currently Running. The command cannot be executed while a program is running.
-285	Program Syntax Error. The syntax of the program definition is not correct.

Value	Description and Corrective Action
-286	Program Runtime Error. An error occurred while running the program. Usually the setpoint is out of range.
-313	Calibration Data Lost. The calibration data has been lost and the unit must be recalibrated.
-315	Configuration Data Lost. The configuration data has been lost. Check all parameters to be sure that they are correct.
-330	Self Test failed. See display for more information.
-350	Queue Overflow. The error queue was full and messages were lost.
-400	Query Error. A read request was received when there was nothing to read.
500	Controller Malfunction. Internal control failure.
501	High Limit Exceeded. The pressure was greater than the high limit.
502	Low Limit Exceeded. The pressure was less than the low limit.
503	Slew Limit Exceeded. The pressure changed faster than the slew limit allowed.
521	Pressure Overrange. The pressure reading is outside the range of the RUSKA 7350.
538	Auto vent. The Vent Limit was exceeded and the instrument entered Vent Mode.
543	Supply Pressure. The instrument is attempting to increase pressure and the pressure is not responding. Check main pressure supply, shop air supply, and for leaks.
600	Factory Data Lost. Internal factory constants have been lost. Contact Fluke for more information.
602	Model Changed. Firmware has been downloaded that is not correct. Download the correct firmware.
706	Pump position failure. The position sensor is not detecting movement in the pump after the pump has been commanded to move.
707	Range Switch. The current range can only be changed when the pressure reading is below 100 psi (700 kPa).