PPC2+ BG0002

Operation and Maintenance Manual (Use with PPC2+ Operation and Maintenance Manual)

High pressure liquids and gases are potentially hazardous. Energy stored in these liquids and gases can be released unexpectedly and with extreme force. High pressure systems should be assembled and operated only by personnel who have been instructed in proper safety practices.

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ABOUT THIS MANUAL

This manual is designed to be used in conjunction with the PPC2+ Operation and Maintenance Manual (Document Number 550091). It contains information specific to the BG0002 model of PPC2+ Pressure Controller/Calibrator.

PPC2+ BG0002 is identical in conception and most features to other PPC2+ models. PPC2+ BG0002 is a specialized PPC2+ model designed to optimize very low gauge pressure performance. This manual covers the aspects of PPC2+ BG0002 that differ from other PPC2+ models.

To operate a PPC2+ BG0002, use the PPC2+ Operation and Maintenance Manual (Document Number 550091) and follow the instructions and information. Refer to this manual for details on BG0002 specifications, installation and set up, pneumatic schematic differences, and **[SPECIAL]**, **<5Valves>** operation. PPC2+ BG0002 is normally used in conjunction with accessory package PK-PPC-BG-DVU (P/N 401699). This package is delivered with its own instruction sheet.

Manual Conventions

(CAUTION) is used in throughout the manual to identify user warnings and cautions.

(NOTE) is used throughout the manual to identify operating and applications advice and additional explanations.

[ ] indicates direct function keys (e.g., **[RANGE]**).
< > indicates PPC2+ BG0002 screen displays (e.g., **<1yes>**).

1. INTRODUCTION

1.1 PRODUCT OVERVIEW

PPC2+ BG0002 is a special model of the PPC2+ line of pressure controller/calibrators. PPC2+ BG0002 is identical to other PPC2+ models except for:

1) Use of a special low pressure “bi-directional gauge” reference pressure transducer (RPT).

2) This model has only one RPT. It does not support dual RPTs.

3) Inclusion and control of two additional internal control valves (a TEST(+)/TEST(-) bypass and a TEST(-) vent) with local and remote control capabilities for both.

4) Special recalibration recommendations for the very low pressure, bi-directional gauge RPT.

PPC2+ BG0002 is normally used in combination with accessory package PK-PPC-BG-DVU (P/N 401699) which includes two thermally isolated volumes installed in the test line to improve control stability. This package is delivered with its own instruction sheet.

Once a PPC2+ BG0002 has been put into service, its operation is identical to other PPC2+ models.

This manual is intended to be used as a supplement to the PPC2+ Operation and Maintenance Manual (Document Number 550091). To operate a PPC2+ BG0002, use the PPC2+ Operation and Maintenance Manual and refer to this manual for aspects specific to the BG0002 model. These are primarily the operating specifications, installation and use recommendations, recalibration recommendations.

1.2 SPECIFICATIONS

1.2.1 GENERAL SPECIFICATIONS

Specifications below are specific to PPC2+ BG0002. All other specifications are identical to PPC2+ specifications found in the PPC2+ Operation and Maintenance Manual (Document Number 550091).

Weight: 12.8 kg (28.2 lb)

Pressure Ranges: PPC2+ BG0002 has three pressure ranges:
H3: -15 to +15 kPa (-2.2 to +2.2 psi)
H2: -10 to +10 kPa (-1.5 to +1.5 psi)
H1: -5 to +5 kPa (-0.8 to +0.8 psi)

Pressure Limits: Line Pressure (min/max low side): 80 to 110 kPaa (11.6 to 16 psia)
Maximum/Minimum Working Test Pressure: +15/-15 kPa (+2.2/-2.2 psi)

Maximum/Minimum Test Pressure without Damage: +16.5/-16.5 kPa (+2.4/-2.4 psi)

Required Supply Pressure: SUPPLY port: 70 kPa gauge (10 psi)
EXHAUST port: Vacuum of 70 kPaa (10 psia) or less with displacement of at least 90 lm (3 cfm)

1.2.2 PRESSURE MEASUREMENT SPECIFICATIONS

All values are ± span of the active range unless otherwise indicated.

Warm Up Time: 30 minutes recommended for RPT temperature stabilization

Resolution: To 1 ppm, user settable by individual range

Temperature Effect: Fully compensated with active independent temperature measurement from 10 to 40 °C

± 0.005 % maximum temperature effect in normal ambient 15 to 35 °C operating range

Acceleration Affect: ± 0.02 %/g maximum, worst axis

Allows operation at ± 20° from reference plane without significant effect

Precision[1]*:* ± 0.008 %

Stability (w/ Autozero):	*90 day*	*1 year*
	0.003 %	0.009 %

Measurement Uncertainty[2]*:*	*90 day*	*1 year*
	0.010 %	0.015 %

1 Measurement Precision: Combined linearity, hysteresis, repeatability of measurements made by the reference pressure transducer.

2 Measurement Uncertainty: Maximum deviation of the reference pressure transducer indication from the true value of measured pressure including precision, stability, temperature effect and calibration standard accuracy of ± 0.003 % of reading.

1.2.3 PRESSURE CONTROL SPECIFICATIONS

All values are ± span of the active range unless otherwise indicated. Control specifications assume that a PK-PPC-BG-DVU dual volume unit is installed on the TEST lines and that a vacuum is applied to the PPC2+ BG0002 EXHAUST port.

Modes and Ready Indication:	Static:	Sets pressure within hold limit and stops active control until hold limit is exceeded
		Pressure is **Ready** when within hold limit and stability test is met
	Dynamic:	Sets pressure within hold limit and continuously adjusts as close as possible to target
		Pressure is **Ready** when within hold limit
Control Parameters:	Hold limit, stability limit (optimum values set by default, can be customized independently for each measurement range)	

Table 1. Default Pressure Control Parameters

	HOLD LIMIT	STABILITY LIMIT
STATIC MODE	± 0.5 % of the active pressure span	± 0.0025 % FS/sec of the active pressure span
DYNAMIC MODE	± 0.0025 % FS of the active pressure span	± 0.0025 % FS of the active pressure span

Maximum Control Precision[1]*:*	± 0.001 %
Normal Test Volume (in addition to system volume):	0 to 1 000 cc (250 cc optimal)
	System volume includes PPC2+ internal volume and the PK-PPC-BG-DVU in-line volume of 840 cc
Control Speed:	Slew Rate (0 to Controller FS) in
	Optimal Volume with No Control: 10 to 15 seconds
	Pressure Setting (Typical Time To
	Ready Indication in Dynamic Mode): 30 seconds
Minimum Control Pressure:	None
***Delivered** Pressure Uncertainty*[2]*:*	*90 day* *1 year*
	0.010 0.015 %

1 Maximum Control Precision: Minimum useable hold limit in dynamic control mode.
2 Delivered Pressure Uncertainty: Maximum deviation from the true value of pressure applied to the device under test in dynamic control mode with default control limits and assuming measurement uncertainty as in Section 1.2.2.

NOTES

2. INSTALLATION

2.1 UNPACKING AND INSPECTION

2.1.1 REMOVING FROM PACKAGING

PPC2+ BG0002 is delivered in a custom corrugated container with high density polyethylene inserts to hold it in place; or in the optional molded polyethylene shipping case with a custom foam insert for holding the PPC2+ and SPLT (if included).

Remove the PPC2+ and its accessories from the shipping container and remove each element from its protective plastic bag.

2.1.2 INSPECTING CONTENTS

Check that all items are present and have NO visible damage.

Table 2. PPC2+ Packing List

DESCRIPTION	PART NO.
PPC2+ BG0002 Pressure Controller/Calibrator	401696 or 401696-CE
Calibration Certificate	550100
Test Report	550103
Accessories:	401702 or 401702-CE
PPC2+ Operation and Maintenance Manual	550091
PPC2+ BG0002 Operation and Maintenance Manual	550124
Power Cord (7.5 ft.)	100770 or 100770-CE
(6) Rubber Feet Caps	400203
General Accessories Disk (Important: Includes system support software and documentation.)	102987

2.2 SITE REQUIREMENTS

The PPC2+ BG0002 can be installed on any **flat, stable surface** at a convenient height. The front feet can be extended so that the unit can be inclined slightly for easier viewing. The PPC2+ BG0002 can also be mounted in a standard 19-in. rack mount using the optional rack mount kit.

Minimizing the length of tubing connecting the PPC2+ BG0002 to the device or system to be tested will enhance control performance and reduce pressure setting times.

Consider the location and connections to the PK-PPC-BG-DVU dual volume unit. See the instruction sheet included with the PK-PPC-BG-DVU kit for additional instructions.

Ready access to the PPC2+ BG0002 rear panel should be considered to facilitate making and breaking pressure connections.

The Self Purging Liquid Trap (SPLT), if used, should be mounted vertically at the low point of the pneumatic system. The SPLT should be mounted on the TEST(+) line, between the PK-PPC-BG-DVU volume connection and the device(s) under test.

Support facilities required include:

- **An electrical power source** of 85 to 264 VAC, 50/60 Hz.
- **A continuous regulated pressure supply** of clean, dry, non-corrosive gas at 70 kPa (10 psig) to be connected to the SUPPLY port.
- **A vacuum source** of 70 kPaa (10 psia) or less and with displacement of at least 90 lm (3 cfm) to be connected to EXHAUST port.

2.3 INITIAL SETUP

2.3.1 PREPARING FOR OPERATION

To prepare PPC2+ BG0002 for check out and operation:

- Remove the plastic caps from the PPC2+ BG0002 rear panel pressure connections.
- Remove the protective plastic sheet from the front panel display.
- Install the rubber feet caps onto the bottom case feet, if desired.
- Familiarize yourself briefly with the front and rear panel (see PPC2+ Operation and Maintenance Manual, Section 2.3.2).

2.3.2 POWER CONNECTION

- Check that the PPC2+ BG0002 power switch is OFF.
- Connect the supplied power cable to the rear panel power module.
- Connect the other end of the power cable to an electrical supply of 85 to 264 VAC, 50/60 Hz.

2.3.3 CONNECTING A PRESSURE SUPPLY (SUPPLY PORT)

Using a pressure connecting hose of appropriate pressure rating, connect the pressure supply to the SUPPLY connection on the rear panel of PPC2+ BG0002. The PPC2+ SUPPLY connection is **1/8 in. NPT female**.

The supply pressure should be 70 kPa gauge (10 psig), ± 10 %.

Never connect a pressure supply greater than 100 kPa gauge (15 psig) to the PPC2+ BG0002 supply port.

2.3.4 CONNECTING A VACUUM PUMP (EXHAUST PORT)

For PPC2+ BG0002 to set pressure properly, a vacuum source must be connected to the EXHAUST port. The vacuum required is 70 kPa absolute (10 psia) or lower with displacement of at least 90 lm (3 cfm).

Never connect a pressure supply to or plug the PPC2+ BG0002 EXHAUST port.

To avoid building up pressure on the EXHAUST port and/or the vacuum pump, the vacuum source should either be continuously ON or should bypass to atmosphere when the vacuum source is OFF. This is because when a supply pressure is applied to the PPC2+ BG0002 SUPPLY port and the PPC2+ BG0002 is NOT in the vent ON condition, there is a constant gas exhaust through the PPC2+ BG0002 EXHAUST port to which the vacuum source will be connected.

2.3.5 CONNECTING TO THE DEVICE UNDER TEST (TEST(+) AND TEST(-) PORTS)

To achieve in tolerance pressure control, PPC2+ BG0002 should be used with the PK-PPC-BG-DVU dual volume unit installed in line on both the TEST(+) and TEST(-) ports. In some cases, the PK-PPC-BG-DVU volumes may be omitted if the volume of each side (high and low) of the system under test exceeds 800 cc.

Install the PK-PPC-BG-DVU dual volume unit in-line between the PPC2+ BG0002 TEST(+) and TEST(-) ports and the high and low ports of the system or devices under test. See the PK-PPC-BG-DVU instruction sheet for details.

If you are using an SPLT, see the PPC2+ Operation and Maintenance Manual, Section 2.3.5.1 and the SPLT Operation and Maintenance Manual before proceeding to connect to the device or system under test.

The recommended tubing for PPC2+ BG0002 test port connections is 1/4 in. (6 mm) PFA tubing or any other large internal diameter tubing that will not restrict the flow between the PPC2+ and the system under test.

For optimal performance it is important that both the TEST(+) and TEST(-) ports of the PPC2+ be connected to the high and low or positive and negative ports of the device or system under test. If no connection is available on the low or negative side of the device or system under test, operation is possible but pressure control and measurement may be adversely affected by instability of ambient pressure in the environment in which the PPC2+ BG0002 is being operated.

The PPC2+ BG0002 TEST(+) and TEST(-) connections are both **1/4 in. NPT female.**

NEVER connect a pressure supply to the TEST(-) port. The pressure applied to this port should be maintained between 80 and 110 kPa (11.6 and 16 psia) (roughly atmospheric pressure ± 15 kPa (2.2 psi) depending on your location. Exceeding these limits may damage the RPT.

Operating the PPC2+ BG0002 connected to a system with liquid contaminants without taking proper precautions to purge the system and test line may cause contamination of the PPC2+ BG0002 that will require non-warranty service.

Minimizing the length of the test connection tubing will enhance control performance and reduce pressure setting time. For normal operation, the total volume of each side (high and low) of the device or system under test (not including the PK-PPC-BG-DVU accessory volumes) should be between 0 and 1 000 cc (60 in^3).

PPC2+ BG0002 pressure control will not operate properly if there are excessive leaks in the test system. In general, the maximum acceptable leak rate for optimal PPC2+ automated pressure control operation and to assure in tolerance measurements with default pressure control parameters is ± 1 % of active span FS/minute. In DYNAMIC CONTROL mode, to handle higher test system leak rates, increase the hold limit using CUSTOM CONTROL (see the PPC2+ Operation and Maintenance Manual, Section 3.2.6).

PPC2+ BG0002 pressure control may be adversely affected if the test connection tubing is too restrictive. For optimum results, the inner diameter of the connecting hose should be at least 2.5 mm (0.1 in.).

For optimum pressure measurement and control, the PPC2+ BG0002 TEST(-) port should be connected to the system or device under test low or negative port.

2.3.5.1 INSTALLING THE SPLT

The SPLT (optional) is intended to collect and exhaust liquid that may be present in the device or system under test so that they do not return to contaminate the PPC2+.

With PPC2+ BG0002, the SPLT is installed in the TEST(+) line between the PK-PPC-BG-DVU and the system or device under test. No SPLT is needed in the TEST(-) line as there should be no flow in the TEST(-) circuit. Also see the SPLT Operation and Maintenance Manual.

2.3.6 THE VENT CONNECTION (VENT PORT)

The PPC2+ BG0002 VENT port is the system vent to atmosphere point. Though a pressure tube can be connected to the VENT port to direct the vented gas flow, a completely unobstructed connection to atmosphere must be maintained for PPC2+ reference pressure measurements to operate normally.

The PPC2+ BG0002 VENT connection is **1/4 in. NPT female**.

NEVER plug, obstruct or connect a supply pressure to the PPC2+ vent connection.

2.3.7 THE ATM REF PASS THROUGH (UNLABELED)

PPC2+ BG0002 does not have an ATM REF pass through. The on-board barometer is connected to the TEST(-) circuit to measure the pressure on the low side of the RPT (see Figure 1).

NOTES

3. OPERATION

3.1 VENT

Pressing the **[VENT]** direct pressure control, sending a remote "VENT" command or requesting zero as the set pressure causes PPC2+ BG0002 to control pressure to near atmospheric pressure and then open the system vent, TEST(+)/TEST(-) bypass and TEST(-) vent valves (see Figure 1 and Section 3.5.2). Vent condition is indicated by lighting a RED LED just above the **[VENT]** key. All three valves will remain open until the **[VENT]** key is pressed again, another direct pressure control key is pressed or an automated pressure control command is given. Pressing the **[VENT]** key also causes the purge function to execute when the PPC2+ LEAK CHECK/PURGE function is active (see the PPC2+ Operation and Maintenance Manual, Section 3.2.8).

3.2 CUSTOM CONTROL

PPC2+ BG0002 default control limits are different from standard PPC2+ model default control limits.

Table 3. System Default Control Limits

	HOLD LIMIT	STABILITY LIMIT
STATIC MODE	± 0.5 % of the active pressure span	± 0.0025 % FS/sec of the active pressure span
DYNAMIC MODE	± 0.0025 % FS of the active pressure span	± 0.0025 % FS of the active pressure span

3.3 UPPER LIMIT

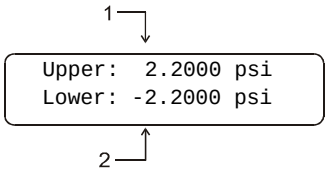
- **PRINCIPLE**

The PPC2+ BG0002 UPPER LIMIT function differs from other PPC2+ models in that there is both an UPPER LIMIT and a LOWER limit. This is due to the bi-directional gauge range of the BG0002 and the possibility of overpressure to the RPT and to devices under test in both the positive and negative direction.

If no upper limit value is entered by the user, the upper and lower limit for each PPC2+ BG0002 range is set by default to +102 % of each range for the upper limit and –102 % of each range for the lower limit.

OPERATION

When the **[UPPER LIMIT]** function key is pressed from the main run screen the display is:



1. Entry field to enter desired upper limit value.
2. Entry field to enter desired lower limit value.

Enter the desired upper and lower limit values and PPC2+ returns to the main run screen with the new limit values active.

When the UPPER or LOWER LIMIT has been exceeded, the display of current pressure flashes and a buzzer sounds for 3 seconds every 2 seconds. Reduce or increase pressure using direct pressure control keys or an automated pressure command to return to normal operation.

Upper and lower limit values are specific to each range. Be careful not to assume that the limits set in one range will apply to another.

3.3.1 OVERPRESSURE FUNCTION

In addition to the UL function, PPC2+ BG0002 has an **overpressure function.** This function executes when the measured pressure is greater than +15.75 kPa or less than -17.5 kP (± 2.3 psi). The overpressure function causes all pressure control to be interrupted and disabled, opens the TEST(+)/TEST(-) bypass valve (see Section 3.5.2, PRINCIPLE and Figure 1), changes the range to H3 and causes the display to flash. The overpressure function also logs the time and date of the overpressure condition to assist in incident diagnosis. To recover from an overpressure condition, cycle PPC2+ BG0002 power.

3.4 SETUP MENU KEY

3.4.1 CONTROLREF

PPC2+ BG0002 requires that a vacuum source be connected to the EXHAUST port for pressure control to operate normally. Therefore, the **<1ControlRef>** setting should always be **<1auto>** or **<2vac>** (see PPC2+ Operation and Maintenance Manual). If you must operate without a vacuum source connected to the PPC2+ BG0002 EXHAUST port, **<1ControlRef>** should be set accordingly but pressure control may not conform to specifications.

3.5 SPECIAL MENU KEY

3.5.1 INTERNAL, RESET

Reset - Sets

In addition to the standard PPC2+ reset – sets, PPC2+ BG0002 reset – sets:

- TEST(-) vent valve setting to **<1Auto>** (see Section 3.5.2.2).

3.5.2 VALVE

- **PURPOSE**

  To operate the PPC2+ BG0002 TEST(+)/TEST(-) bypass valve and the TEST(-) vent valve locally (see Figure 1).

- **PRINCIPLE**

  PPC2+ BG0002 has two additional valves relative to other PPC2+ models. These are the TEST(+)/TEST(-) bypass valve and the TEST(-) vent valve (see Figure 1).

  The TEST(+)/TEST(-) bypass valve connects the TEST(+) and TEST(-) ports directly together which also connects the BG0002 RPT and the device or system under test high and low sides directly together. The valve is opened automatically whenever PPC2+ is in the VENT condition to assure that the RPT and system under test are at zero differential pressure. The TEST(+)/TEST(-) bypass valve is operated automatically by the PPC2+ BG0002. It may also be controlled manually using **[SPECIAL]**, **<5valve>**, **<1bypass>** (see Section 3.5.2.1).

  The TEST(-) vent valve is used to open the TEST(-) port of the PPC2+ BG0002 to atmosphere which also connects the BG0002 RPT and the device or system under test low side to atmosphere. The valve is closed automatically whenever the PPC2+ BG0002 is performing fine pressure control to isolate the low pressure circuit from fluctuations in ambient pressure. The valve is opened whenever the PPC2+ BG0002 is in the VENT condition or slewing to assure that the pressure on the low pressure circuit does not move too far away from atmospheric pressure as it might if it were permanently shut off. The TEST(-) vent valve is operated automatically by the PPC2+ BG0002. It may also be controlled manually using [**SPECIAL]**, **<5valve>**, **<2TEST(-) vent>** (see Section 3.5.2.2).

- **OPERATION**

  From the main run screen, press **[SPECIAL]** and select **<5valve>**. The display is:

  ```
  Valves:
  1bypass 2test(-)vent
  ```

  Select **<1bypass>** to operate the TEST(+)/TEST(-) bypass valve (see Section 3.5.2.1).
  Select **<2TEST(-)vent>** to operate the TEST(-) vent valve (see Section 3.5.2.2).

3.5.2.1 BYPASS

- **PURPOSE**

To operate the PPC2+ BG0002 TEST(+)/TEST(-) valve locally (see Section 3.5.2 PRINCIPAL and Figure 1).

- **OPERATION**

To access the bypass function press **[SPECIAL]** and select **<5Valve>, <1bypass>**. The display is:

```
Bypass valve:
1open 2close
```

The bypass valve's operation is normally controlled automatically by PPC2+ BG0002 based on current operation (see Section 3.5.2). When the **<Bypass valve:>** menu is entered, the cursor is positioned on the number corresponding to the current valve status.

Press **<1open>** to open the bypass valve. Operation is momentary so the valve remains open only as long as the key is pressed.

Press **<2close>** to close the bypass valve. Operation is momentary so the valve remains closed only as long as the key is pressed.

3.5.2.2 TEST(-) VENT

- **PURPOSE**

To operate the PPC2+ BG0002 TEST(-) vent valve locally (see Section 3.5.2 PRINCIPLE and Figure 1).

- **OPERATION**

The normal setting for the TEST(-) vent valve is <1auto> in which PPC2+ BG0002 automatically controls the valve based on current PPC2+ operation. Setting other than <1auto> should only be selected by advanced users.

To access the TEST(-) vent valve control press **[SPECIAL]** and select **<5Valve>**, **<2TEST(-) vent>**.

The display is:

```
TEST(-)vent: 1auto
2open 3close 4view
```

Select **<1auto>** for the TEST(-) vent valve operation to be controlled automatically by PPC2+ BG0002 based on current operation. This is the normal and recommended setting.

Select **<2open>** to cause the TEST(-) valve to open and remain open regardless of PPC2+ BG0002 operation until the **<2TEST(-)vent>** setting is changed. If PPC2+ BG0002 detects a condition in which it determines there could be a risk of overpressure to the RPT by opening the TEST(-) vent valve, the message **<Cannot open lo vent, DP overpressure risk>** is displayed. If this message is displayed, return to normal operation and vent the PPC2+ BG0002 and then try again.

Select **<3close>** to cause the TEST(-) valve to close and remain closed regardless of PPC2+ BG0002 operation until the **<2TEST(-)vent>** setting is changed.

Select **<4view>** to view the current condition of the TEST(-) valve. The display indicates whether current valve operation is controlled by the PPC2+ BG0002 (**<Auto TEST(-)vent>**) or has been set manually (**<Manual TEST(-)vent>**) followed by the current valve status (**<Open>** or **<Close>**).

3.5.3 INTERNAL, ATM

- **PURPOSE**

To view the value of pressure on the TEST(-) port at measured by the on-board barometer.

- **PRINCIPLE**

PPC2+ BG0002 has an independent on-board barometer. The on-board barometer is used to monitor the pressure on the TEST(-) port which is the pressure applied to the low side of the BG0002 RPT and the system under test. The measurements of TEST(-) pressure made by the on-board barometer are used to compensate the BG0002 RPT differential pressure measurements for line pressure.

- **OPERATION**

To view the current reading of the pressure on the TEST(-) port, press **[SPECIAL]** and select **<4Internal>**, **<7Atm>**. The display is in the pressure units of the current PPC2+ range.

NOTES

4. REMOTE OPERATION

4.1 OVERVIEW

PPC2+ BG0002 remote operation and protocol is identical to other PPC2+ models (see PPC2+ Operation and Maintenance Manual, Section 4).

NOTES

5. MAINTENANCE, ADJUSTMENTS AND CALIBRATION

PPC2+ is covered by a limited one (1) year warranty. Unauthorized service or repair during the warranty period is undertaken at the owner's risk and may cause damage that is not covered under warranty and/or may void the warranty.

5.1 CALIBRATION OF REFERENCE PRESSURE TRANSDUCERS

5.1.1 PRINCIPLE

The principles of calibrating a BG0002 RPT are the same as other PPC2+ RPTs (see PPC2+ Operation and Maintenance Manual, Section 5).

When calibrating the PPC2+ BG0002, the following should be considered:

- For best results, the TEST(-) port of the BG0002 should be connected to an equivalent port of the standard being used for calibration. If measures are not taken to assure that the BG0002 TEST(-) port and the standard are connected together at a common pressure, noise in ambient pressure during the calibration are likely to affect the results.

- The maximum “line pressure” at which the BG0002 can be calibrated is 110 kPaa (16 psia). Generally, this rules out calibration at an elevated static pressure using two piston gauges differentially.

- The BG0002 RPT is a true bidirectional gauge sensor. It should be calibrated by applying positive and negative pressures to the TEST(+) port, not by applying positive pressures to the TEST(+) and then the TEST(-) port. The normal calibration sequence is 0 to (+)FS to (-)FS to 0. However, negative pressures need not be included if the BG0002 will be used for positive pressure operation only.

5.1.2 EQUIPMENT REQUIRED

1. **Gas operated piston gauge (deadweight tester) or other pressure standard**, with the following characteristics:

   - **Measurement uncertainty of ± 0.003 % reading or 0.15 Pa or better**, if best PPC2+ BG0002 accuracy is to be obtained. A standard with greater measurement uncertainty may be used but PPC2+ measurement uncertainty will be degraded proportionally from published specifications.

   - **Able to apply gauge pressures in the range of -15 kPa to +15 kPa (-2.2 to +2.2 psi) with a minimum pressure of ± 1 kPa (± 0.15 psi):** It is not desirable to define the negative values by applying positive pressure to the PPC2+ BG0002 TEST(-). Negative pressures need not be included in the calibration data if the BG0002 will be used for positive pressure operation only.

   - **The pressure standard should have a high (+) and low (-) test port:** Better results are obtained if the TEST(-) port and the low or (-) side of the reference can be tied together.

   - **Able to apply pressures at 20 % increments in the range to be calibrated:** It is not necessary that the calibration pressure standard used apply precisely the nominal pressure value requested for a calibration point as long as the exact value of the applied pressure is known. Best results will be obtained if the pressure actually applied is within ± 2 % of FS of the range being calibrated from the nominal increment.

The recommended calibration standards for supporting PPC2+ BG0002 are either the DHI PG7601 Gas Operated Piston Gauge with differential mode or an FPG8601 Force Balanced Piston Gauge system. DHI's A2LA accredited calibration service is also available to perform recalibrations. Contact DHI for additional information.

5.1.3 SET-UP AND PREPARATION

Set-up recommendations for the PPC2+ BG0002 are the same as for other PPC2+ models (see PPC2+ Operation and Maintenance Manual Section 5.2.3) with the following differences:

1. Always connect a vacuum source to the PPC2+ BG0002 rear panel EXHAUST port (1/4 in. NPT F). There will be a constant bleed of gas through the EXHAUST port so the vacuum pump should be self-venting or disconnected when OFF.

2. Connect the calibration standard output to the PPC2+ BG0002 rear panel TEST(+) port (1/4 in. NPT F). Connect the calibration standard low or (-) side to the PPC2+ BG0002 rear panel TEST(-) port (1/4 in. NPT F).

5.2 ADJUSTMENT OF ON-BOARD BAROMETER

PURPOSE

To adjust the output of the on-board barometer (see the PPC2+ Operation and Maintenance Manual).

PRINCIPLE

The on-board barometer output can be adjusted using PA and PM values in the same manner as for the reference pressure transducers (see the PPC2+ Operation and Maintenance Manual).

The on-board barometer is a low accuracy sensor. In PPC2+ BG0002 it is used to measure the pressure on the TEST(-) side of the BG0002 RPT. This measurement is used to compensate the BG0002 RPT differential pressure readings for static or line pressure.

OPERATION

To edit the values of PA and PM for the barometer, press **[SPECIAL]** and select **<4Internal>**, **<2cal>**, **<2barometer>**. Pressing **[ENTER]** steps through displays of the calibration date [YYMMDD] and PA/PM. In **edit** mode, the values can be edited. Pressing **[ENTER]** after the last screen activates the edited values.

To view the current atmospheric pressure measurement made by the barometer board, press [SPECIAL] and select <4Internal>, <7Atm>.

5.3 PNEUMATIC CONTROL MODULE CONFIGURATION

PURPOSE

In addition to the configuration function described in the PPC2+ Operation and Maintenance Manual:

PPC2+ BG0002 is designed to control pressure into an 840 cc accessory volume in addition to the volume under test. If the PPC2+BG0002 is used to control pressure without the accessory volume, the configuration function should be used to adapt pressure control to the different volume.

OPERATION

Poor control is usually caused by invalid control parameters excessive leaks, restrictions in the test line and/or other set up problems. These issues should be identified and eliminated before resorting to use of the configuration function (see Section 6).

To access the Config function press **[SPECIAL]** and select **<4Internal>**, **<1Config>**.

The display is:

```
1Run 2Defaults
```

Selecting **<2Defaults>** will cause PPC2+ to reload the factory default control coefficients. This feature can be useful to return to a normal condition if a faulty Config routine has been activated.

Selecting **<1Run>** will cause the pneumatic module configuration routine to execute. Before running a user Config, be sure the KP-PPC-BG-DVU dual volume unit, and no other volume, is connected to the TEST(+) port. Connect the normal supply pressure to the rear panel SUPPLY port and a vacuum source to the EXHAUST port.

The display is:

```
Config type:
1vac 2atm
```

Select **<1vac>**, do not use **<2atm>** with the BG0002 model. If the ControlRef setting (see the PPC2+ Operation and Maintenance Manual, Section 3.3.1) does not correspond to your choice, you will receive an error.

The next display is:

```
CAUTION:  About to
set -0.4939 kPa g
```

This display notifies the user that pressure will increase to roughly 50 % of range H3. Press **[ENTER]** to continue.

PPC2+ will then pulse and set pressures around mid scale pressure (near zero for PPC2+ BG0002), and "CFG" will flash in the lower right corner of the display. After about ten minutes, the user will be asked whether or not to save the new configurations. If the Config function ran completely and without incident, select **<1Yes>**. Selecting **<2No>** returns to the main run screen with no change to the internal pressure control coefficients.

```
Save New Config
 1Yes  2No
```

The configuration routine must be run with the BG0002 PK-PPC-BG-DVU accessory volume connected to the TEST(+) port. Running the configuration routine without the accessory volume with which the BG0002 is normally used, will result in poor pressure control.

The effect of the Cfg function can be eliminated and control coefficients returned to factory defaults by pressing [SPECIAL] and selecting <4Internal>, <1Config>,<1Defaults>.

5.4 SUBASSEMBLY DESCRIPTION AND LOCATION

See PPC2+ Operation and Maintenance Manual for complete information. See Figure 1 for PPC2+ BG0002 pneumatic schematic.

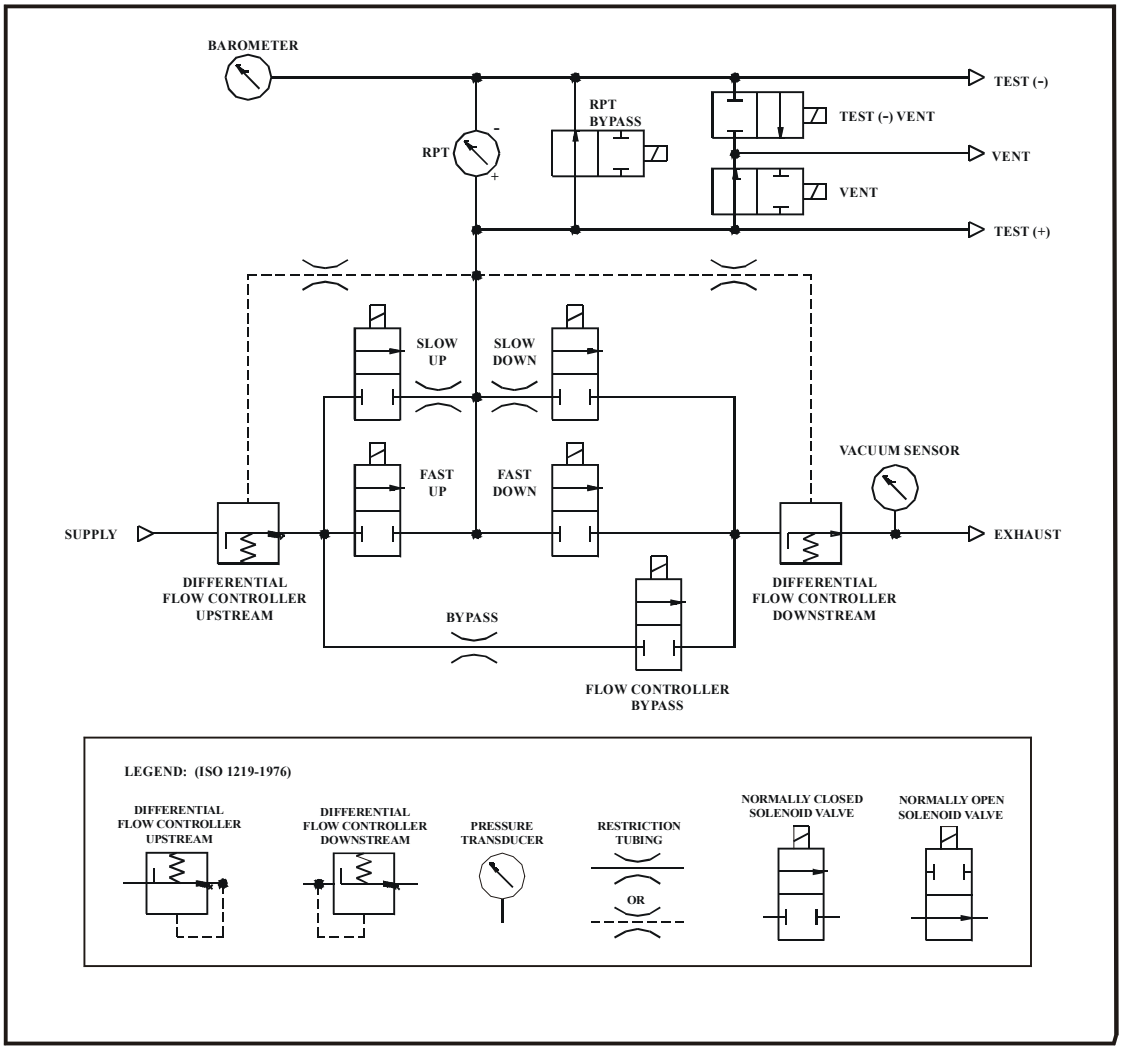


Figure 1. Pneumatic Module (Schematic)

NOTES

6. TROUBLESHOOTING

6.1 OVERVIEW

See the PPC2+ Operation and Maintenance Manual, Section 6 for general PPC2+ troubleshooting advice. The table below covers troubleshooting specific to the PPC2+ BG0002 model.

Table 4. Troubleshooting Guide

SYMPTOM	POSSIBLE CAUSE	SOLUTION
Poor pressure control and/or cannot set negative pressure.	There is no vacuum applied to the EXHAUST port.	Connect a vacuum source to the EXHAUST port.
Pressure appears unstable in vented condition.	The TEST(-) vent valve is set to closed.	Use **[SPECIAL]**, **<5valve>**, **<2TEST(-)vent>** to set the TEST(-) vent valve to AUTO (see Section 3.5.2.2).
Poor pressure measurement, incorrect pressure measurement.	The BG0002 line pressure limit is being exceeded.	Assure that pressure on TEST(-) side is between 80 and 110 kPa (11.6 and 16 psia).

NOTES