



**Alicat Scientific PCD Series
Closed Volume Pressure Controller
Operating Bulletin**

Table of Contents

	Page
Introduction	3
Installation	3
Plumbing	3
Pressure Controller Diagram	4
Wiring	5
Operation	5
PCD Pressure Controllers	6
RS-232 Input and Output	7
Configuring Hyperterminal	7
Data Format	7
Sending a Set Point Via RS-232	8
Collecting Data	8
Changing from Streaming to Polling Mode	8
Maintenance and Recalibration	9
Warranty	9
Performance Specifications	10

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Note: Although we provide assistance on Alicat Scientific products both personally and through our literature, it is the complete responsibility of the user to determine the suitability of any product to their application.

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Alicat Scientific P and PC Series Pressure Gauges and Controllers

Introduction:

PCD Series Closed Volume Pressure Controllers

Alicat Scientific PCD Series Closed Volume Pressure Controllers incorporate a digital pressure gauge with a control valve and circuitry. The integrated PID loop measures the pressure, compares it with the set point, and adjusts either the Inlet or Exhaust valve accordingly in excess of a thousand times per second. It is most common to have a .030 inch diameter orifice in the inlet valve, and a .050 inch diameter exhaust valve. The response time of the system will depend on the size of the volume being controlled and the feed pressure. The controllers are intended for use with clean, non-corrosive gases only. They are designed with a feed port, a process port, and an exhaust port. This allows the controllers to raise and lower the pressure of a closed system within the operating range of the controller without wasting gas under constant pressure conditions. The standard valve material is brass with stainless steel, delrin, and Viton components. As with the digital pressure gauges, each controller comes with a graphic display.

Installation

Plumbing

Connect your PCD into your process via the 1/8" NPT port on the front of the unit. This is the "Process" port. Connect a supply pressure greater than the full scale pressure control range of the device, not to exceed 125 PSIG, to the inlet 1/8" NPT port on the left side device. This is the "Inlet" port. The 1/8" NPT "Exhaust" port, located on the right side of the device can vent to atmosphere if the application is suitable, or to a collection network if necessary. The pressure at the exhaust port should be at atmospheric pressure or below to allow the controller to be used over its full scale range. If necessary, there are two 8-32 mounting holes located on the bottom of the unit as shown in the dimensional drawing located in this manual. Connect your PCD to power and output lines as detailed in the "Wiring" section in this manual.

Figure 1. PCD Plumbing Diagram

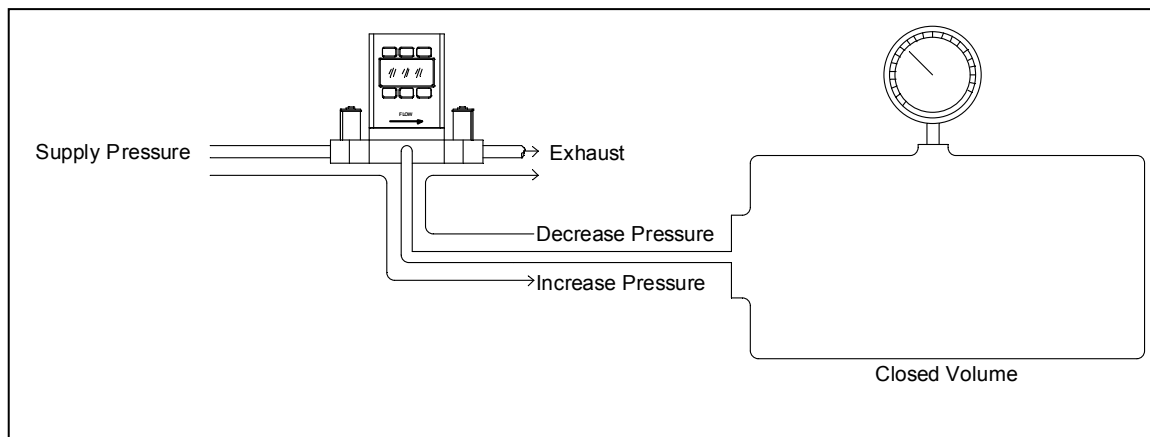
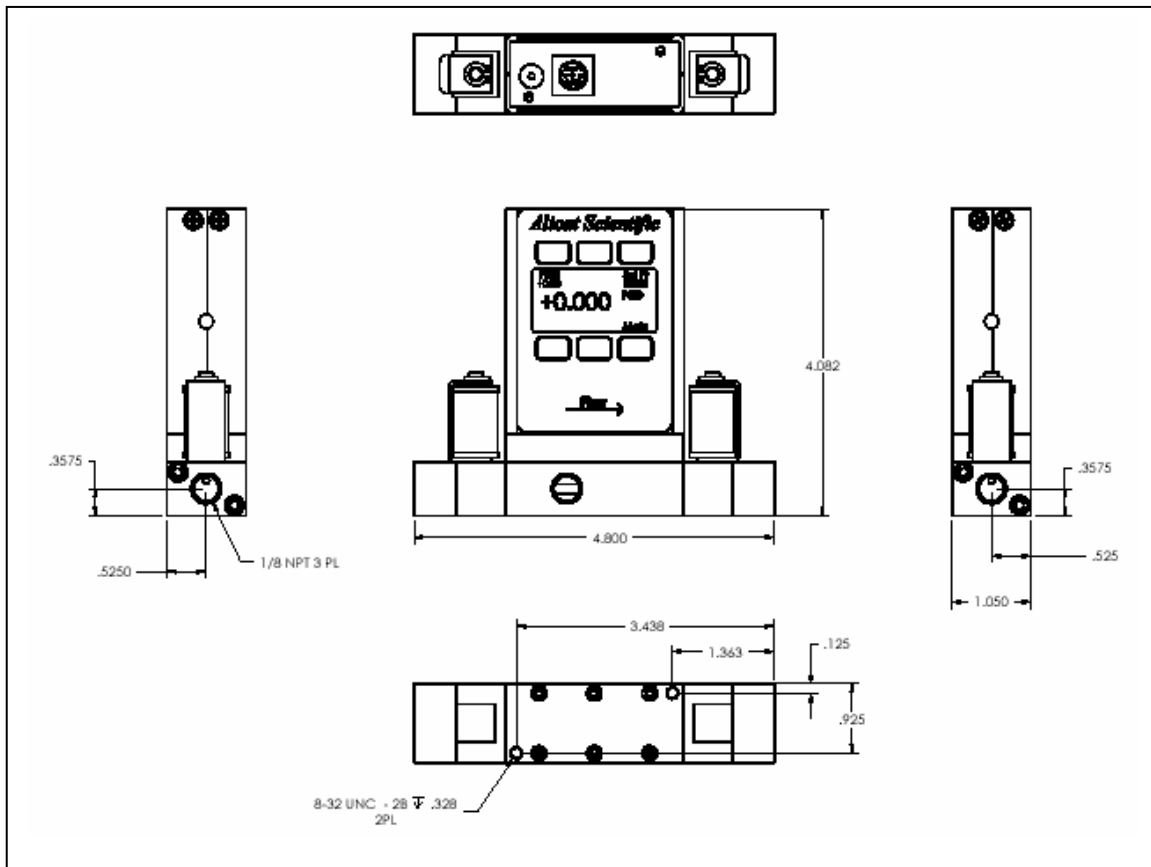


Figure 2. PCD Series Closed Volume Pressure Controller

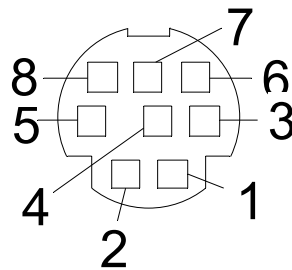


Wiring:

All Alicat Scientific PCD Series Pressure Controllers come with an 8 Pin Mini-DIN female connector on the top of the electronics housing as shown in figure 3. This connector has pins for

the output signal, the input signal, and power for the unit. Alternately, power may be supplied via an AC to DC adapter (Alicat Scientific PVPS) though the power jack, also located on the top of the electronics housing.

Figure 3. 8 Pin Mini-DIN Connector



1 - 4-20 mA out	BLACK
2- 5.12 vDc Out	BROWN
3- RS232 in	RED
4- Set Point In	ORANGE
5- RS232 out	YELLOW
6- Signal Out	GREEN
7- Power In	BLUE
8- Ground	PURPLE

The standard Input/Output signal is 8- Ground . PURPLEs are available via special order and would be accessed through the Mini-DIN connector as shown in the pin out diagram in figure 3. The output signal is available through pin 6 (the green wire on the data cable) and the input signal should be wired to pin 4 (the orange wire in the data cable). Power (12-18 Vdc @300 mA) can be applied through pins 7 (Power) and 8 (Ground) in the 8 Pin Mini-DIN connector located on the top of the case.

Operation

PCD Pressure Controllers:

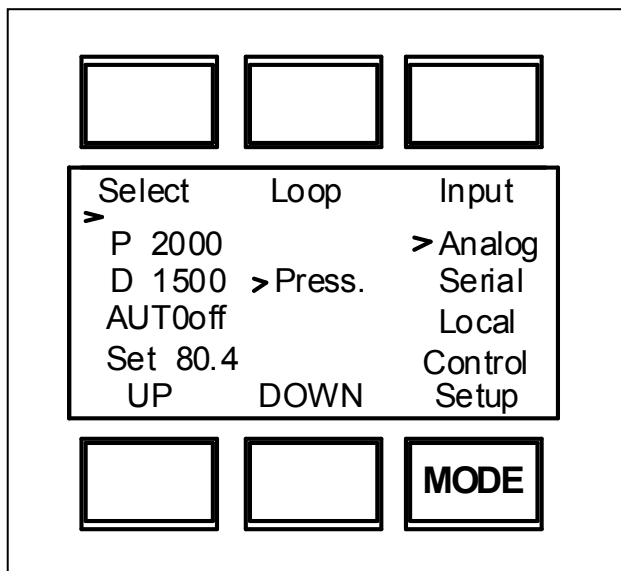
Operation: Alicat Scientific PCD Series Pressure Controllers have one active button in the main display.

MODE: All controllers feature a MODE button near the lower right hand corner of the display. This button cycles the controller through its display modes, typically Main, Control Set Up, and I.D.

Control Setup Mode:

The Control Setup Mode is accessed by pressing the button labeled “MODE” until the dynamic label over the button reads “Control Setup” as shown below. This mode allows the user to set up most parameters commonly associated with PID control. Alicat Scientific controllers allow the user to select how the set point is to be conveyed to the controller, what that set point is if control is local, and what the Proportional and Differential terms of the PID control loop will be. The UP and DOWN buttons for adjusting variables can be held down for higher speed adjustment or pressed repeatedly for fine adjustment.

Figure 4. PCD Series Control Setup Mode Screen



Input – Alicat Scientific Flow Controllers normally ship defaulted to analog control as indicated in Figure 4 above. To change how the set point will be conveyed to the controller push the button in the upper right hand corner just above the dynamic label “Input” until the arrow is directly in front of the desired option. The controller will ignore any set point except that of the selected input and it will remember which input is selected even if the power is disconnected.

Analog refers to a remote analog set point applied to Pin 4 of the Mini-DIN connector as described in the installation section of this manual. To determine what type of analog set point your controller was ordered with, refer to the Calibration Data Sheet that was included with your controller. 0-5 Vdc is standard unless ordered otherwise. Note that if nothing is connected to Pin 4, and the controller is set for analog control, the set point will float.

Serial refers to a remote digital RS-232 set point applied via a serial connection to a computer or PLC as described in the Installation and RS-232 sections of this manual.

Local refers to a set point applied directly at the controller. For more information on changing the set point locally refer to the heading “Select” below. Local input must be selected prior to attempting to change the set point locally.

Select – To avoid accidental changing of the PID loop parameters or the set point, the Control Setup mode defaults with the selector on a null position. To change the set point or the P and D PID loop parameters, push the button in the upper left corner just above the dynamic label “Select” until the selection arrow is pointing to the parameter you wish to change. When the parameter you wish to change is selected, it may be adjusted up or down with the buttons under the display below the dynamic labels “UP” and “DOWN”. Press the buttons repeatedly to make slow adjustments or hold them down to make fast adjustments.

P refers to the Proportional term of the PID loop. Before changing this parameter, it is good practice to write down the initial value so that it can be returned to the factory settings if necessary. In addition, the factory set P and D terms are listed on the Calibration Data Sheet for your controller.

D refers to the Differential term of the PID loop. Before changing this parameter, it is good practice to write down the initial value so that it can be returned to the factory

settings if necessary. In addition, the factory set P and D terms are listed on the Calibration Data Sheet for your controller.

AUTOon / AUTOoff refers to the standard auto-tare or “auto-zero” feature (if equipped). Unless your application specifically requires it, this should normally be left in AUTOoff position. If it is left on, the controller will automatically set the pressure reading to zero any time it receives a zero set point for more than two seconds. Should the controller ever read a significant non-zero figure when the process port is exposed to atmospheric pressure, the autotare feature may be turned on and a zero set point sent to the unit to re-zero the pressure sensor. Remember to reset the autotare to AUTOoff before using the device.

Set refers to the Set Point. This parameter may only be changed if “Local” is selected as the input. See above for information on selecting the input. Using the UP and DOWN buttons, the set point may be adjusted between zero and the full-scale range of the controller.

For more information on PID loop tuning, see the Alicat Scientific web site. The online version of Control Engineering Magazine at www.controleng.com is also an excellent source for PID tuning articles and information.

RS-232 Input/Output

Configuring HyperTerminal®:

1. Open your HyperTerminal® RS-232 terminal program (installed under the “Accessories” menu on all Microsoft Windows operating systems).
2. Select “Properties” from the file menu.
3. Click on the “Configure” button under the “Connect To” tab. Be sure the program is set for: 19,200 baud and an 8-N-1-None (8 Data Bits, No Parity, 1 Stop Bit, and no Flow Control) protocol.
4. Under the “Settings” tab, make sure the Terminal Emulation is set to ANSI.
5. Click on the “ASCII Setup” button and be sure the “Send Line Ends with Line Feeds” box is not checked, and that the “Append Line Feeds to Incoming Lines” box is checked. Those settings not mentioned here are normally okay in the default position.
6. If the meter is connected to the serial port on the computer, data should begin streaming to the window. If not, try hitting the “Enter” key several times to clear any extraneous information. Type “*@=@” followed by “Enter” without the quotations. If data still does not appear, check all the connections and com port assignments.

Data Format: The data stream on the screen represents the pressure parameters of the main mode in the units shown on the display. For pressure controllers, there are 2 columns of data representing the pressure and the set point. The first column is the pressure, the second column is set point (in the units specified at time of order and shown on the display).

```
+025.10 +025.00
+025.05 +025.00
+025.07 +025.00
+025.09 +025.00
+025.10 +025.00
+025.11 +025.00
```

PC Series Pressure Controller Data Format

Sending a Set Point via RS-232: To send a set point via RS-232, "Serial" must be selected under the "Input" list in the control set up mode. To give controllers a set point, or change an existing point, simply type in a number between 0 and 65535 (2% over range), where 64000 denotes full-scale flow rate, and hit "Enter". The set point column and flow rates should change accordingly. If they do not, try hitting "Enter" a couple of times and repeating your command. The formula for performing a linear interpolation is as follows:

$$\text{Value} = (\text{Desired Setpoint} \times 64000) / \text{Full Scale Flow Range}$$

For example:

If your device is a 100 PSIG full-scale unit and you wish to apply a set point of 35 PSIG you would enter the following value:

$$22400 = (35 \text{ PSIG} \times 64000) / 100 \text{ PSIG}$$

If the controller is in polling mode as described in *Changing from Streaming Mode to Polling Mode*, the set point must be preceded by the address of the controller. For example, if your controller has been given an address of D, the set point above would be sent by typing:

D22400 followed by "Enter"

Collecting Data: The RS-232 output updates to the screen many times per second. Very short-term events can be captured simply by disconnecting (there are two telephone symbol icons at the top of the HyperTerminal® screen for disconnecting and connecting) immediately after the event in question. The scroll bar can be driven up to the event and all of the data associated with the event can be selected, copied, and pasted into Microsoft® Excel® or other spreadsheet program as described below.

For longer term data, it is useful to capture the data in a text file. With the desired data streaming to the screen, select "Capture Text" from the Transfer Menu. Type in the path and file name you wish to use. Push the start button. When the data collection period is complete, simply select "Capture Text" from the Transfer Menu and select "Stop" from the sub-menu that appears.

Data that is selected and copied, either directly from HyperTerminal® or from a text file can be pasted directly into Excel®. When the data is pasted it will all be in the selected column. Select "Text to Columns..." under the Data menu in Excel® and a Text to Columns Wizard (dialog box) will appear. Make sure that "Fixed Width" is selected under Original Data Type in the first dialog box and click "Next". In the second dialog box, set the column widths as desired, but the default is usually acceptable. Click on "Next" again. In the third dialog box, make sure the column data format is set to "General", and click "Finish". This separates the data into columns for manipulation and removes symbols such as the plus signs from the numbers. Once the data is in this format, it can be graphed or manipulated as desired.

Changing From Streaming to Polling Mode: Under normal circumstances, pressure gauges and controllers with RS-232 are shipped in the Streaming Mode. This means that the screen is updated 10-60 times per second (depending on how much data is on each line) so that the user sees the data essentially in real time. It is sometimes desirable, and necessary when using more than one unit on a single RS-232 line, to be able to poll the unit. In Polling Mode, the unit measures the pressure normally, but only sends a line of data when it is "polled". Each unit can be given it's own unique identifier or address. Unless otherwise specified each unit is shipped with a default address of capital A. Other valid addresses are B thru Z.

Once you have established communication with the unit and have a stream of information filling your screen:

1. Type *@=A followed by "Enter" to stop the streaming mode of information. Note that the flow of information will not stop while you are typing and you will not be able to read what you have typed. Also, the unit does not accept a backspace or delete in the line so it must be typed correctly. If in doubt, simply hit enter and start again. If the unit does not get exactly what it is expecting, it will ignore it. If the line has been typed correctly, the data will stop.
2. You may now poll the unit by typing A followed by "Enter". This does an instantaneous poll of unit A and returns the values once. You may type A "Enter" as many times as you like. Alternately you could resume streaming mode by typing *@=@ followed by "Enter". Repeat step 1 to remove the unit from the streaming mode.
3. To assign the unit a new address, type *@=New Address, e.g. *@=B Care should be taken not to assign an address to a unit if more than one unit is on the RS232 line as all of the addresses will be reassigned. Instead, each should be individually attached to the RS-232 line, given an address, and taken off. After each unit has been given a unique address, they can all be put back on the same line and polled individually.

Maintenance and Recalibration

General: Alicat Scientific Pressure Gauges and Controllers require very minimal maintenance. The single most important thing that affects the life and accuracy of these devices is the quality of the gas or fluid being controlled. They are nominally designed to measure and control CLEAN, NON-CORROSIVE gases and liquids. Upstream filtration is recommended, especially for controllers.

Recalibration: The recommended period for recalibration is once every year. Under normal service conditions, this periodic recalibration is quite sufficient. A label located on the back of the meter lists the recalibration due date. The gauge or controller should be returned to Alicat Scientific for recalibration near the listed due date. Before calling to schedule a recalibration, please note the serial number on the back of the meter. The Serial Number, Model Number, and Date of Manufacture are also available on the Identity Mode screen.

Cleaning: The PCD Series require no periodic cleaning. If required, the outside of the meter can be cleaned with a soft dry rag. Avoid excess moisture or solvents.

For repairs, re-calibrations, or recycling of this product, contact:

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Bldg. 103
Tucson, AZ 85745
Ph. 520-290-6060
Fax 520-290-0109
Web Address: <http://www.alicatscientific.com>

Warranty

This product is warranted to the original purchaser for a period of one year from the date of purchase to be free of defects in material or workmanship. Under this warranty the product will be repaired or replaced at manufacturers option, without charge for parts or labor when the product is carried or shipped prepaid to the factory together with proof of purchase. This warranty does not apply to cosmetic items, nor to products that are damaged, defaced or otherwise

misused or subjected to abnormal use. Where consistent with state law, the manufacturer shall not be liable for consequential economic, property, or personal injury damages. Alicat Scientific, Inc. does not warrant or assume responsibility for the use of its products in life support applications or systems.

Performance Specifications for PCD Series Pressure Controllers:

Specification	PCD Series	Units
Accuracy	+/-1%	Full Scale
Repeatability	+/-0.5%	Full Scale
Response Time* (typical)	100	ms
Operating Temperature	-10-50	°C
Zero Shift	0.02%	Full Scale / °C / ATM
Span Shift	0.02%	Full Scale / °C / ATM
Humidity Range	0-100%	Non-Condensing
Supply Current** (small valve)	250	mA
Common Mode Pressure (max)	125	PSIG
Supply Voltage	12-18	Volts dc

* 100 ms represents a typical default response time for 63.2% of a step change under ideal conditions. Actual pressure response times depend on system bleed rate. A variable register allows response time to be field adjustable to a certain extent via. RS-232 communication. The primary trade off for response time is signal noise and control stability.

**250 mA represents typical current draw for small valve at wide open condition.