Alicat Scientific™

Operating Manual

PC Series

PCR Series

P Series

PCD Series

PC3 Series

16 Series
Digital Pressure and Vacuum Gauges and Controllers

Innovative Flow and Pressure Solutions

CE NIST

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.

Limited Lifetime Warranty

Alicat Scientific, Inc. warrants to the original purchaser (hereinafter referred to as “Buyer”) that instruments manufactured by Alicat Scientific (hereinafter referred to as “Product”) shall be free from defects in materials and workmanship for the life of the Products.

Under this warranty, the Product will be repaired or replaced at manufacturer’s option, without charge for parts or labor when the Product is carried or shipped prepaid to the factory together with proof of purchase.

The foregoing shall constitute the exclusive and sole remedy in lieu of other remedies of the Buyer for any breach by Alicat Scientific of this warranty to the maximum extent permitted by law.

This warranty does not apply to any Product which has not been installed or used in accordance with the Product operation and installation specifications provided to Buyer verbally or in writing by Alicat Scientific for the proper and normal use of the Product.

Buyer agrees hereunder that Alicat reserves the right to void any warranty, written or implied, if upon Alicat’s examination of Product shall disclose to Alicat’s satisfaction that the Product failure was due solely, or in part, to accident, misuse, neglect, abuse, alteration, improper installation, unauthorized repair or improper testing by Buyer or agent of Buyer.

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Alicat Scientific does not recommend, warrant or assume responsibility for the use of the Products in life support applications or systems.

Alicat’s warranties as herein above set forth shall not be enlarged, diminished or affected by, and no obligation or liability shall arise or grow out of Alicat’s rendering of technical advice in connection with Buyer’s order of the Products furnished hereunder.

If Product becomes obsolete, Alicat Scientific, at its own discretion, reserves the right to repair the Product with available replacement parts or upgrade the Product to a current , commercially available version of the original Product. Should upgrading the Product be deemed necessary by Alicat, Buyer hereby agrees to pay an upgrade fee equal to seventy percent of the retail value of the replacement Product. Alicat Scientific hereunder makes no claim that replacement Products will look, function or operate in the same or similar manner as the original product.

When a Product is returned to Alicat Scientific for recalibration this service is considered normal preventative maintenance. Recalibration of Product shall not be treated as a warranty service unless recalibration of Product is required as the result of repairs to Product pursuant to this Warranty. **Failure to recalibrate Product on a yearly basis will remove any and all obligations regarding repair or replacement of Product as outlined by this Warranty to Buyer from Alicat Scientific.**

This Warranty is in lieu of all other relevant warranties, expressed or implied, including the implied warranty of merchantability and the implied warranty of fitness for a particular purpose, and any warranty against infringement of any patent.

Continued use or possession of Products after expiration of the applicable warranty period stated above shall be conclusive evidence that the warranty is fulfilled to the full satisfaction of Buyer.

Alicat makes no warranty as to experimental, non-standard or developmental Products.

Accessories purchased from Alicat are not covered by this warranty.

Conformity / Supplemental Information:

The product complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC (including 93/68/EEC) and carries the CE Marking accordingly. Contact the manufacturer for more information.

Thank you for purchasing a P Series Pressure Gauge or PC Series Vacuum and Pressure Controller. Please take the time to find and read the information for your specific device. This manual covers the following Alicat Scientific, Inc. instruments:

P Series 16 Bit Digital Pressure Gauges	P-XXPSIG-D P-XXPSIA-D
PC Series 16 Bit Vacuum and Pressure Controllers	PC-XXPSIG-D PC-XXPSIA-D
PCR Series 16 Bit High Flow Vacuum and Pressure Controllers	PCR-XXPSIA-D PCR-XXPSIG-D
PCD Series 16 Bit Dual Valve Pressure Controllers	PCD-XXPSIA-D PCD-XXPSIG-D

Alicat Portable Pressure Gauges
(**Note:** All Alicat Portable Pressure Gauges operate in acccordance with the instructions found in this manual. Please see page 37 for information regarding battery replacement.)

The 16 Series data presentation format utilizes a full graphic display that allows viewing of all operating parameters. The installation (plumbing, mounting and power/signal connection instructions are applicable to all P, PC (includes PC3), PCR and PCD series devices. **Unless specifically noted, all instructions for PC Series Controllers are applicable to PC3, PCR and PCD controllers as well.**

Installation

Plumbing

All P Series Gauges and PC Series Controllers are equipped with female inlet and outlet port connections. No straight runs of pipe are required upstream or downstream of the gauge. The inlet and outlet ports are equal in size and symmetric (in-line). The port sizes (process connections) and mechanical dimensions for different pressure ranges are shown on pages 30 & 31. Pressure Gauges are shipped with a plug for static pressure measurement. This plug may be removed for flow through operation.

On all gauges/controllers, avoid the use of pipe dopes or sealants on the ports, as these compounds can cause permanent damage should they get into the flow stream. Use of thread sealing Teflon tape is recommended to prevent leakage around the threads. When applying the tape, avoid wrapping the first thread or two to minimize the possibility of getting a piece of shredded tape into the flow stream. When changing fittings, always clean any tape or debris from the port threads.

For additional notes on PCD (dual valve controller) plumbing see page 22.

For gas applications, it is recommended that a 50 micron filter be installed upstream of P and PCR Series instruments and a 20 micron filter be installed upstream of PC and PCD Series instruments.

For liquid applications, see “Using P and PC Series Instruments with Fluids”, page 6.

For fittings and filters see page 40.

Mounting

All P Series Gauges and PC Series Controllers have mounting holes for convenient mounting to flat panels. These meters are position insensitive and can be mounted in any orientation. The sizes and dimensions for the mounting holes are shown on pages 32 to 36.

P Series Pressure Gauges may be connected into your system with the flow going in either direction for ease of viewing the display. These units are shipped with a plug for dead end applications. This plug should be removed for flow through applications.

PC Series Vacuum and Pressure Controllers are normally intended to control the process pressure *downstream* of the controller. In order for this to occur the controller should be mounted so the flow goes from left to right as you look at the front of the unit. This puts the measuring portion of the device between the valve and the leakage point where you are attempting to control the pressure application. Back-pressure controllers reverse this configuration (see Fig. 15, page 19).

Using P and PC Series Instruments with Fluids

All of these devices may by used with chemically compatible liquids providing a couple of things are taken into account:

1. Water is about 50 times more viscous than air. This is important when sizing a pressure controller. The PC Series which can be used to flow up to 20 SLPM of gas, will be limited to roughly 0.5 LPM of water-like fluid. The PCR will be limited to roughly 30 LPM of water-like fluid.

2. The factory PID tune is established using air flow. It may be necessary to adjust the PID tuning parameters if you will be using a controller with liquids.

Special Configurations

P, PC, and PCR Series pressure devices are occasionally ordered with special configurations which are covered here:

1. External Sense Port: Occasionally it is necessary or desirable to sense the pressure at some point other than at the location of the pressure device. All P, PC, or PCR Series pressure devices can be ordered with an additional NPT port which is connected directly with the pressure sensor of the device. In these devices the flow path through the device is NOT connected to the pressure sensor. See “PC3 Series Pressure Controllers” – page 20.

2. Differential Pressure: Occasionally it is necessary or desirable to monitor or control a differential pressure. P, PC, and PCR Series pressure devices can be ordered as low differential pressure devices (usually 1 to 5 PSID). These devices have two ports located on the front face of the unit for connection to the points in the system where the differential pressure is to be measured. The upstream port is for the higher pressure and the downstream port is for the lower pressure. In these devices the flow path through the device is NOT connected to either leg of the differential pressure sensor. See “Differential Pressure Gauges and Differential Pressure Controllers” – page 21.

Power and Signal Connections

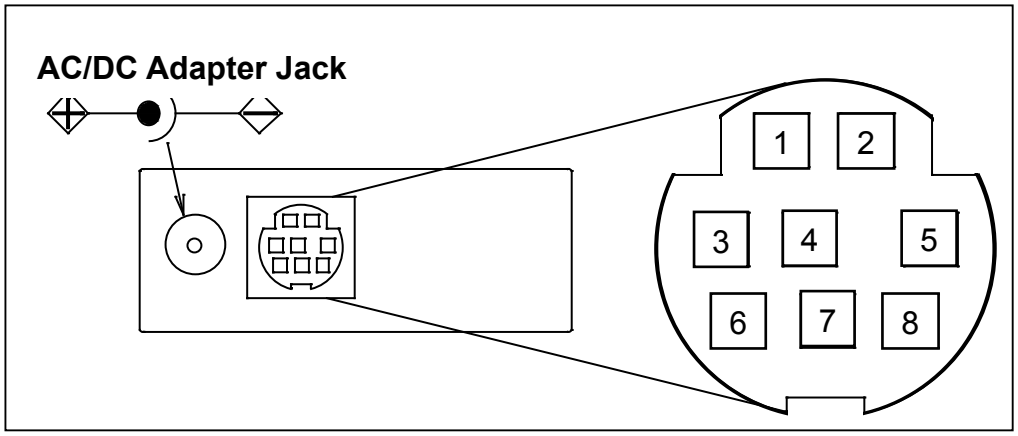
Power can be supplied to your gauge or controller through either the AC/DC adapter jack or through the 8 pin Mini-DIN connector as shown in Figure 1.

A 2.1mm, positive center, 7-30 Vdc AC/DC adapter rated for at least 100 mA is required to use the adapter jack in a **P Series pressure gauge**.

A 2.1mm, positive center, 12-30 Vdc AC/DC adapter rated for at least 250 mA is required to use the adapter jack in a **PC** or **PCD Series pressure controller. Note:** 4-20mA output requires at least 15 Vdc.

A 2.1mm, positive center, 24-30 Vdc AC/DC adapter rated for at least 500 mA is required to use the adapter jack in a **PCR Series pressure controller.**

Cables can be purchased from the manufacturer (see Accessories on page 40) or they are available from electronics suppliers. Alternatively, power can be supplied through the Mini-DIN connector as shown below:



Pin	Function	Mini-DIN cable color
1	Inactive or 4-20mA Primary Output Signal	Black
2	Static 5.12 Vdc or Secondary Analog Output (4-20mA, 5Vdc, 10Vdc) or Basic Alarm	Brown
3	RS-232 Input Signal	Red
4	Analog Input Signal = Remote Tare (Gauges - see Figure 7) = Set-Point In (Controllers - see Figure 2)	Orange
5	RS-232 Output Signal	Yellow
6	0-5 Vdc (or 0-10 Vdc) Output Signal	Green
7	Power In (as descibed above)	Blue
8	Ground (common for power, communications and signals)	Purple

Note: The above pin-out is applicable to all pressure gauges and controllers available with the Mini-DIN connector. The availability of different output signals depends on the options ordered.
Underlined Items in the above table are optional configurations that are noted on the unit's calibration sheet.

Figure 1. 8 Pin Mini-DIN Connector

CAUTION:*Do not connect power to pins 1 through 6 as permanent damage can occur!*

Note: Upon initial review of the pin out diagram in Figure 1, **it is common to mistake Pin 2 (labeled 5.12 Vdc Output) as the standard 0-5 Vdc analog output signal!** In fact Pin 2 is normally a constant 5.12 Vdc that reflects the system bus voltage and can be used as a source for the input signal. This allows the user in the field to run this output through a 50K ohm potentiometer and back into the analog set-point pin to create a 0-5 Vdc set-point source (see Figure 2).

Analog Input Signal

Apply analog input to Pin 4 as shown in Figure 1.

Unless ordered otherwise, 0-5 Vdc is the standard analog input signal. Apply the 0-5 Vdc input signal to pin 4, with common ground on pin 8. The 5.12 Vdc output on pin 2 can be wired through a 50K ohm potentiometer and back to the analog input on pin 4 to create an adjustable 0-5 Vdc input signal source as in Figure 2 below.

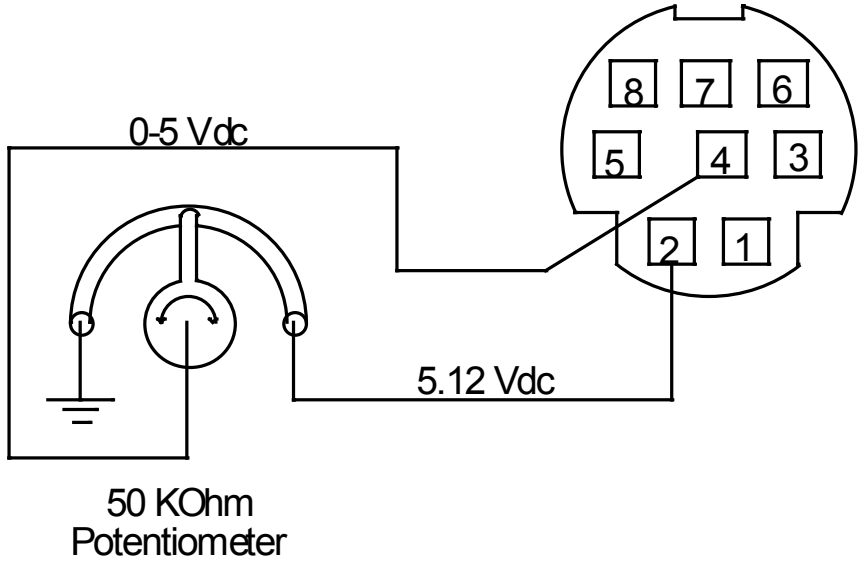


Figure 2. Simple Method for Providing Set-Point to Controllers

Optional 0-10 Vdc: If specified at time of order, a 0-10 Vdc input signal can be applied to pin 4, with common ground on pin 8.

Optional 4-20 mA: If specified at time of order, a 4-20 mA input signal can be applied to pin 4, with common ground on pin 8.

RS-232 Digital Input Signal

If you will be using the RS-232 output signal, it is necessary to connect the RS-232 Output Signal (Pin 5), the RS-232 Input Signal (Pin 3), and Ground (Pin 8) to your computer serial port as shown in Figure 3. *Adapter cables are available from Alicat (see Accessories page 40)* or they can be constructed in the field with parts from an electronics supply house. In Figure 3, note that the diagrams represent the “port” side of the connections, i.e. the connector on top of the gauge and the physical DB-9 serial port on the back of the computer. The cable ends will be mirror images of the diagram shown in Figure 4. (See page 22 for details on accessing RS-232 output and input.)

RS-232 Digital Output Signal

If you will be using the RS-232 output signal, it is necessary to connect the RS-232 Output Signal (Pin 5), the RS-232 Input Signal (Pin 3), and Ground (Pin 8) to your computer serial port as shown in Figure 3. Adapter cables are available from the manufacturer or they can be constructed in the field with parts from an electronics supply house. In Figure 3, note that the diagrams represent the “port” side of the connections, i.e. the connector on top of the gauge and the physical DB-9 serial port on the back of the computer. The cable ends will be mirror images of the diagram shown in Figure 3. (See page 23 for details on accessing RS-232 output.)

Standard Voltage (0-5 Vdc) Output Signal

All P and PC Series pressure gauges/controllers have a 0-5 Vdc (optional 0-10 Vdc) output signal available on Pin 6. This is generally available in addition to other optionally ordered outputs. This voltage is usually in the range of 0.010 Vdc for zero pressure and 5.0 Vdc for full-scale pressure. The output voltage is linear over the entire range. Ground for this signal is common on Pin 8.

Optional 0-10 Vdc Output Signal

If your gauge/controller was ordered with a 0-10 Vdc output signal, it will be available on Pin 6. (See the Calibration Data Sheet that shipped with your gauge to determine which output signals were ordered.) This voltage is usually in the range of 0.010 Vdc for zero pressure and 10.0 Vdc for full-scale pressure. The output voltage is linear over the entire range. Ground for this signal is common on Pin 8.

Optional Current (4-20 mA) Output Signal

If your gauge/controller was ordered with a 4-20 mA current output signal, it will be available on Pin 1. (See the Calibration Data Sheet that shipped with your device to determine which output signals were ordered.) The current signal is 4 mA at 0 pressure and 20 mA at the gauge's full scale pressure. The output current is linear over the entire range. Ground for this signal is common on Pin 8. (Current output units require 15-30Vdc power.)

Note: *This is a current sourcing device. Do not attempt to connect it to "loop powered " systems*.

Optional 2nd Analog Output Signal

You may specify an optional 2nd analog output on Pin 2 at time of order. (See the Calibration Data Sheet that shipped with your device to determine which output signals were ordered.) This output may be a 0-5 Vdc, 0-10 Vdc, or 4-20 mA analog signal that can represent any measured parameter.

Note: *This is a current sourcing device. Do not attempt to connect it to "loop powered " systems.*

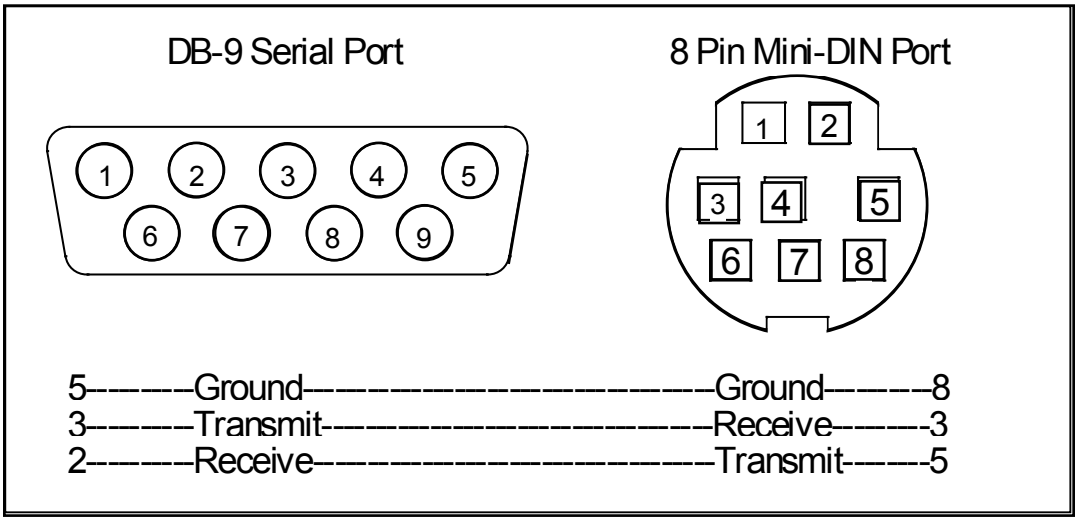


Figure 3. Mini-DIN to DB-9 Connection for RS-232 Signals

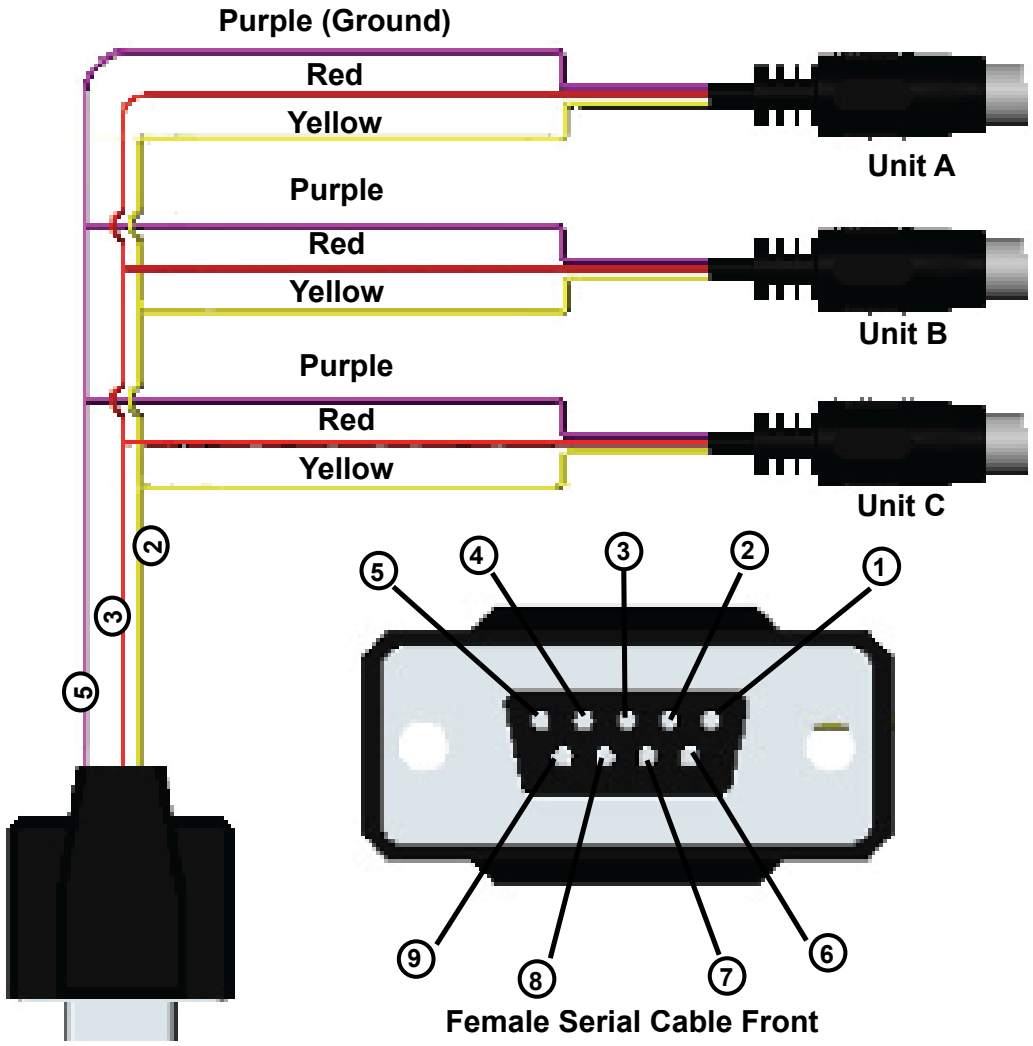


Figure 4. Typical Multiple Device (Addressable) Wiring Configuration

Note: The easiest way to connect multiple devices is with a Multi-Drop Box (see page 38).

An optional industrial connector is also available:

Pin	Function	Cable Color
1	Power In (+)	Red
2	RS-232 Output	Blue
3	RS-232 Input Signal	White
4	Remote Tare (Ground to Tare)	Green
5	Ground (common for power, communications and signals)	Black
6	Signal Out (Voltage or Current as ordered)	Brown

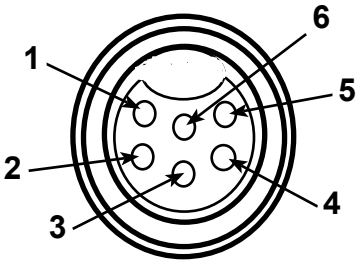


Figure 5. Optional Industrial Connector

Note: The above pin-out is applicable to all the pressure gauges and controllers ordered with the industrial connector. The availability of different output signals depends on the options ordered.

DB15 Pin-out Diagrams: Pin-out diagrams for devices ordered with a DB15 connector can be found on pages 43 and 44 .

PROFIBUS Pin-out Diagrams: Pin-out diagrams for PROFIBUS configured devices can be found on page 41 .

P Series Gas Pressure Gauge Operation

The P Series can have several screen “modes” depending on how the device is ordered. All P Series Gauges have a default Main Mode, Select Menu Mode, a Communication Select Mode, a Manufacturer Data Mode and a Miscellaneous Mode. The device defaults to Main Mode as soon as power is applied to the gauge.

Note: P Series Pressure Gauges may also be ordered as portable devices as described on page 37.

Main Mode

The main mode screen shows the pressure in the units specified at time of order.

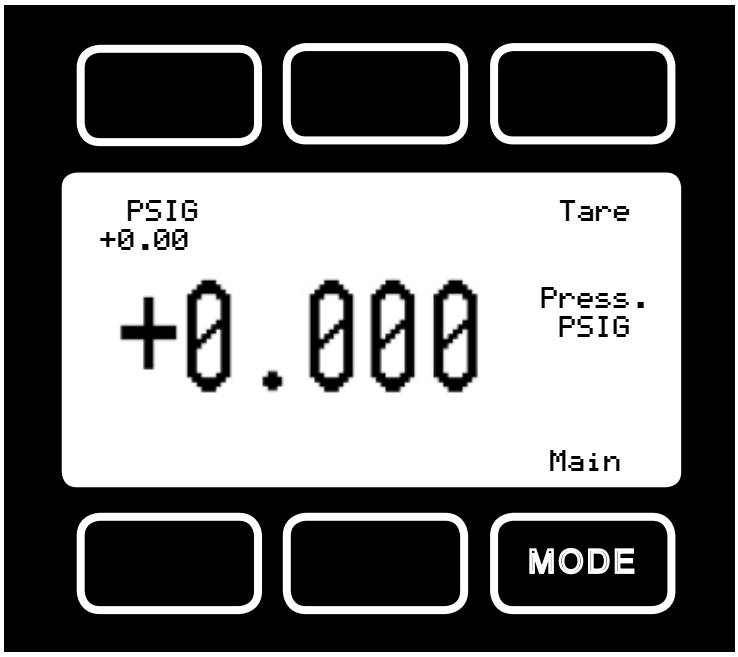


Figure 6. Main Mode Display, P Series Pressure Gauge

The “MODE” button in the lower right hand corner toggles the display between modes.

Tare – P Series gauges which reference atmospheric pressure as zero (gauge pressure devices) have a tare button. Pushing the dynamically labeled Tare button in the upper right hand corner tares the pressure gauge and provides it with a reference point for zero pressure. *This is a very simple but important step in obtaining accurate measurements*. It is good practice to “zero” the gauge any time the gauge does not read zero when exposed to atmospheric pressure. If the unit reads a significant negative value when it is exposed to atmospheric pressure, it is a good indication that it was given a false tare.

Note: A remote tare can be achieved by momentarily grounding pin 4 to tare as shown in Figure 7 on page 12.

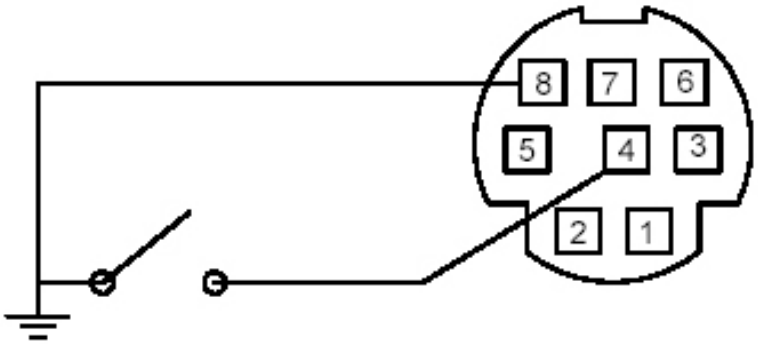


Figure 7. Proper Set Up for Remote Tare on Gauges (Momentarily ground Pin 4 to Tare)

Flashing Error Message: Our pressure gauges and controllers display an error message (POV = pressure overrange) when a the pressure exceeds the range of the sensors in the device. When any item flashes on the display, the pressure measurement is not accurate. Reducing the pressure to within specified limits will return the unit to normal operation and accuracy.

Select Menu Mode

Pushing “Mode” once will bring up the “Select Menu” display. Push the button nearest your selection to go to the corresponding screen. Push “Mode” again to return to the Main Mode display.

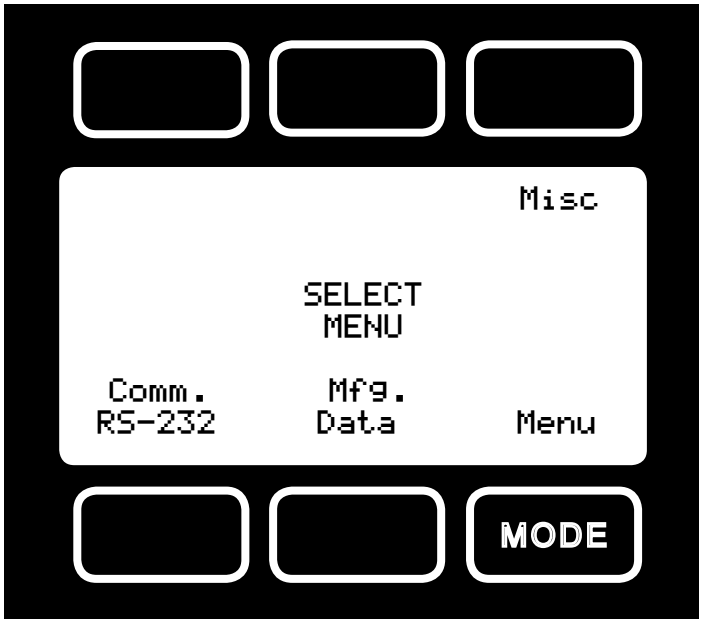


Figure 8. Select Menu Display

Communication Select Mode

The Communication Select mode is accessed by pressing the button below “Comm. RS-232” on the Select Menu display. The screen will appear as shown in Figure 9 below.

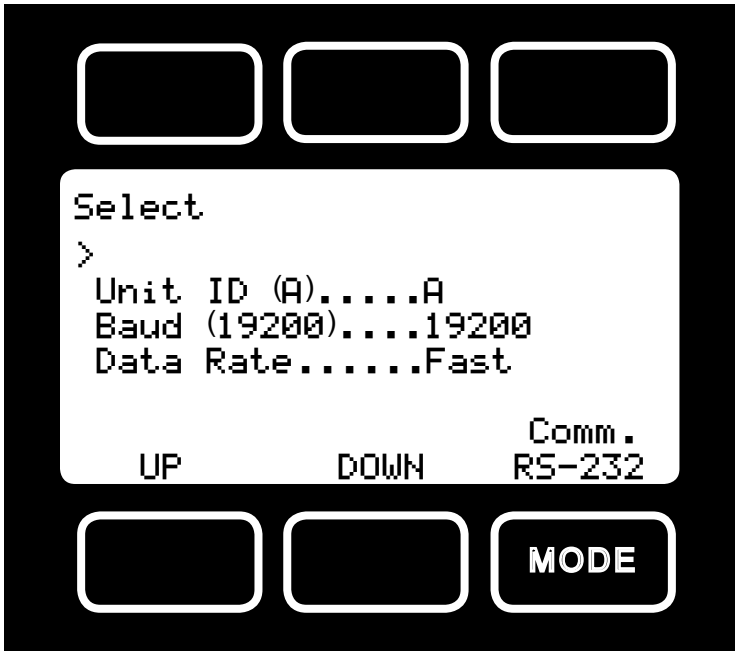


Figure 9. Communication Select Display

Unit ID – Valid unit identifiers are letters A-Z and @ (see **Note** below). This identifier allows the user to assign a unique address to each device so that multiple units can be connected to a single RS-232 port on a computer. The Communication Select Mode allows you to view and/or change a unit’s unique address. To change the unit ID address, press the “Select” button in the upper left corner of the display until the cursor arrow is in front of the word “Unit ID”. Then, using the UP and DOWN buttons at the bottom of the display, change the unit ID to the desired letter. ***Any ID change will take effect when the Communication Select Screen is exited by pushing the MODE button.***

Note: When the symbol @ is selected as the unit ID, the device will go into streaming mode when the Communication Select Mode is exited by pushing the MODE button. See the RS-232 Communications chapter in this manual for information about the streaming mode.

Baud – The baud rate (bits per second) determines the rate at which data is passed back and forth between the instrument and the computer. Both devices must send/receive at the same baud rate in order for the devices to communicate via RS-232. The default baud rate for these devices is 19200 baud, sometimes referred to as 19.2K baud. To change the baud rate in the Communication Select Mode, press the “Select” button in the upper left corner of the display until the cursor arrow is in front of the word “Baud”. Then, using the UP and DOWN buttons at the bottom of the display, select the required baud rate to match your computer or PLC. The choices are 38400, 19200, 9600, or 2400 baud. ***Any baud rate change will not take effect until power to the unit is cycled.***

Data Rate – Changing the Data Rate affects the rate at which the instrument dumps its data. Slow mode inserts idle characters between the data characters. The speed of the Fast rate is determined by the selected baud rate. It is sometimes desirable to reduce the data rate if the communication speed bogs down the computer’s processor (as is not uncommon in older laptops), or to reduce the size of data files collected in the streaming mode. To change the data rate in the Communication Select Mode, press the “Select” button in the upper left corner of the display until the cursor arrow is in front of the word “Data Rate”. Then, using the UP and DOWN buttons at the bottom of the display, select either Fast or Slow. ***Any data rate change will be effective immediately upon changing the value between Fast and Slow.***

Manufacturer Data Mode

"Manufacturer Data" is accessed by pressing the "Mfg. Data" button on the Select Menu display (Figure 8). The "Mfg 1" display shows the name and telephone number of the manufacturer. The"Mfg 2" display shows important information about your pressure device including the model number, serial number, and date of manufacture.

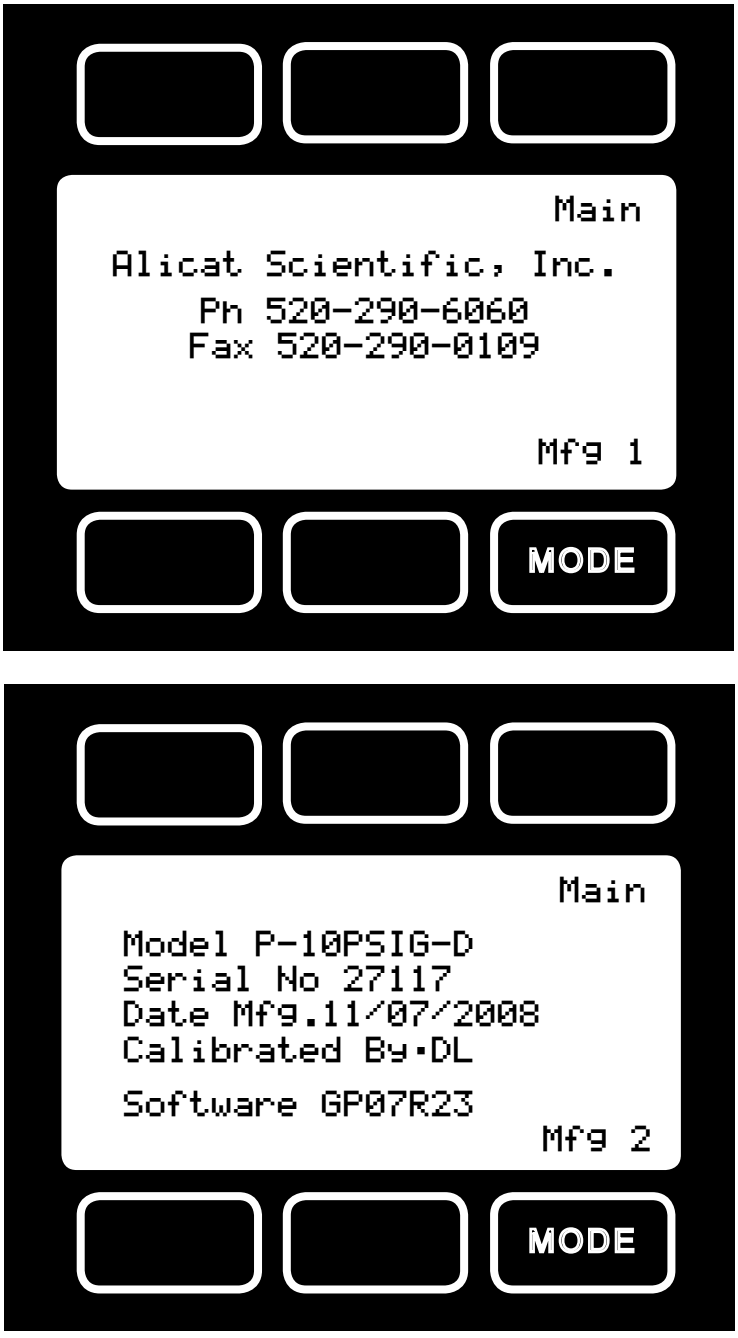


Figure 10. Manufacturer Data Displays

Miscellaneous Mode

The Miscellaneous mode is accessed by pressing the button above the "Misc" label in the upper right hand corner of the Select Menu display. The screen will appear as shown in Figure 11. Push the button above "Select" to move the cursor even with the item you wish to adjust. Then use the "UP" and "DOWN" buttons to make the adjustment.

NOTE: All Miscellaneous changes are recorded when you exit the Miscellaneous display.

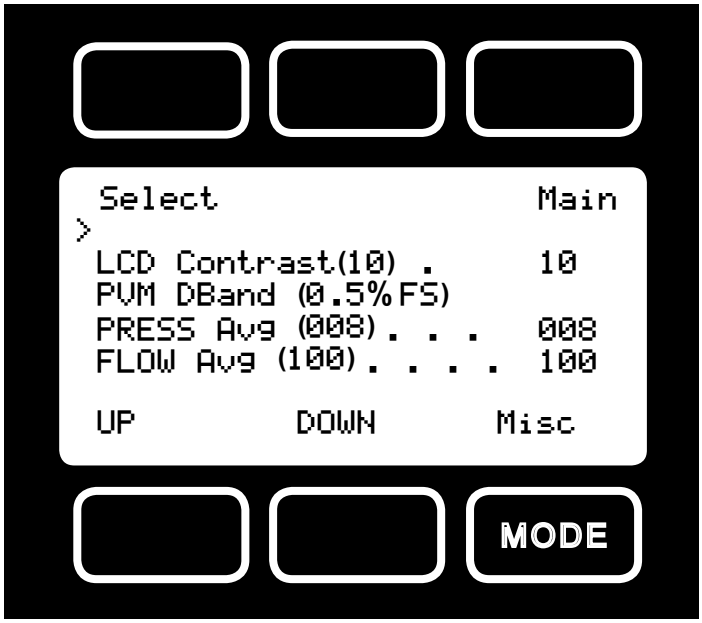


Figure 11. Miscellaneous Display

LCD Contrast: The Liquid Crystal Display Contrast can be adjusted between 0 and 30 with zero being the lightest contrast and 30 being the darkest contrast. To change the contrast, press the “Select” button in the upper left hand corner of the display until the cursor arrow is in front of the words “LCD Contrast (X)”. Then using the UP and DOWN buttons at the bottom of the display, change the contrast value as desired. The change is immediate and the effect can be monitored as the value is changed.

Display Zero Deadband: Zero deadband refers to a value below which the display simply jumps to zero. This deadband is often desired to prevent electrical noise from showing up on the display as minor flows or pressures that do not actually exist, especially in high noise (electrical) environments. This display deadband does not affect the analog or digital signal outputs — there is no zero deadband on the output signals. The display zero deadband can be adjusted between 0 and 3.2% of the Full Scale (FS) of the sensor. PVM refers to Pressure, Volumetric Flow, and Mass Flow, the three parameters to which the deadband applies. *Note: Only the Pressure parameter is applicable to and adjustable in pressure devices.*To adjust the display zero deadband, press the “Select” button in the upper left hand corner of the display until the cursor arrow is in front of the words “PVM DBand (X %F.S.)”. Then using the UP and DOWN buttons at the bottom of the display, change the display zero deadband value as desired.

Pressure Averaging: It is sometimes advantageous to apply an averaging factor to the pressure output (and display) to make it easier to read and interpret rapidly fluctuating pressures. Pressure averaging can be adjusted between 1 (no averaging) and 256 (maximum averaging). This is a geometric running average where the number between 1 and 256 can be considered very roughly equivalent to the response time constant in milliseconds. This can be very effective at “smoothing” high frequency process oscillations such as those caused by diaphragm pumps. To adjust the pressure averaging, press the “Select” button in the upper left hand corner of the display until the cursor arrow is in front of the words “PRESS Avg (XXX)”. Then using the UP and DOWN buttons at the bottom of the display, change the pressure averaging value as desired.

Flow Averaging: *While “Flow Avg” appears on the display, this adjustment has no application in pressure devices. Changing it will have no effect on the operation of a pressure device.*

PC, PC3, PCR3, PCR and PCD Series Pressure Controller Operation

All PC, PC3, PCR3, PCR and PCD Series Controllers have a default Main Mode, a Select Menu Mode, a Control Setup Mode, a Communication Select Mode, a Manufacturer Data Mode and a Miscellaneous Mode. The device defaults to Main Mode as soon as power is applied to the controller.

PC Series Pressure Controllers are normally shipped with a 0.050” diameter valve orifice which permits flows up to 20 SLPM (with inlet pressure 20 PSI over controlled pressure). For much smaller flows, consult factory for details on specifying a smaller valve orifice. For larger flows, a PCR Series Pressure Controller is recommended. ***For additional information specific to the PCD series (dual valve controllers) see page 22.***

Main Mode

The main mode screen shows the pressure in the units specified at time of order.

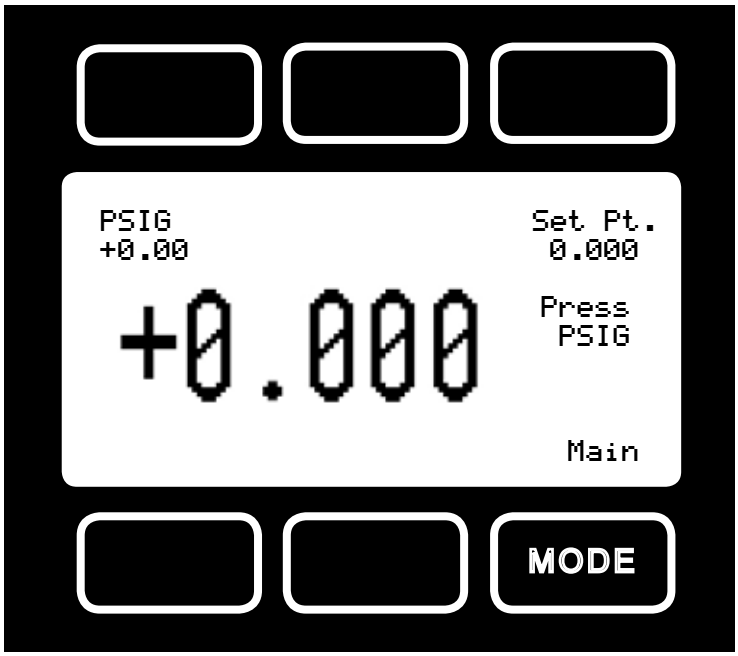


Figure 12. Main Mode Display, PC Series Pressure Controller

The “MODE” button in the lower right hand corner toggles the display between the Main Display and the Select Menu Display.

Line Pressure – Pressing the dynamically labeled PSIG button located in the upper left corner of the display will move the line gauge pressure to the primary display.

Set Pt – The set-point is shown in the upper right corner of the display. The set-point cannot be adjusted from the main mode screen. (For information on changing the set-point, see the Control Set Up Mode below.)

Flashing Error Message: Our pressure gauges and controllers display an error message (POV = pressure overrange) when the pressure exceeds the range of the sensors in the device. When the pressure reading flashes on the display, the pressure measurement is not accurate. Reducing the value of the line pressure to within specified limits will return the unit to normal operation.

Select Menu Mode

Pushing “Mode” once will bring up the “Select Menu” display (Figure 13, page 17). Push the button nearest your selection to go to the corresponding screen. Push “Mode” again to return to the Main Mode display.

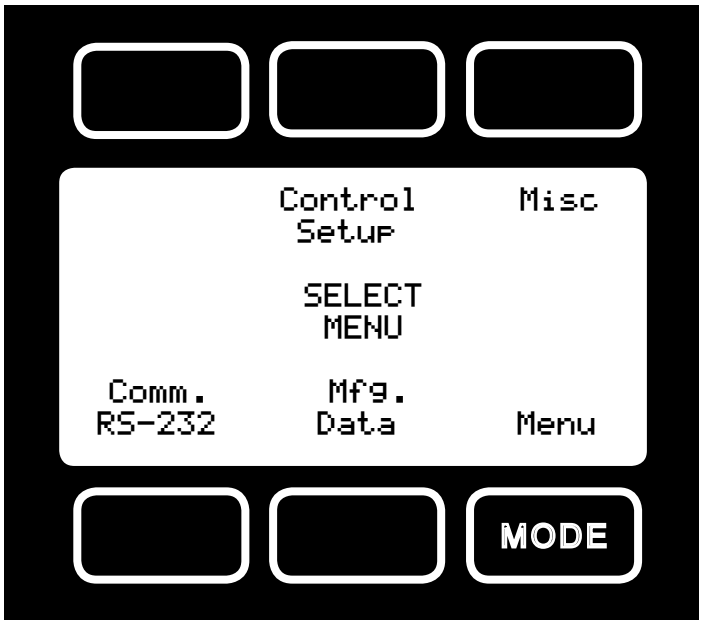


Figure 13. PC Series Select Menu Display

Control Setup Mode

The Control Setup Mode is accessed by pressing the center button above “Control Setup” on the select menu display. This mode allows the user to set up most parameters commonly associated with PID control. PC Series Pressure 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.

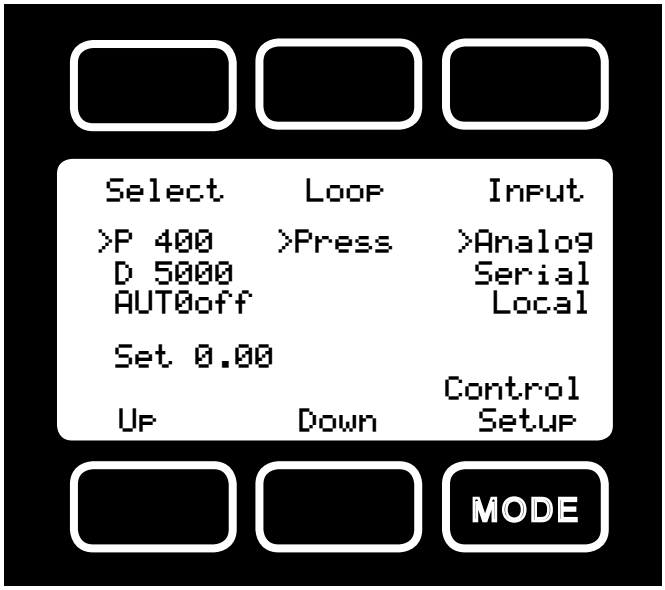


Figure 14. PC Series Control Setup Display

Input – PC Series Pressure Controllers normally ship defaulted to analog control as indicated in Figure 14 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 at some positive value.

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.

Loop – The PC Series is defaulted to pressure.

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.

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.

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. **CAUTION!** ***Never leave a Controller with any non-zero set-point if no flow is available to make pressure. The controller will apply full power to the valve in an attempt to reach the set-point. When there is no flow, this can make the valve very HOT!***

Communication Select Mode

The Communication Select mode is accessed by pressing the button below “Comm. RS-232” on the Select Menu display. Please see page 13 for Communication Select mode instructions.

Manufacturer Data Mode

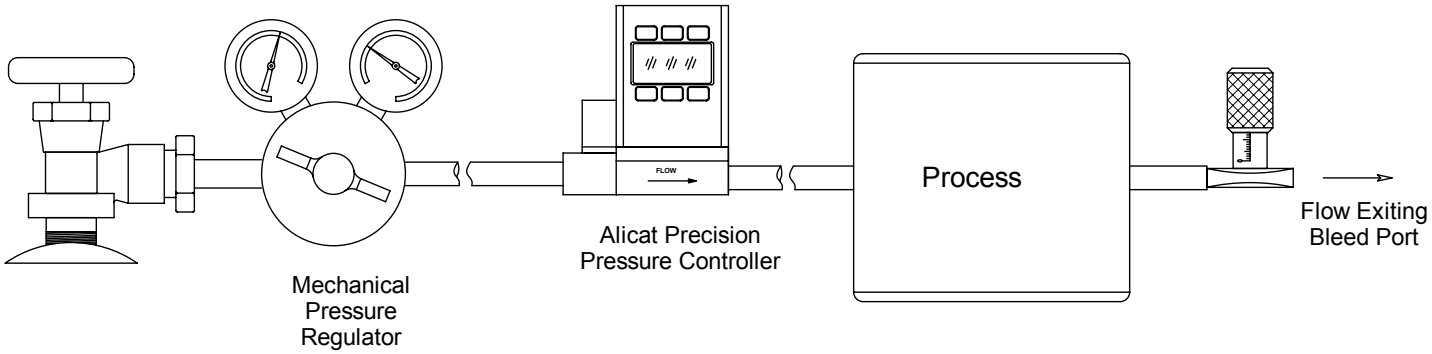
“Manufacturer Data” is accessed by pressing the “Mfg. Data” button on the Select Menu display (Figure 12, page 16). The “Mfg 1” display shows the name and telephone number of the manufacturer. The“Mfg 2” display shows important information about your pressure gauge including the model number, serial number, and date of manufacture (Figure 10, page 14).

Miscellaneous Mode

The Miscellaneous mode is accessed by pressing the button above the “Misc” label in the upper right hand corner of the Select Menu display. The screen will appear as shown in Figure 11. Push the button above “Select” to move the cursor even with the item you wish to adjust. Then use the “UP” and “DOWN” buttons to make the adjustment. See pages 14 & 15.

NOTE: All Miscellaneous changes are recorded when you exit the Miscellaneous display.

Pressure Control Application, Upstream Valve



Back Pressure Control Application, Downstream Valve (DS)
Specify DS in part number adder code

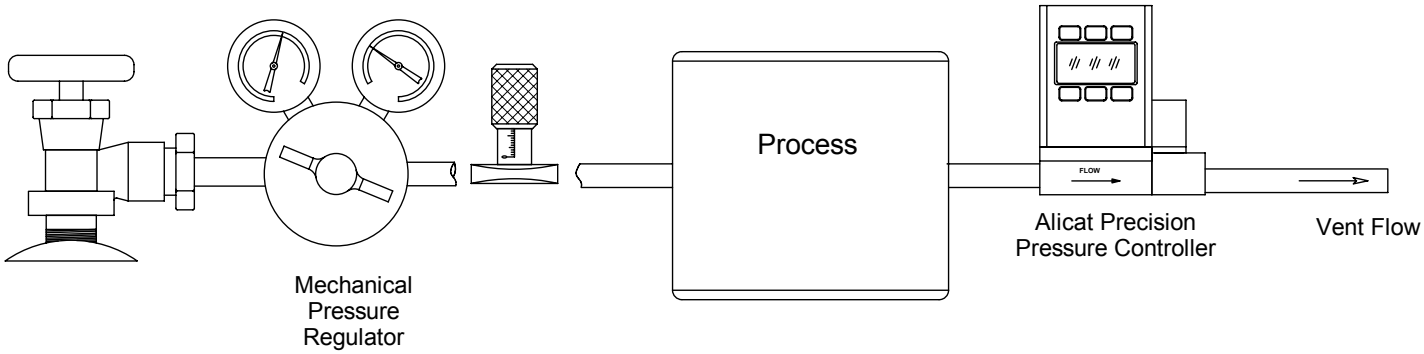


Figure 15. Upstream and Downstream Valve Diagram

PC3 and PCR3 Series Pressure Controllers:

The PC3 and PCR3 Series pressure controller is designed to change the flow to allow the control of pressure at some point away from the body of the controller. This is most helpful when it is necessary to mount pneumatic components such as valves, fittings or flow meters that introduce significant pressure drop between pressure controller body and the point where pressure control is necessary. To accomplish this, the PC3 has an external sensing port to which the pressure at the location where pressure is to be controlled is piped back to the pressure sensor in the controller.

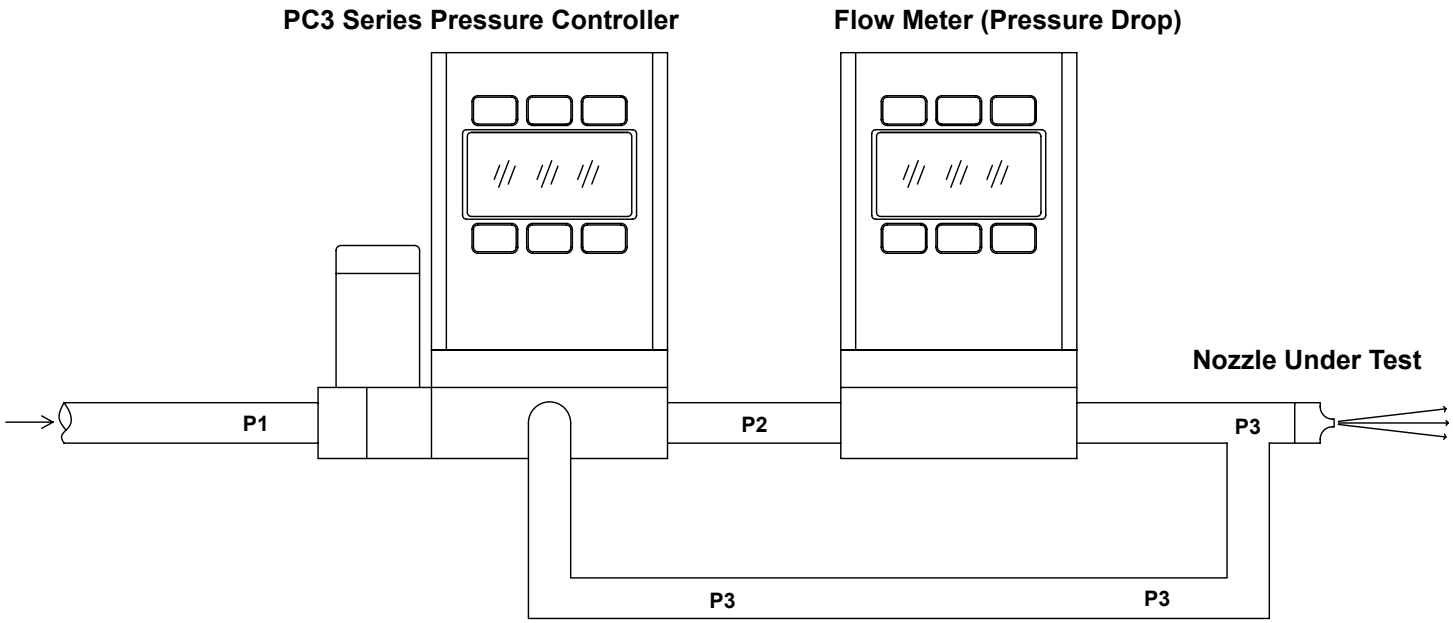


Figure 16. Typical PC3 Application Diagram

Differential Pressure Gauges:

The differential pressure gauge is designed to measure a pressure ratio between two points in the line. There are a variety of applications for this device. One of the most common is to measure the difference in pressure across some sort of element that changes resistance to flow over time, such as a filter, or one that changes area with time as would happen with orifice testing. The gauge has two sensing ports which are piped to the upstream and downstream sides of the pressure drop of interest in the system. These two ports run either to two separate pressure sensors or for low differential pressures – they may be run to the two legs of a single differential pressure sensor. The higher (upstream) pressure is applied to the left port and the lower (downstream) pressure is applied to the right port.

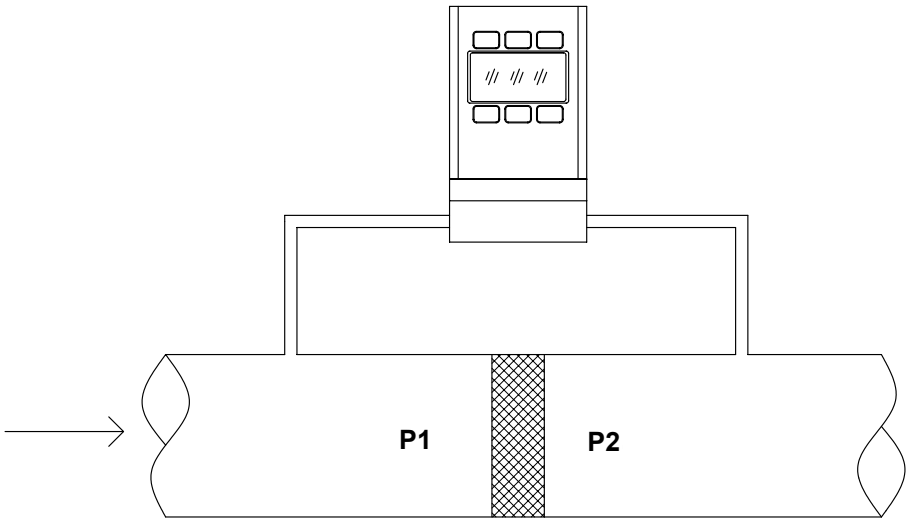


Figure 17. Differential Pressure Gauge

Differential Pressure Controllers:

The differential pressure controller is designed to change the flow to allow the control of a pressure ratio between two points in the line. There are a variety of applications for this device. One of the most common is to control the difference in pressure across some sort of element that changes resistance to flow over time, such as a filter or one that changes area with time as would happen with orifice testing. To accomplish differential pressure control, the controller has two sensing ports which are piped to the upstream and downstream sides of the pressure drop in the system. These two ports run either to two separate pressure sensors or for low differential pressures – they may be run to the two legs of a single differential pressure sensor. The controller itself changes the flow to the two sensing ports until the difference between the two pressures matches the set-point.

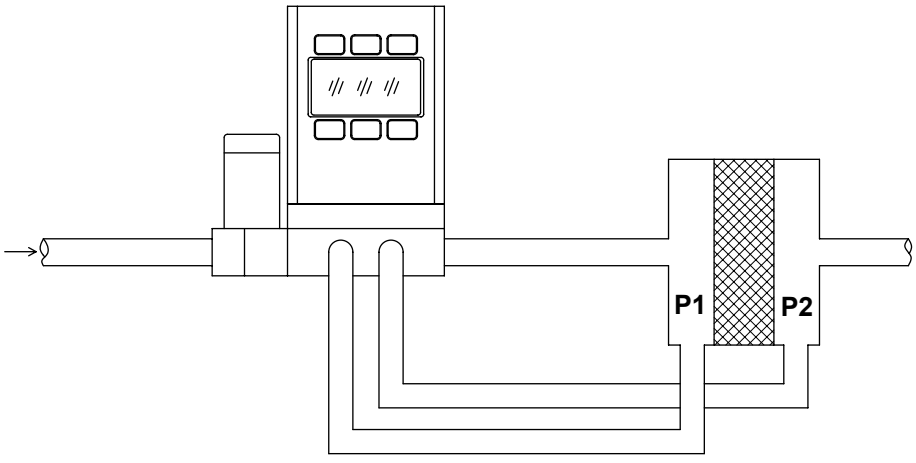


Figure 18. Differential Pressure Controller

PCD Series Dual Valve Pressure Controller Operation

PCD Series Closed Volume Pressure Controllers

Alicat Scientific PCD Series Closed Volume Pressure Controllers incorporate a digital pressure gauge with dual control valves 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 two thousand times per second.

It is most common to have a .050 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.

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 145 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 desired, there are two 8-32 mounting holes located on the bottom of the unit as shown in the dimensional drawing on page 36.

Connect your PCD to power and output lines as detailed in the "Wiring" section in this manual.

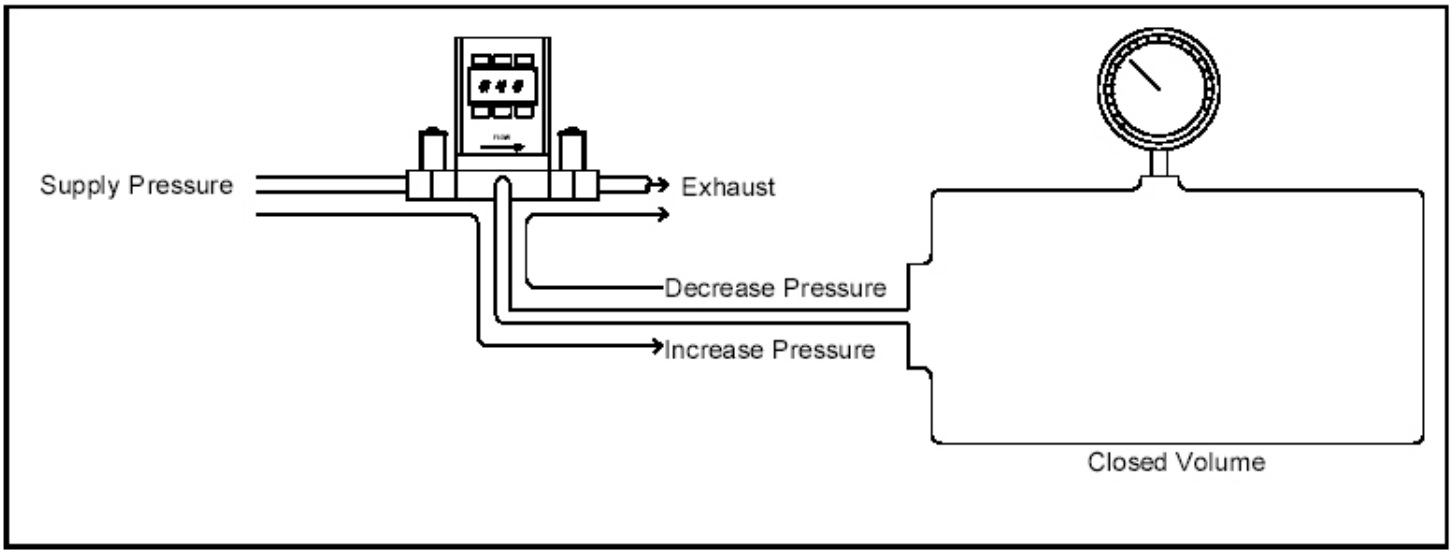


Figure 19. PCD Plumbing Diagram

RS-232 Output and Input

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 (or matches the baud rate selected in the RS-232 communications menu on the gauge) 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 or Auto Detect.
5. Click on the “ASCII Setup” button and be sure the “Send Line Ends with Line Feeds” box is not checked and the “Echo Typed Characters Locally” box and the “Append Line Feeds to Incoming Lines” boxes are checked. Those settings not mentioned here are normally okay in the default position.
6. Save the settings, close HyperTerminal® and reopen it.

In Polling Mode, the screen should be blank except the blinking cursor. In order to get the data streaming to the screen, hit the “Enter” key several times to clear any extraneous information. Type “*@=@” followed by “Enter” (or using the RS-232 communcation select menu, select @ as identifier and exit the screen). If data still does not appear, check all the connections and com port assignments.

Changing From Streaming to Polling Mode:
When the gauge is in the Streaming Mode, the screen is updated approximately 10-60 times per second (depending on the amount of data 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 its 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” (or using the RS-232 communcation select menu, select A as identifier and exit the screen) 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.

Tareing via RS-232 (Gauges only):
Tareing (or zeroing) the pressure gauge provides it with a reference point for zero pressure. *This is a very simple but important step in obtaining accurate measurements*. It is good practice to "zero" the pressure gauge each time it is powered up. If the pressure reading varies significantly from zero after an initial tare, give the unit a minute or so to warm up and re-zero it. Zeroing the unit while there is any pressure will directly affect the accuracy by providing a false zero point. If in doubt about whether the pressure is zero, remove it from the line and open both ports to atmosphere before entering the Tare command. If the unit reads a significant negative value when removed from the line and open, it is a good indication that it was given a false zero. To send a Tare command via RS-232, enter the following strings:

In Streaming Mode:	$$P<Enter>	
In Polling Mode:	Address$$P<Enter>	(e.g. B$$P<Enter>)

Sending a Set-point via RS-232 (Controllers only):
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 pressure, and hit "Enter". The set-point column and pressure 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:

Value = (Desired Set-point X 64000) / Full Scale Pressure Range

For example, if your device is a 50 PSIG full-scale unit and you wish to apply a set-point of 12.5 PSIG you would enter the following value:

16000 = (12.5 PSIG X 64000) / Full Scale Pressure Range

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:

D16000 followed by "Enter"

Adjusting the Proportional and Differential (P&D) Terms via RS-232 (Controllers only):

Type *@=A followed by “Enter” to stop the streaming mode of information.

To adjust the “P” or proportional term of the PID controller, type *R21 followed by “Enter”.

The computer will respond by reading the current value for register 21 between 0-65535. It is good practice to write this value down so you can return to the factory settings if necessary. Enter the value you wish to try by writing the new value to register 21. For example, if you wished to try a “P” term of 220, you would type *W21=**220** followed by “Enter” where the bold number denotes the new value.

The computer will respond to the new value by confirming that 21=220. To see the effect of the change you may now poll the unit by typing A followed by “Enter”. This does an instantaneous poll 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 3 to remove the unit from the streaming mode.

To adjust the “D” or proportional term of the PID controller, type *R22 followed by “Enter”.

The computer will respond by reading the current value for register 22 between 0-65535. It is good practice to write this value down so you can return to the factory settings if necessary. Enter the value you wish to try by writing the new value to register 22. For example, if you wished to try a “D” term of 25, you would type *W22=**25** followed by “Enter” where the bold number denotes the new value.

The computer will respond to the new value by confirming that 22=25. To see the effect of the change you may now poll the unit by typing A followed by “Enter”. This does an instantaneous poll 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.

You may test your settings for a step change by changing the set-point. To do this type A32000 (A is the default single unit address, if you have multiple addressed units on your RS-232 line the letter preceding the value would change accordingly.) followed by “Enter” to give the unit a ½ full scale set-point. Monitor the unit’s response to the step change to ensure it is satisfactory for your needs. Recall that the “P” term controls how quickly the unit goes from one set-point to the next, and the “D” term controls how quickly the signal begins to “decelerate” as it approaches the new set-point (controls the overshoot).

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. ***For extended term data capture see:*** “Sending a Simple Script to HyperTerminal®” on page 27.

Data Format:

The data stream on the screen represents the pressure parameters of the main mode in the units shown on the display. For P Series Pressure Gauges, there is a single column of data. This column represents the measured pressure in the units specified at time of order and shown on the display.

+4.123
+4.123
+4.123
+4.123
+4.124
+4.125

P Series Pressure Gauge Data Format

For PC Series Controllers, there are 2 columns of data representing pressure and set-point. The first column is pressure (normally in PSIG), the second column is the set-point (in the units specified at time of order and shown on the display).

+014.70 +014.70
+014.70 +014.70
+014.70 +014.70
+014.70 +014.70
+014.70 +014.70
+014.70 +014.70

PC Series Vacuum and Pressure Controller Data Format

Sending a Simple Script File to HyperTerminal®

It is sometimes desirable to capture data for an extended period of time. Standard streaming mode information is useful for short term events, however, when capturing data for an extended period of time, the amount of data and thus the file size can become too large very quickly. Without any special programming skills, the user can use HyperTerminal® and a text editing program such as Microsoft® Word® to capture text at user defined intervals.

1. Open your text editing program, MS Word for example.
2. Set the cap lock on so that you are typing in capital letters.
3. Beginning at the top of the page, type A<Enter> repeatedly. If you're using MS Word, you can tell how many lines you have by the line count at the bottom of the screen. The number of lines will correspond to the total number of times the device will be polled, and thus the total number of lines of data it will produce.

For example: A
A
A
A
A
A

will get a total of six lines of data from the pressure gauge, but you can enter as many as you like.

The time between each line will be set in HyperTerminal.

4. When you have as many lines as you wish, go to the File menu and select save. In the save dialog box, enter a path and file name as desired and in the "Save as Type" box, select the plain text (.txt) option. It is important that it be saved as a generic text file for HyperTerminal to work with it.
5. Click Save.
6. A file conversion box will appear. In the "End Lines With" drop down box, select CR Only. Everything else can be left as default.
7. Click O.K.
8. You have now created a "script" file to send to HyperTerminal. Close the file and exit the text editing program.
9. Open HyperTerminal and establish communication with your pressure device as outlined in the manual.
10. Set the pressure device to Polling Mode as described in the manual. Each time you type A<Enter>, the gauge should return one line of data to the screen.
11. Go to the File menu in HyperTerminal and select "Properties".
12. Select the "Settings" tab.
13. Click on the "ASCII Setup" button.
14. The "Line Delay" box is defaulted to 0 milliseconds. This is where you will tell the program how often to read a line from the script file you've created. 1000 milliseconds is one second, so if you want a line of data every 30 seconds, you would enter 30000 into the box. If you want a line every 5 minutes, you would enter 300000 into the box.
15. When you have entered the value you want, click on OK and OK in the Properties dialog box.
16. Go the Transfer menu and select "Send **Text** File…" (NOT Send File…).
17. Browse and select the text "script" file you created.
18. Click Open.
19. The program will begin "executing" your script file, reading one line at a time with the line delay you specified and the pressure device will respond by sending one line of data for each poll it receives, when it receives it.

You can also capture the data to another file as described in the manual under "Collecting Data". You will be simultaneously sending it a script file and capturing the output to a separate file for analysis.

TROUBLESHOOTING

Display does not come on or is weak.
Check power and ground connections and supply voltage.

Pressure reading is approximately fixed either near zero or near full scale regardless of actual line pressure.
The pressure sensor may be damaged. Damage due to excessive pressure is not covered by warranty.

Displayed pressure is flashing and message POV is displayed:
Our pressure gauges and controllers display an error message (POV = pressure overrange) when a the pressure exceeds the range of the sensors in the device. When any item flashes on the display, the pressure measurement is not accurate. Reducing the pressure to within specified limits will return the unit to normal operation and accuracy.

My controller does not respond to the set-point.
Check the control set up screen to be sure the Input parameter selection matches the set-point you are trying to use. Also, be sure that the unit was ordered for the type of analog signal you are trying to use.

After installation, there is no pressure.
Alicat Scientific PC Series Controllers incorporate normally closed valves and require a set-point to operate. Check that your set-point signal is present and supplied to the correct pin and that the correct input is selected under the Input list in the control set up mode screen. Also check that the unit is properly grounded.

The pressure lags below the set-point.
Be sure there is enough pressure available. If either the set-point signal line and/or the output signal line is relatively long, it may be necessary to provide heavier wires (especially ground wiring) to negate voltage drops due to line wire length. An inappropriate PID tuning can also cause this symptom if the D term is too large relative to the P term.

Controller is slow to react to a set-point change or imparts an oscillation to the flow.
An inappropriate PID tuning can cause these symptoms. Use at conditions considerably different than those at which the device was originally set up can necessitate a re-tuning of the PID loop. Note: The larger the volume pressured, the longer it takes to change the pressure in that volume.

The output signal is lower than the reading at the display.
This can occur if the output signal is measured some distance from the gauge/controller as voltage drops in the wires increase with distance. Using heavier gauge wires, especially in the ground wire, can reduce this effect.

My controller oscillates wildly and/or exhibits very different reactions to the set-point than I expect.
Conditions considerably different than those at which the device was originally set up can necessitate a re-tuning of the PID loop.

RS-232 Serial Communications is not responding.
Check that your gauge is powered and connected properly. Be sure that the port on the computer to which the gauge is connected is active. Confirm that the port settings are correct per the RS-232 instructions in this manual (Check the RS-232 communications select screen for current gauge readings). Close HyperTerminal® and reopen it. Reboot your PC.

Slower response than specified.
P Series Gauges and PC Series Controllers feature an RS-232 programmable Geometric Running Average (GRA). Depending on the full scale range of the gauge, it may have the GRA set to enhance the stability/readability of the display, which would result in slower perceived response time. Please see “Pressure Averaging” and “Flow Averaging” on page 15.

Jumps to zero at low pressure.
P Series Gauges and PC Series Controllers feature an RS-232 programmable zero deadband. The factory setting is usually 0.5% of full scale. This can be adjusted between NONE and 3.2% of full scale. See “Display Zero Deadband” on page 15.

Maintenance and Recalibration

General: P, PC, PCR and PCD Series Pressure Gauges and Controllers require minimal maintenance. The devices are designed to measure CLEAN, NON-CORROSIVE gases and fluids.

Recalibration: The recommended period for recalibration is once every year. Providing that the CLEAN, NON-CORROSIVE mantra is observed, this periodic recalibration is sufficient. A label located on the back of the device lists the recalibration due date. The device should be returned to the factory for recalibration near the listed due date. Before calling to schedule a recalibration, please note the serial number on the back of the device. The Serial Number, Model Number, and Date of Manufacture are also available on the Manufacture Data 2 display (see page 14).

Cleaning: P, PC, PCR and PCD Series instruments require no periodic cleaning. If necessary, the outside of the instrument can be cleaned with a soft dry rag. Avoid excess moisture or solvents.

For repairs, recalibrations, or recycling of this product, contact:

Alicat Scientific, Inc.
7641 N Business Park Drive
Tucson, Arizona 85743
USA
Ph. 520-290-6060
Fax 520-290-0109
email: info@alicatscientific.com
Web site: www.alicatscientific.com

Pressure Conversion Table				
PSI	**1.00**	**=**	**51.7150**	**mmHg**
PSI	**1.00**	**=**	**2.0360**	**inHg**
PSI	**1.00**	**=**	**27.7080**	**inH20**
PSI	**1.00**	**=**	**68.9480**	**mbar**
PSI	**100.00**	**=**	**6.8046**	**atm**
PSI	**1.00**	**=**	**51.7150**	**torr**
PSI	**1.00**	**=**	**6.8948**	**kPa**
mmHg	**100.00**	**=**	**3.9370**	**inHg**
mmHg	**100**	**=**	**1.9337**	**PSI**
inHg	**100**	**=**	**49.1159**	**PSI**
inH2O	**100**	**=**	**3.6091**	**PSI**
mbar	**100**	**=**	**1.4504**	**PSI**
atm	**1**	**=**	**14.6959**	**PSI**
torr	**100**	**=**	**1.9337**	**PSI**
kPa	**100**	**=**	**14.5037**	**PSI**
inHg	**1**	**=**	**25.4000**	**mmHg**

Technical Data for Pressure Gauges and Single Valve Pressure Controllers

The following specifications are for the standard configuration of the Alicat product as shipped from the factory. There are many low-cost customization options available. PCR Series high flow pressure controllers are for applications with required flows above 20LPM. Please contact Application Assistance for additional PCR operating specifications.

Operating Specifications

Specification	P Series	PC & PCR Series	Description
Full scale pressure < 2" H2O Accuracy	Consult Factory		Full Scale
Full scale pressure ≥ 2" H2O Standard Accuracy	± 0.25%		Full Scale
Full scale pressure ≥ 2" H2O High Accuracy Option	± 0.125%		Full Scale
Repeatability	± 0.08%		Full Scale
Turndown Ratio	200:1		
Adjustable Response Time[1]	5	100	Milliseconds
Operating Temperature	−10 to +50		Degree Celsius
Zero Shift	0.02%		Full Scale / °Celsius
Span Shift	0.02%		Full Scale / °Celsius
Excess Pressure	128% Measurable	102.4% Controllable	Full Scale
Burst Pressure	3X		Full Scale
Supply Current Peak	0.035	0.250 (***PCR: 0.750***)	Amp
Supply Voltage	7 – 30	12 – 30 (***PCR Series = 24 – 30***)	Volts dc
Input /Output Signal Standard	RS-232 Serial & 0-5Vdc or PROFIBUS[2]		
Electrical Connections	8 Pin Mini-DIN or DB-15		
Wetted Materials[3]	302 & 303 Stainless Steel, Viton®. Silicone RTV, Silicon, Glass. All Controllers add: 400 Series Stainless Steel. PC Series Controllers only add: Brass		

1. Volumes, feed pressures, exhaust pressures and line sizing will determine the limits of response times.
2. If selecting PROFIBUS no analog signal is available. PROFIBUS units do not have the display. See PROFIBUS specifications for PROFIBUS supply voltages and currents.
3. If your application demands a different material, please contact Application Assistance for available options.

Mechanical Specifications

Pressure Product	Mechanical Dimensions	Process Connections[1]
P Series Gauges	4.1"H x 2.4"W x 1.1"D	1/8" NPT Female
PC Series Controllers	4.1"H x 3.6"W x 1.1"D	1/8" NPT Female
PCR Series Controllers	5.3"H x 3.0"W x 5.5"D	3/4" NPT Female

1. Compatible with Swagelok® tube, Parker®, face seal, push connect & compression adapter fittings. Alternates available.

Standard Available Ranges

P Series Gauges			PC, PCR Series Controllers		
-15PSIG to 0PSIG			-15PSIG to 0PSIG		
2inH_2OD	2inH_2OG		2inH_2OD	2inH_2OG	
4inH_2OD	4inH_2OG		4inH_2OD	4inH_2OG	
1PSID	1PSIG		1PSID	1PSIG	
5PSID	5PSIG		5PSID	5PSIG	
15PSID	15PSIG	15PSIA	15PSID	15PSIG	15PSIA
30PSID	30PSIG	30PSIA	30PSID	30PSIG	30PSIA
100PSID	100PSIG	100PSIA	100PSID	100PSIG	100PSIA
150PSID		300PSIA	150PSID		300PSIA
Other ranges available. Please contact Application Assistance.					

Select One Unit of Measure when Ordering		
PSIA	inHG	Atm
PSIG	inH_2O	Torr
mmHG	mBar	kPa

Dimensional Drawings: pages 32 to 35

Technical Data for Dual Valve Pressure Controllers

The following specifications are for the standard configuration of the Alicat product as shipped from the factory. There are many low-cost customization options available.

Operating Specifications

Specification	PCD Series	Description
Full scale pressure < 2" H2O Accuracy	Consult Factory	Full Scale
Full scale pressure ≥ 2" H2O Standard Accuracy	± 0.25%	Full Scale
Full scale pressure ≥ 2" H2O High Accuracy Option	± 0.125%	Full Scale
Feed Valve Orifice	0.050	Inches
Exhaust Valve Orifice	0.050	Inches
Alternate Valve Orifices Available	0.010 or 0.030	Inches
Repeatability	± 0.08%	Full Scale
Turndown Ratio	200:1	
Adjustable Response Time[1]	≤100	Milliseconds
Operating Temperature	−10 to +50	Degree Celsius
Zero Shift	0.02%	Full Scale / °Celsius
Span Shift	0.02%	Full Scale / °Celsius
Excess Pressure	102.4% Controllable	Full Scale
Burst Pressure	≥3X	Full Scale
Supply Current Peak	0.250	Amp
Supply Current Average	0.050	Amp
Supply Voltage	12 – 30	Volts dc
Input /Output Signal Standard	RS-232 Serial & 0-5Vdc or PROFIBUS[2]	
Electrical Connections	8 Pin Mini-DIN or DB-15	
Wetted Materials[3]	302 & 303 Stainless Steel, Viton®, Silicone RTV, Brass, 400 Series Stainless Steel (standard units are for non-corrosive gases), Silicon, Glass.	

1. Volumes, feed pressures, exhaust pressures and line sizing will determine the limits of response times.
2. If selecting PROFIBUS no analog signal is available. PROFIBUS units do not have the display. See PROFIBUS specifications for PROFIBUS supply voltages and currents. Please contact Applications Assistance for PCD - PROFIBUS options.
3. If your application demands a different material, please contact Application Assistance for available options.

Mechanical Specifications

PCD Series Dual Valve Controller	Mechanical Dimensions	Process Connections[1]
All Standard Ranges	4.1"H x 4.8"W x 1.1"D	1/8" NPT Female

1. Compatible with Swagelok® tube, Parker®, face seal, push connect and compression adapter fittings.

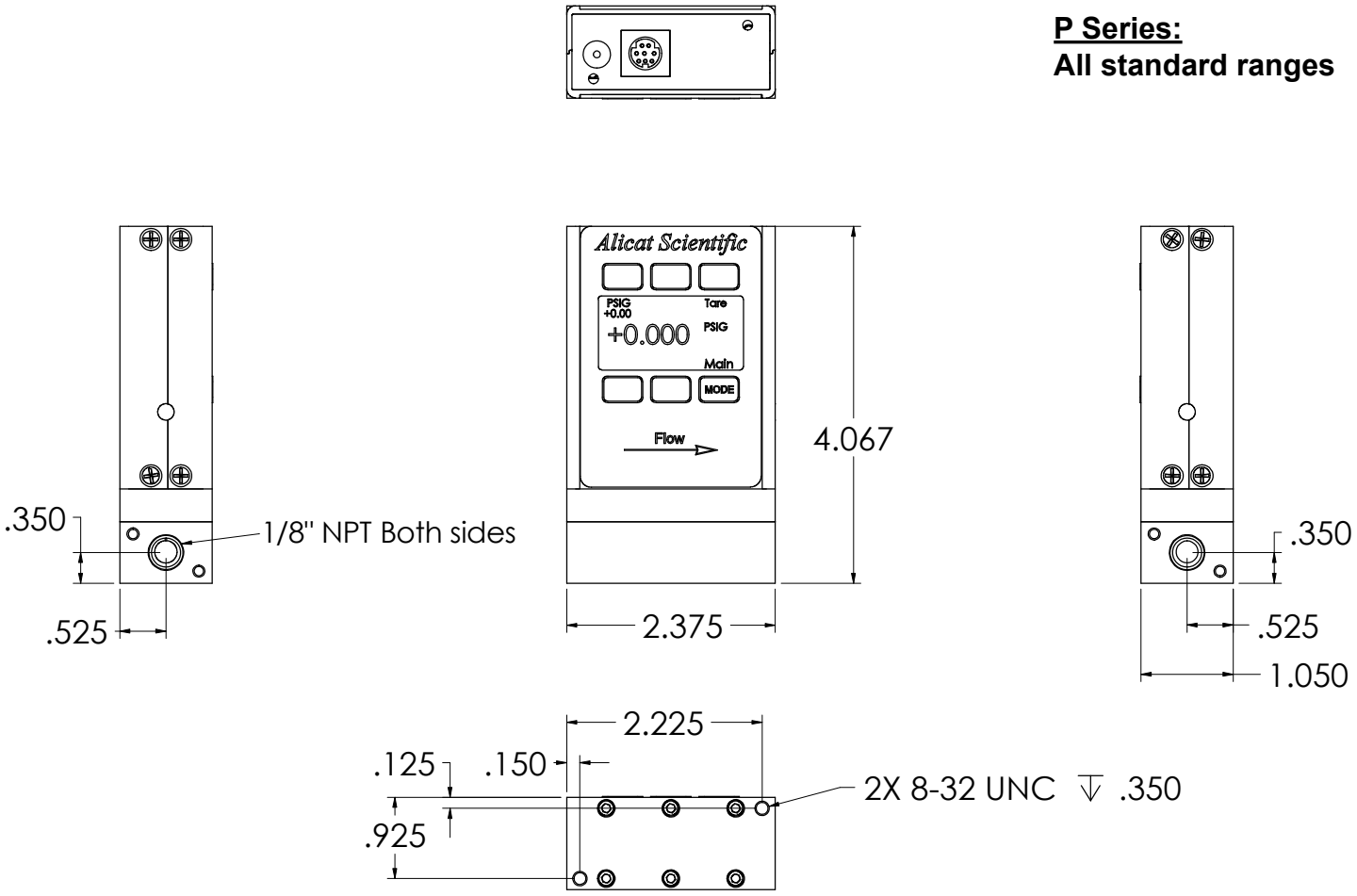
Standard Available Ranges

PCD Series Pressure Controllers		
-15PSIG to 0PSIG		
2inH_2OD	2inH_2OG	
4inH_2OD	4inH_2OG	
1PSID	1PSIG	
5PSID	5PSIG	
15PSID	15PSIG	15PSIA
30PSID	30PSIG	30PSIA
100PSID	100PSIG	100PSIA
150PSID		300PSIA
Other ranges available. Please contact Application Assistance.		

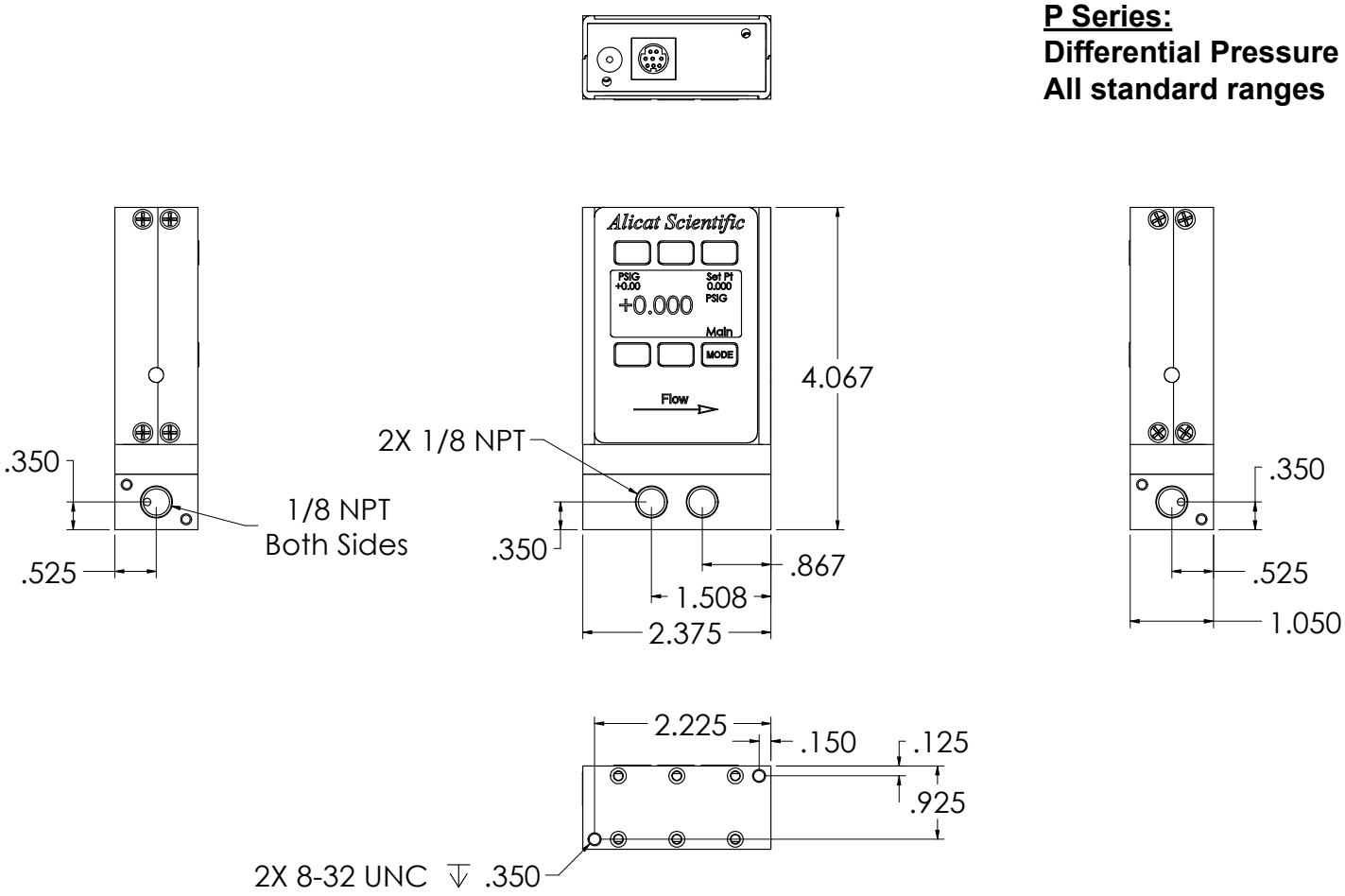
Select One Unit of Measure when Ordering		
PSIA	inHG	Atm
PSIG	inH_2O	Torr
mmHG	mBar	kPa

Dimensional Drawings: page 36

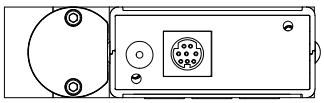
P Series:
All standard ranges

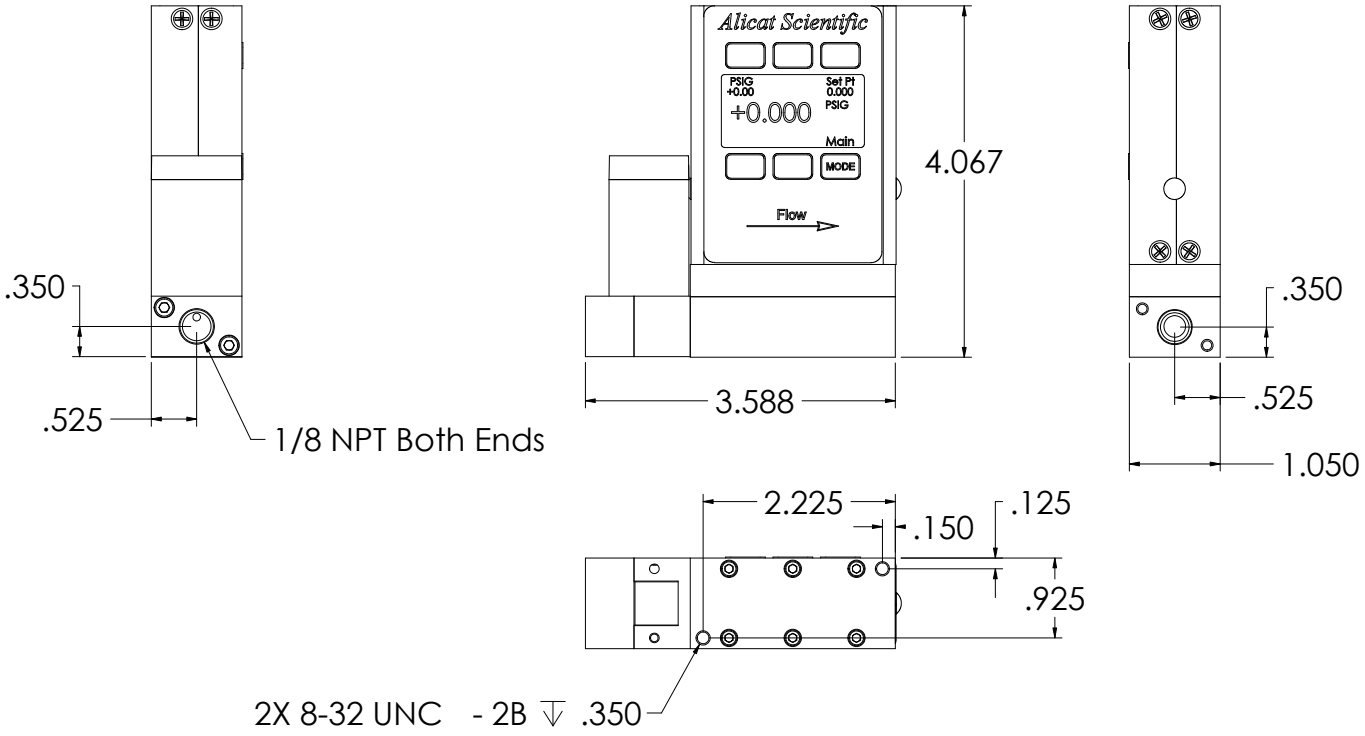


P Series:
Differential Pressure
All standard ranges

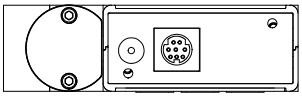


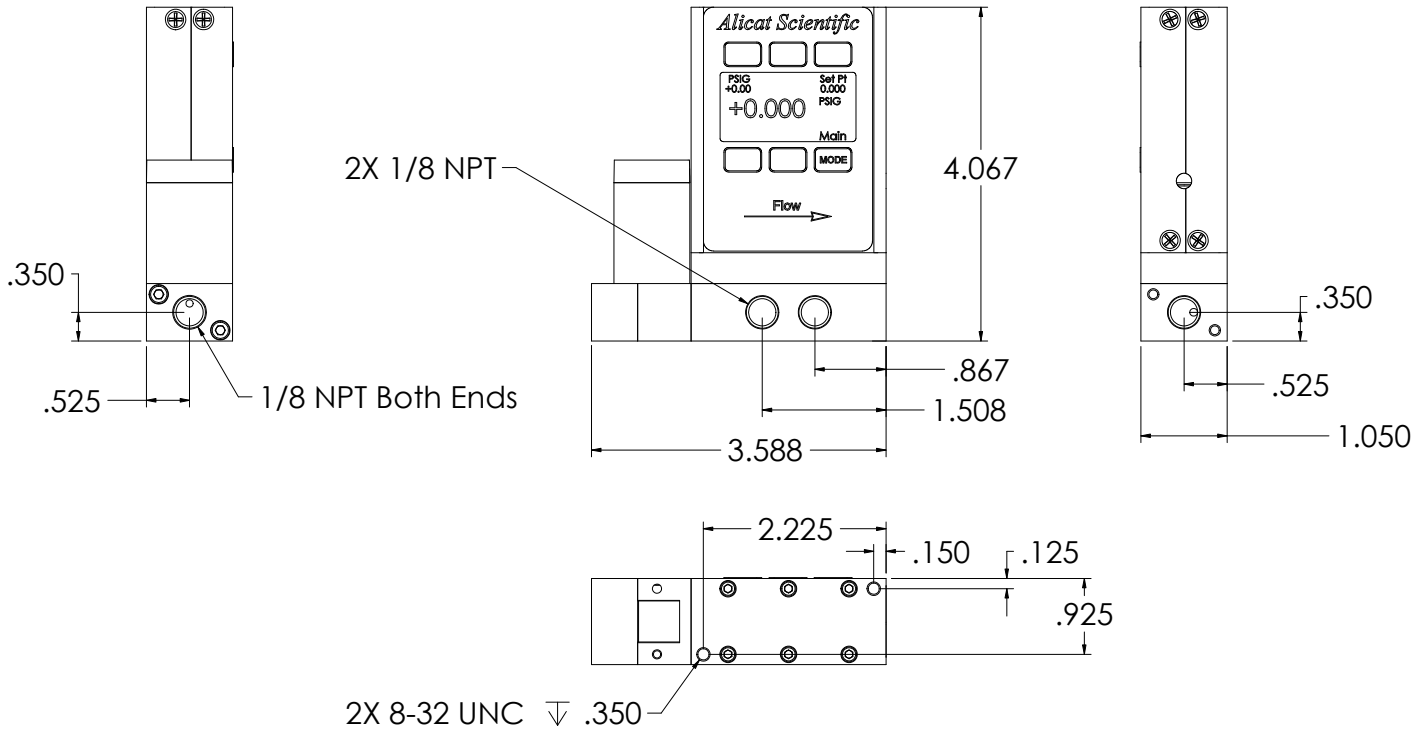
PC Series:
All standard ranges



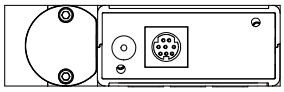


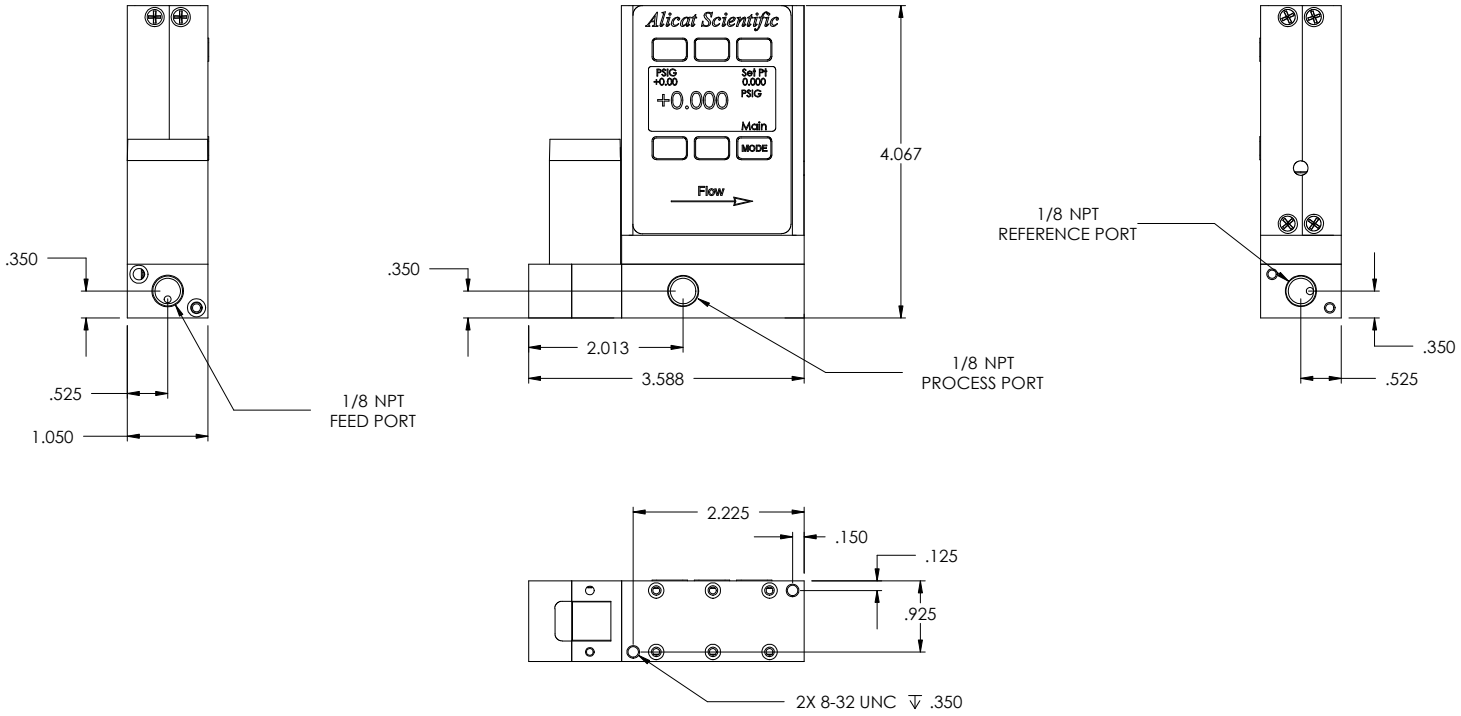
PC Series:
Differential Pressure
All standard ranges



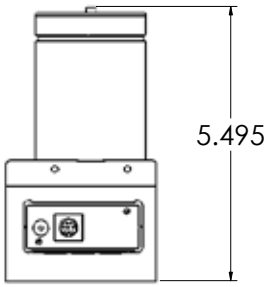


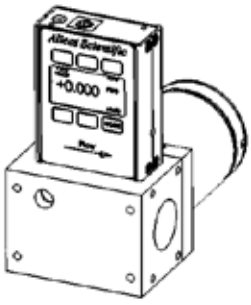
PC3 Series:
All standard ranges

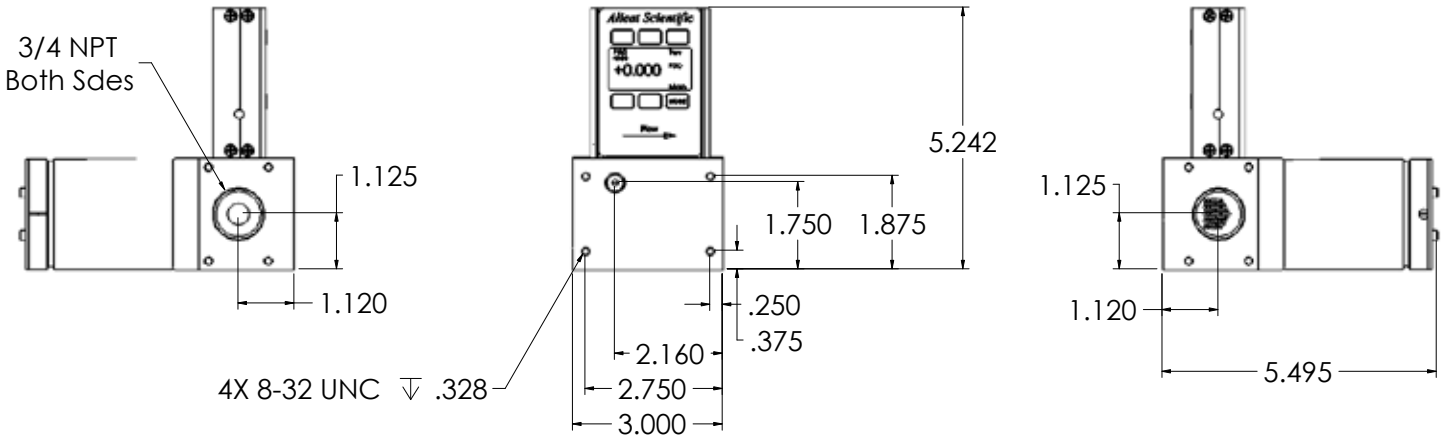




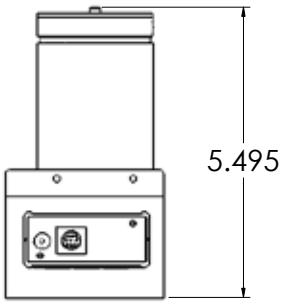
PCR3 Series:
All standard ranges

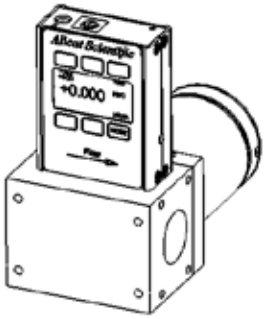


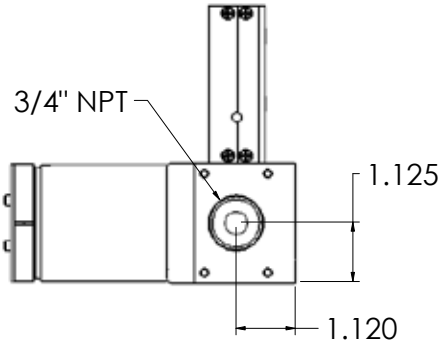


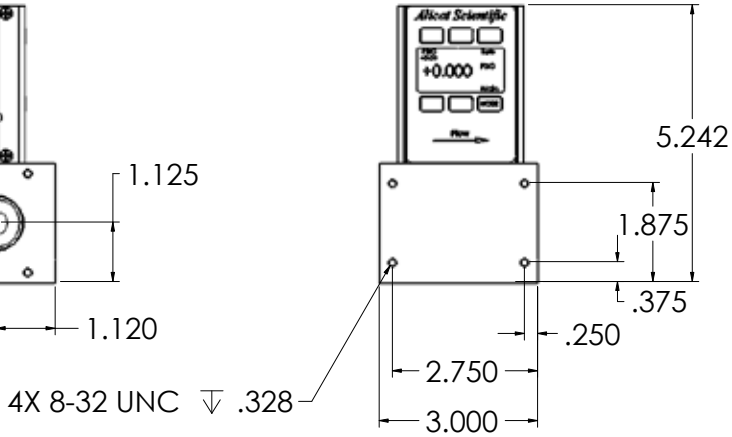


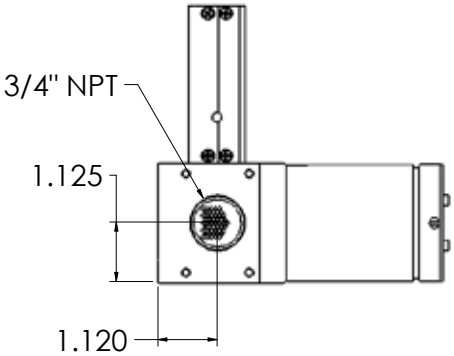
PCR Series:
Most standard ranges



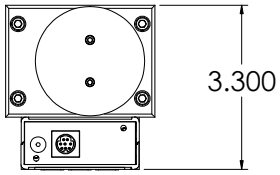


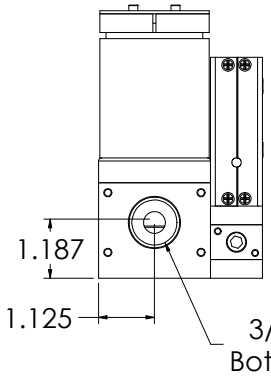


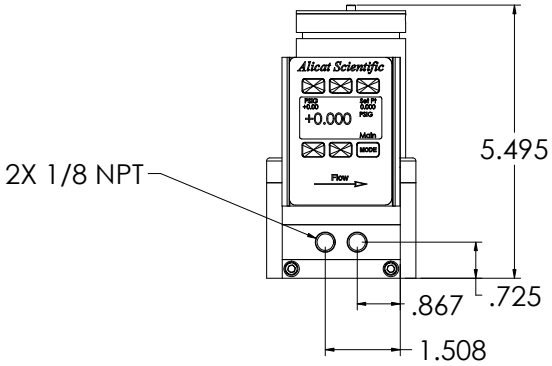


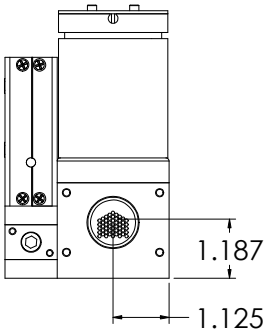


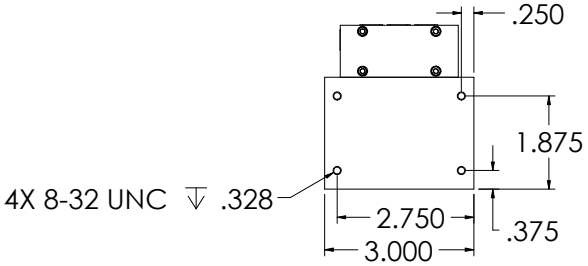
PCR Series:
Differential Pressure 5inH2O



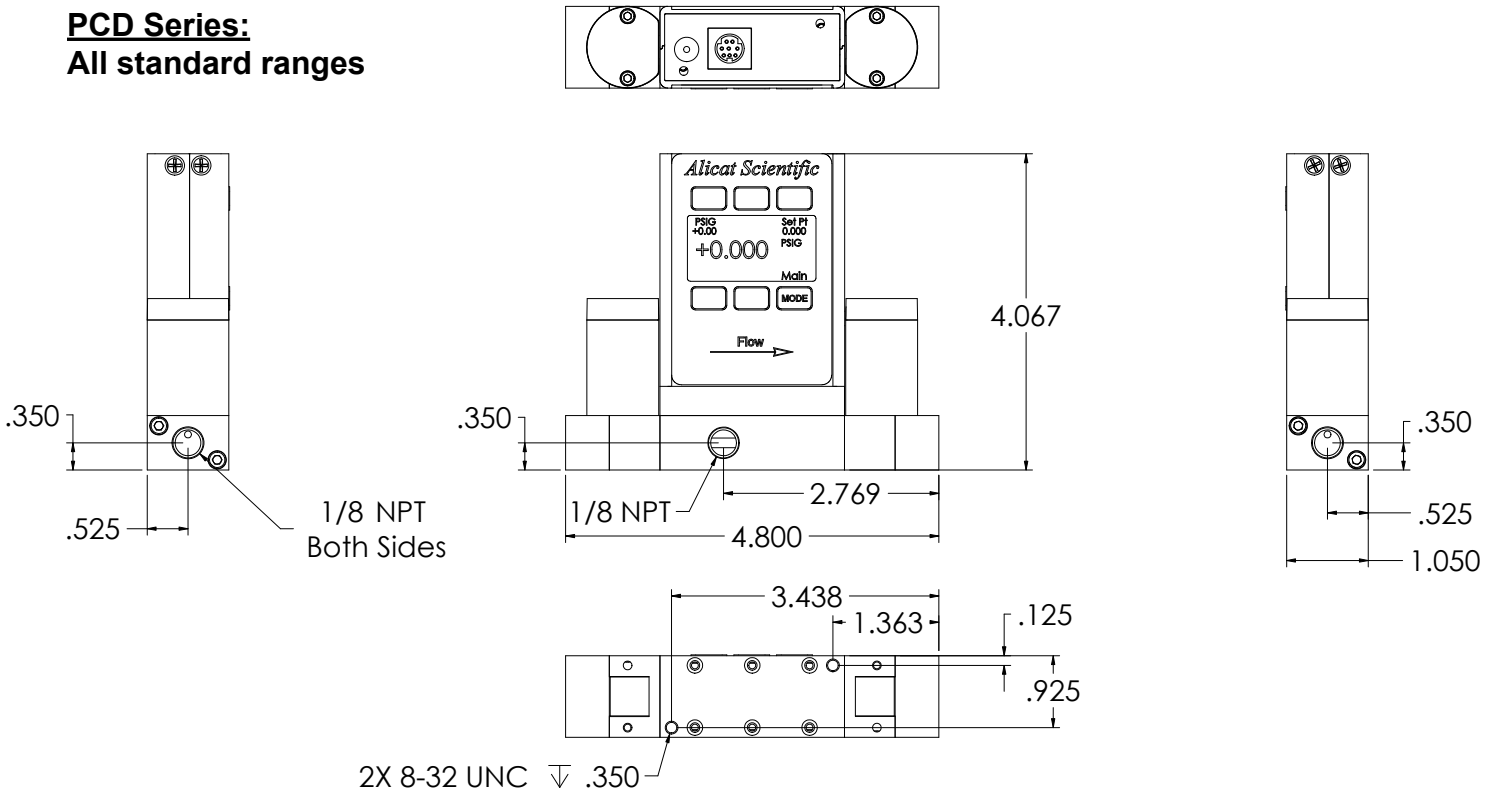




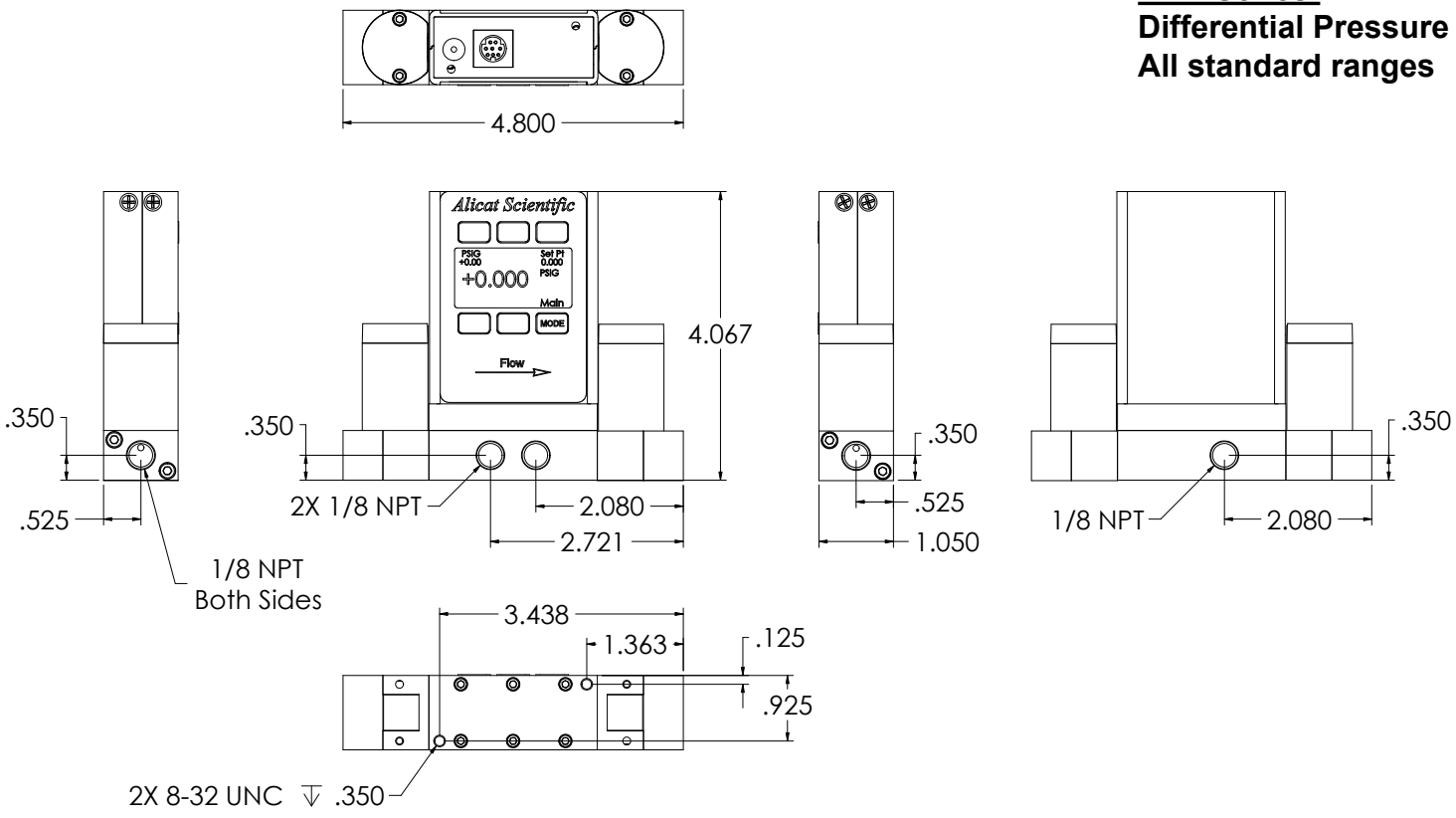




PCD Series:
All standard ranges



PCD Series:
Differential Pressure
All standard ranges



Alicat Portable Meters and Gauges

Alicat Portable Flow Meters and Gauges use a common 9 Volt battery located in the top section of your meter.

Output signals from the flow meter are passed through the female connector on top of the flow meter. Turn the switch on top of the flow meter “off” when the meter is not in use.

Normal (9V alkaline) battery life is approximately 8 hours (30-40 hours with a 9V-lithium battery), however many factors can affect this.

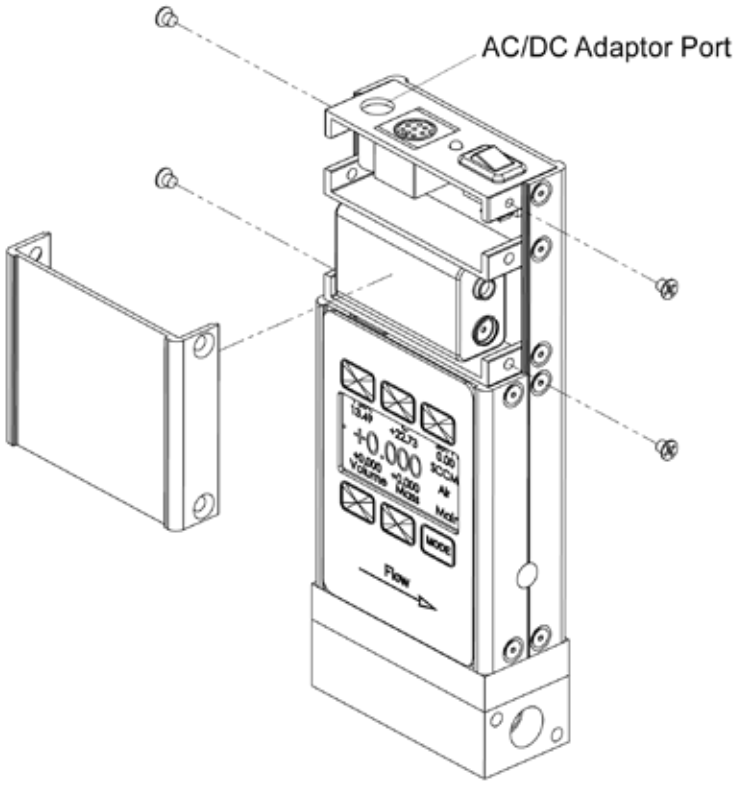
Replace the battery as often as required. A yellow LED indicates low voltage and that the battery should be replaced.

A false signal can result when the voltage drops below its normally regulated level.

Alicat Portable Flow Meters and Gauges can also be powered by an optional AC/DC plug-in wall adaptor. With the adaptor plugged into the flow meter, the battery is bypassed and the meter will operate solely off the adaptor power supply.

Replacing the Battery:

1. Remove the four Phillips head screws from the front cover and gently remove it as shown below.
2. Remove the 9V battery, pulling the top of the battery out first.
3. Disconnect the old battery from the harness and replace it with a new battery.
4. Install the new battery bottom end first and replace the back cover so that the cushioning pad presses directly down on the battery.
5. Replace the four Phillips head screws.

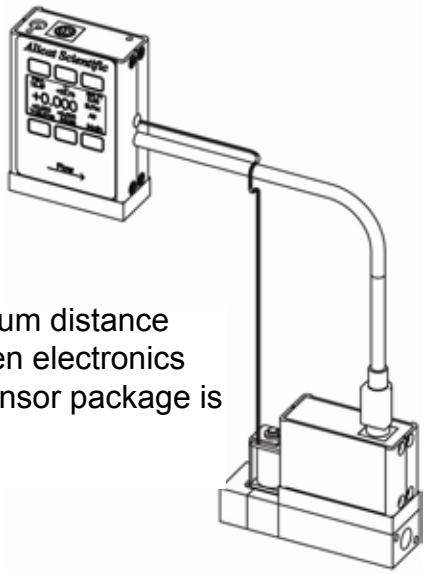


Battery cover removal

Option: Remote Electronics for High Line or Gas Temperatures

Some applications involve operating temperatures outside the standard Alicat device specifications. A solution using remote electronics is available. (This option is not applicable to liquid devices.)

The flow body's components are minimized to only the required sensors. The flow data is sent to the microprocessor electronics up to 6 feet away from the sensor package. Relocating the sensitive electronics, including the LCD, allows for installation of the flow body in ambient temperatures as high as 85° Celsius with gas temperatures under 100°Celsius.



Maximum distance between electronics and sensor package is 6 feet.

In these applications we recommend our custom gauge calibration at a gas temperature of up to 70°Celsius. This will reduce zero shift errors that occur when actual gas flow temperatures deviate substantially from the gas calibration temperature. This configuration is also used in integrations that require a compact flow package at the installation point.

Accessory: BB-9 Multi-Drop Box

The **BB-9 Multi-Drop Box** makes it convenient to wire multiple flow and/or pressure devices to a single RS-232 port.

The Multi-Drop Box has nine 8 pin mini-DIN ports available. The ports are to be used with a standard double ended 8 pin mini-DIN (DC-62) style cable going from the box to each flow or pressure device. A single DB9 D-SUB type connector (COM PORT) connects, using the included cable, to the serial connector on a PC or laptop.

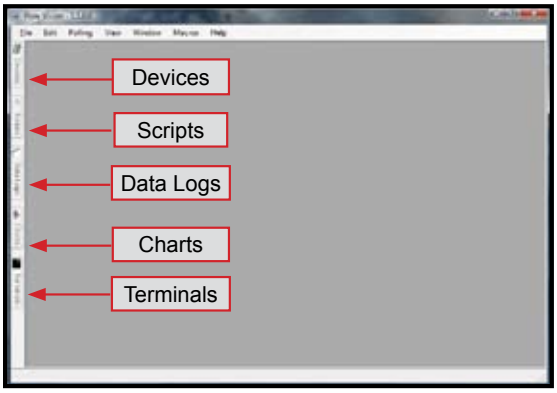
All of the flow and/or pressure devices are powered via a terminal block on the front of the box.

If more than nine devices will be required, additional Multi-Drop Boxes can be daisy chained together with a double ended 8 pin mini-DIN cable plugged into any receptacle on both boxes.

Accessory: RS-232 to RS-485 Converter

Since most computers have RS-232 communication onboard, Alicat has chosen RS-232 as the digital standard on all of its flow instruments. For those using RS-485 as their primary standard, our **RS-232 to RS-485** converter will allow interface between an RS-485 system and Alicat's flow instrumentation.

Accessory: Flow Vision™ SC Software



Flow Vision™ SC is an intuitive software interface to help your test cycles run smoother and shorten your engineering time!

Flow Vision™ SC lets you connect to and communicate with multiple Alicat units simultaneously. Now you can view virtual displays, control tabs, charts and data lines from every connected Alicat device on the same screen.

Flow Vision™ SC supports all RS-232 Serial communication functions, including: **gas selection, tareing, set-point control, valve tuning and flow averaging.**

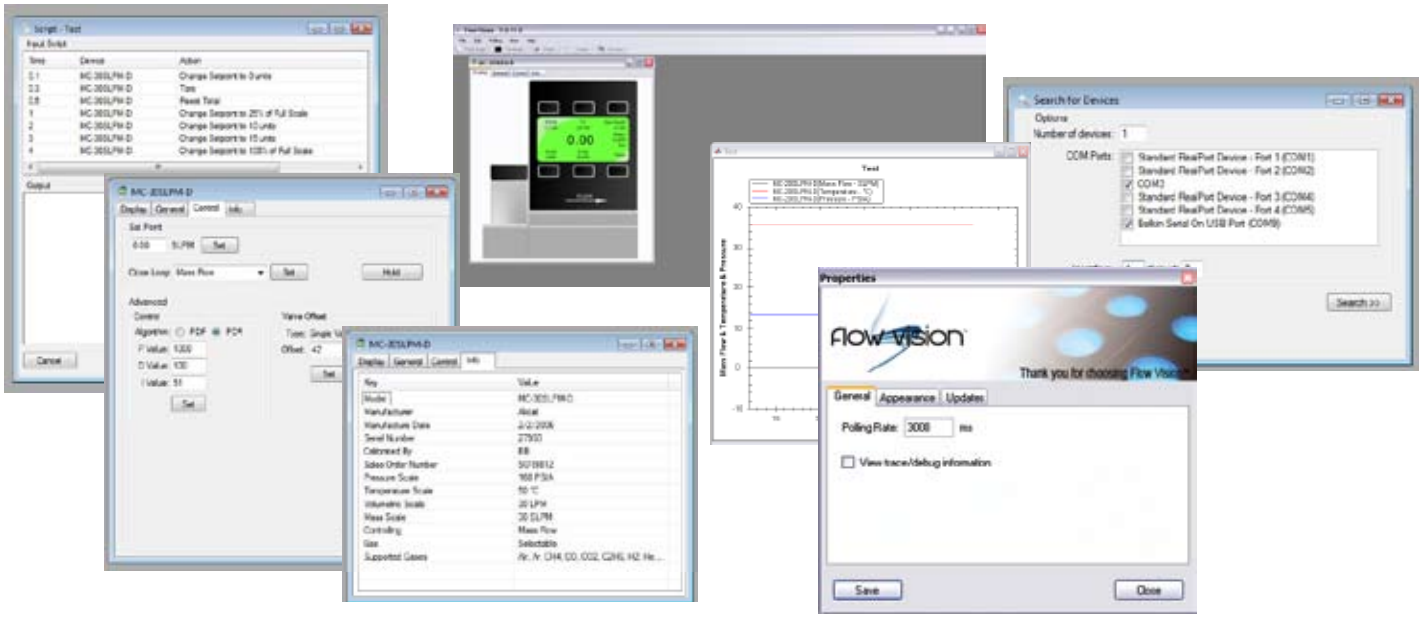
Session Saving: Save and reload your configuration data with confidence.

Script Building: Create scripts to adjust a controller's set-point value at variable specified time intervals.

Charting: Chart as many parameters as you want off as many devices as you want, with color coding, zooming, and printing functionality.

Alarms: Create software alarms that will notify you of given parameter conditions.

Data Capture & Logging: Capture and log data to either a .csv file or a .txt file. Improved Data Logging and Data Log File Splitting for easy to manage data.



***Flow Vision™ SC* supports multiple devices** connected to the same RS-232 port.

Simply connect each device to a ***BB-9 Multi-Drop Box***, then using device addressability, assign an identifier to each instrument.

Now you can easily monitor and control multiple Alicat instruments from your computer.

Accessories

Part Number	Description
FLOWVISIONSC	Flow Vision™ SC software for interface with all Alicat instruments
BB-9	Multi-Drop Box
PCASE	Industrial carry and storage case for portable meters/gauges
DC-61	8 Pin Male Mini-DIN connector cable, single ended, 6 foot length
DC-251	8 Pin Male Mini-DIN connector cable, single ended, 25 foot length
DC-301	8 Pin Male Mini-DIN connector cable, single ended, 30 foot length
DC-501	8 Pin Male Mini-DIN connector cable, single ended, 50 foot length
DC-751	8 Pin Male Mini-DIN connector cable, single ended, 70 foot length
DC-6RT	8 Pin Male *Right Angle* Mini-Din Cable, single ended, 6 foot length
DC-62	8 Pin Male Mini-DIN connector cable, double ended, 6 foot length
DC-252	8 Pin Male Mini-DIN connector cable, double ended, 25 foot length
DC-502	8 Pin Male Mini-DIN connector cable, double ended, 50 foot length
DC-602	8 Pin Male Mini-DIN connector cable, double ended, 60 foot length
MD8DB9	8 Pin Male Mini-DIN to DB9 Female Adapter, 6 foot length
IC10	Industrial cable, 6 Pin, single ended, 10 foot length
IC10-18G	18 gauge industrial cable, 6 Pin, single ended, 10 foot length
IC20	Industrial cable, 6 Pin, single ended, 20 foot length
IC24-18G	18 gauge industrial cable, 6 Pin, single ended, 24 foot length
IC50	Industrial cable, 6 Pin, single ended, 50 foot length
PVPS24U	Universal 100-240 VAC to 24 Volt DC Power Supply Adapter
LSPM	Local Set-Point Module
RS485-KIT	RS-232 to RS-485 Converter
REMOTE	Remote electronics with display
RD	Remote Panel Mount Display

	ALICAT DEVICE PROCESS CONNECTION				
	M5 (10-32)	**1/8”**	**1/4”**	**1/2”**	**3/4”**
COMPRESSION FITTING					
1/8”	SS-200-1-0157	SS-200-1-2	SS-200-1-4	SS-200-1-8	
1/4”	SS-400-1-0256	SS-400-1-2	SS-400-1-4	SS-400-1-8	SS-400-1-12
1/2”		SS-810-1-2	SS-810-1-4	SS-810-1-8	SS-810-1-12
3/4”				SS-1210-1-8	SS-1210-1-12
3mm		SS-3M0-1-2	SS-3M0-1-4		
4mm		SS-4M0-1-2	SS-4M0-1-4		
6mm		SS-6M0-1-2	SS-6M0-1-4	SS-6M0-1-8	
8mm		SS-8M0-1-2	SS-8M0-1-4	SS-8M0-1-8	
12mm		SS-12M0-1-2	SS-12M0-1-4	SS-12M0-1-8	SS-12M0-1-12
16mm				SS-16M0-1-8	SS-16M0-1-12
FILTER					
10 micron		2F-F2L-10-B			
20 micron	CF-303-20-316				
50 micron		2F-F2L-50-B	4F-F4L-50-B	8F-F8L-50-B	12F-F12L-50-B
Adapter	410133	Male M5 (10-32) Buna-N O-ring face seal to 1/8”Female NPT			

NOTICE: The following specifications are applicable to Alicat PROFIBUS enabled mass meters and mass controllers only.

All standard device features and functions are available and operate in accordance with the standard Alicat Scientific device operating manual provided with the device.

Specification	Mass Meter	Mass Controller	Description
Accuracy	± (0.8% of Reading + 0.2% of Full Scale)		At calibration conditions after tare
High Accuracy Option	± (0.4% of Reading + 0.2% of Full Scale)		At calibration conditions after tare
Repeatability	± 0.2%		Full Scale
Operating Range	1% to 100% Full Scale		Measure and Control
Typical Response Time	10	100	Milliseconds (Adjustable)
Standard Conditions (STP)	25ºC & 14.696PSIA		Mass Reference Conditions
Operating Temperature	−10 to +60		ºCelsius
Zero Shift	0.02%		Full Scale / ºCelsius / Atm
Span Shift	0.02%		Full Scale / ºCelsius / Atm
Humidity Range	0 to 100%		Non–Condensing
Measurable Flow rate	128%		Full Scale
Controllable Flow Rate		102.4%	Full Scale
Maximum Pressure	145		PSIG
Input /Output Signal Digital	Mass, Volumetric, Pressure & Temperature		RS-232 Serial, PROFIBUS DP
Electrical Connections	DB9		
Supply Voltage:			
Meters	7 to 30 Vdc		
Small Valve Controllers		12 to 30 Vdc	
Large Valve Controllers		24 to 30 Vdc	
Supply Current	80mA @ 12Vdc 65mA @ 24Vdc	295mA @ 12Vdc 280mA @ 24Vdc	
Mounting Attitude Sensitivity	None		
Warm-up Time	< 1		Second
Wetted Materials[2]	303 & 302 Stainless Steel, Viton®, Silicone RTV (Rubber), Glass Reinforced Nylon, Aluminum, Brass, 410 & 416 Stainless Steel.		

1. If your application demands a different material, please contact Application Assistance for available options.

Power and Signal Connections:

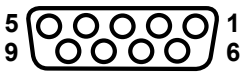
Connect to the device using two DB9 connectors.

The female top connection is PROFIBUS.

The male connection on the side is power and RS-232.

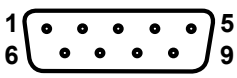
Pin out diagrams for all PROFIBUS enabled Alicat devices are shown:

TOP

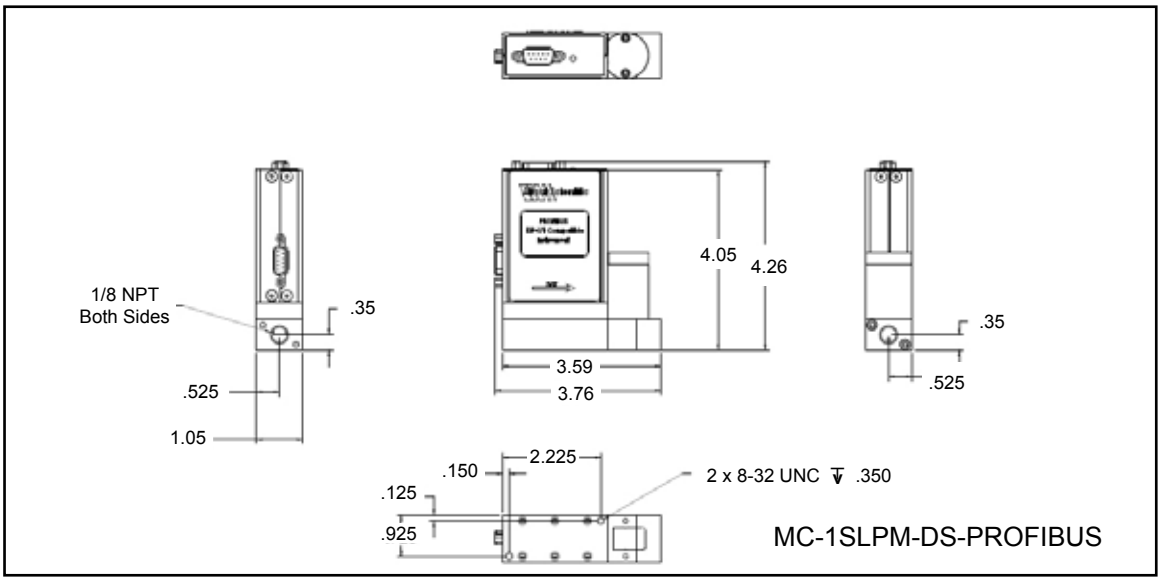


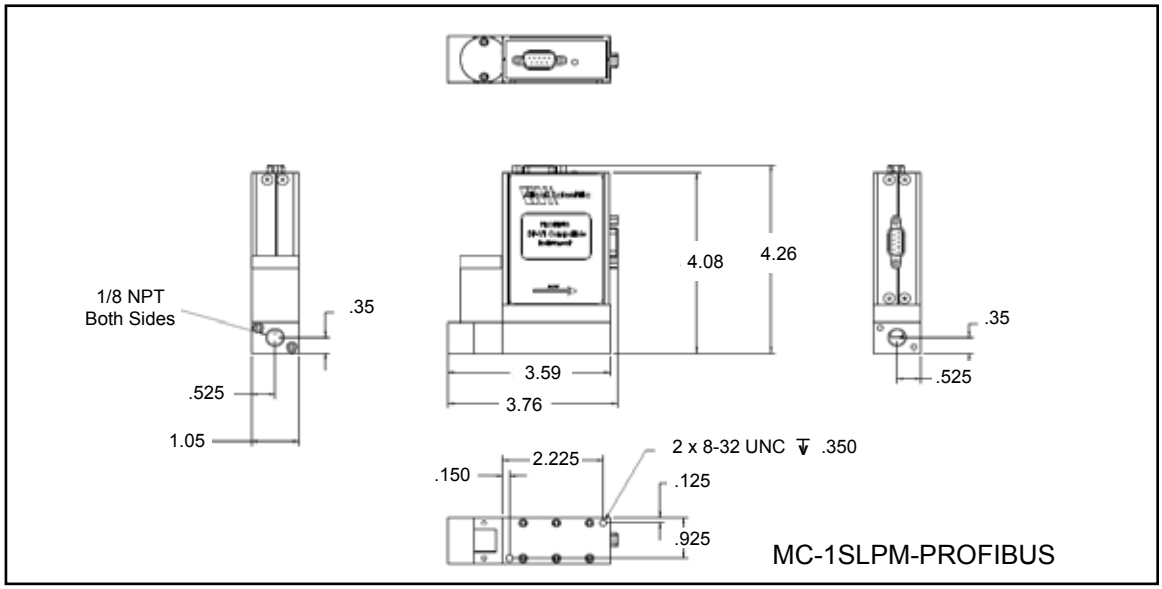
1. NC
2. OPT GND
3. DP
4. RTS
5. DGD
6. VP
7. OPT 7 to 30VDC
8. DN
9. NC

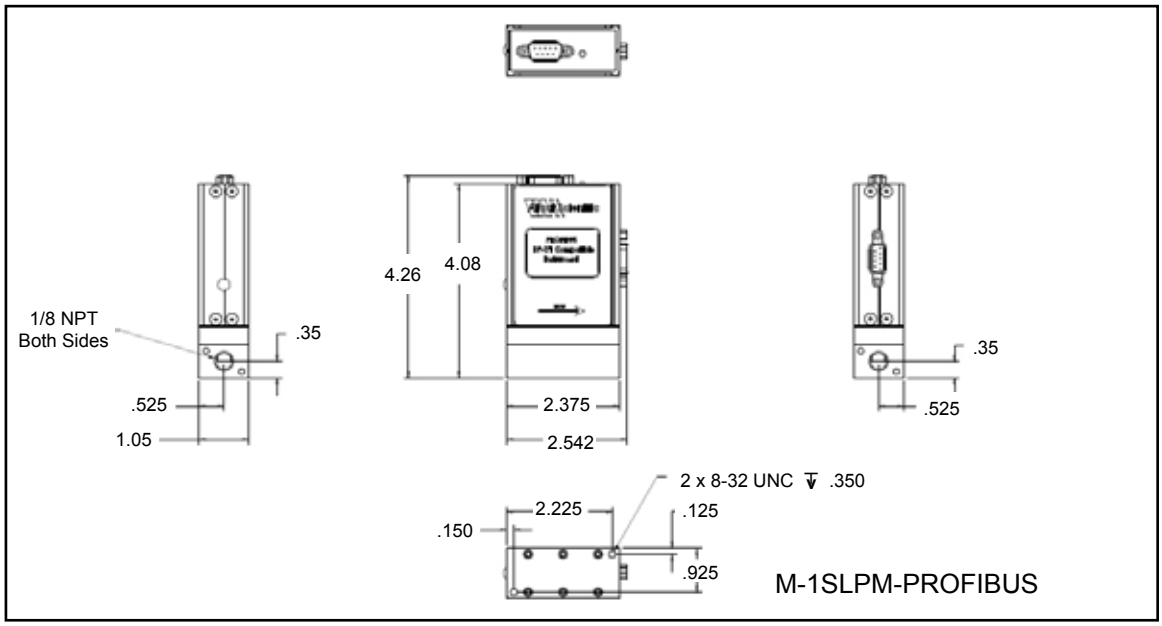
SIDE



1. NC
2. RS232TX
3. RS232RX
4. NC
5. GND
6. NC
7. 7 to 30VDC
8. GND
9. NC







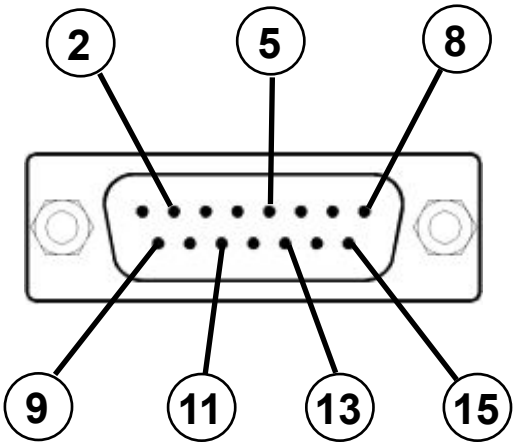
Flow body dimensions will vary with range. Please see Alicat's device specifications for flow body dimensions.

DB15 Pin-Outs

If your Alicat Instrument was ordered with a DB15 connection, please be sure to reference the appropriate pin-out diagram.

DB15 Pin-Out

Pin Number	Function
2	Signal Out
5	Supply
8	Set-Point
9	Ground
11	Secondary Out
13	RS-232 Receive
15	RS-232 Send



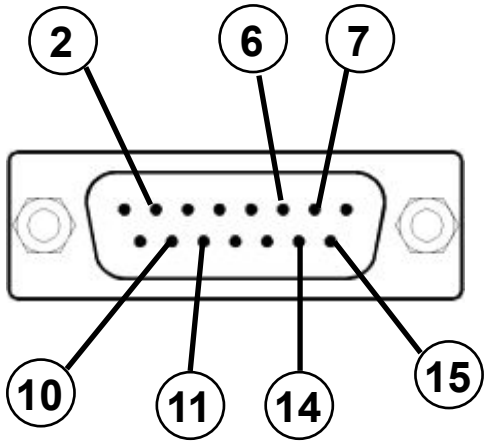
Note: The above pin-out is correct for units with a **DB15** pin-out. If your unit is marked **DB15H** or **DB15K**, you must use the correct pin-out (as shown on the following page).

DB15 Pin-Outs

If your Alicat Instrument was ordered with a DB15 connection, please be sure to reference the appropriate pin-out diagram.

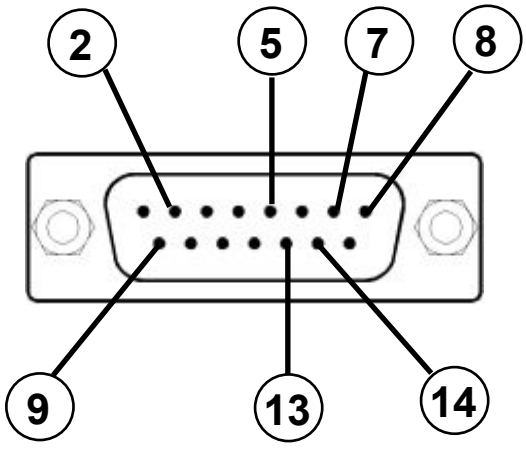
DB15H Pin-Out

Pin Number	Function
6	Signal Out
7	Ground
11	Supply
14	Set-Point
10	Secondary Out
2	RS-232 Receive
15	RS-232 Send



DB15K Pin-Out

Pin Number	Function
2	Signal Out
5	Ground
7	Supply
8	Set-Point
9	Secondary Out
13	RS-232 Receive
14	RS-232 Send



Note: The above pin-outs are correct for units with a **DB15H or DB15K** pin-out. If your unit is marked **DB15,** you must use the correct pin-out (see the previous page).