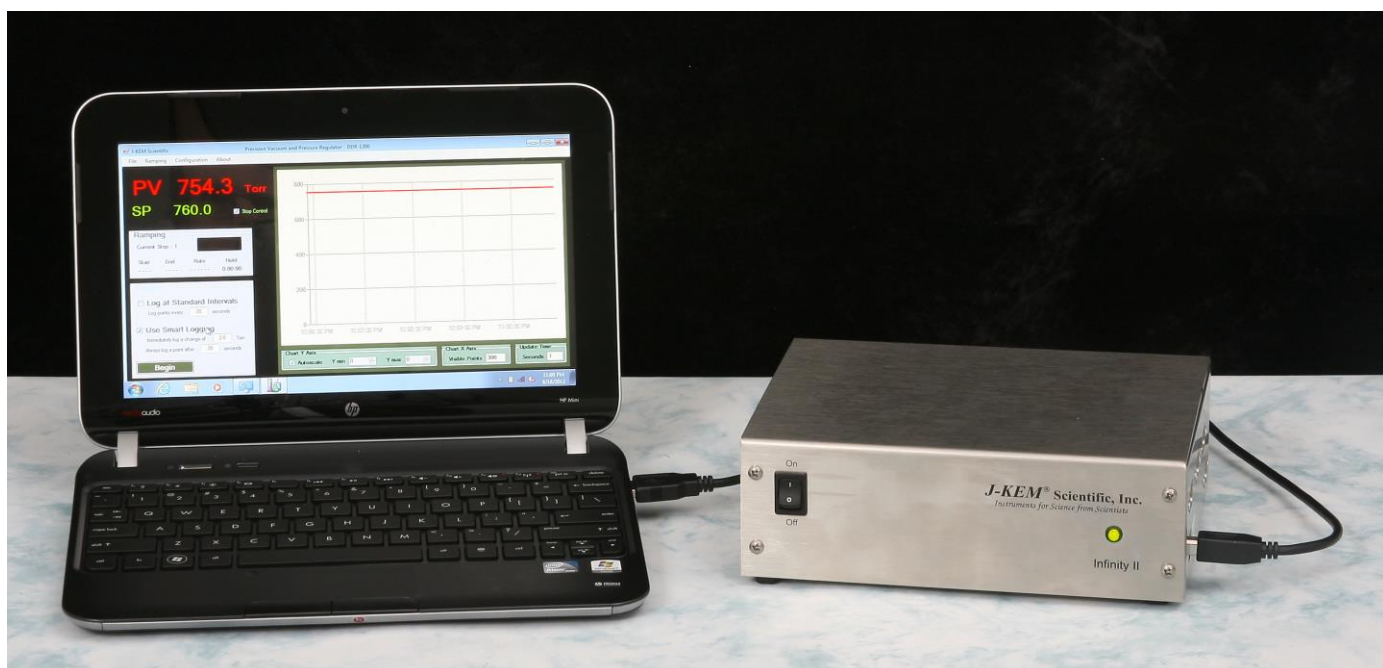


## Precision Vacuum Controller, DVR-1000

J-KEM Scientific's precision vacuum and pressure regulators consist of J-KEM's Infinity-II pressure sensor/controller and KEM-Torr software that presents a graphical user interface to the Infinity controller. KEM-Torr software displays the system pressure in real-time both graphically and with a digital display, allows the user to construct and run a 12-step pressure ramp, and optionally data logs time, pressure and ramping history.



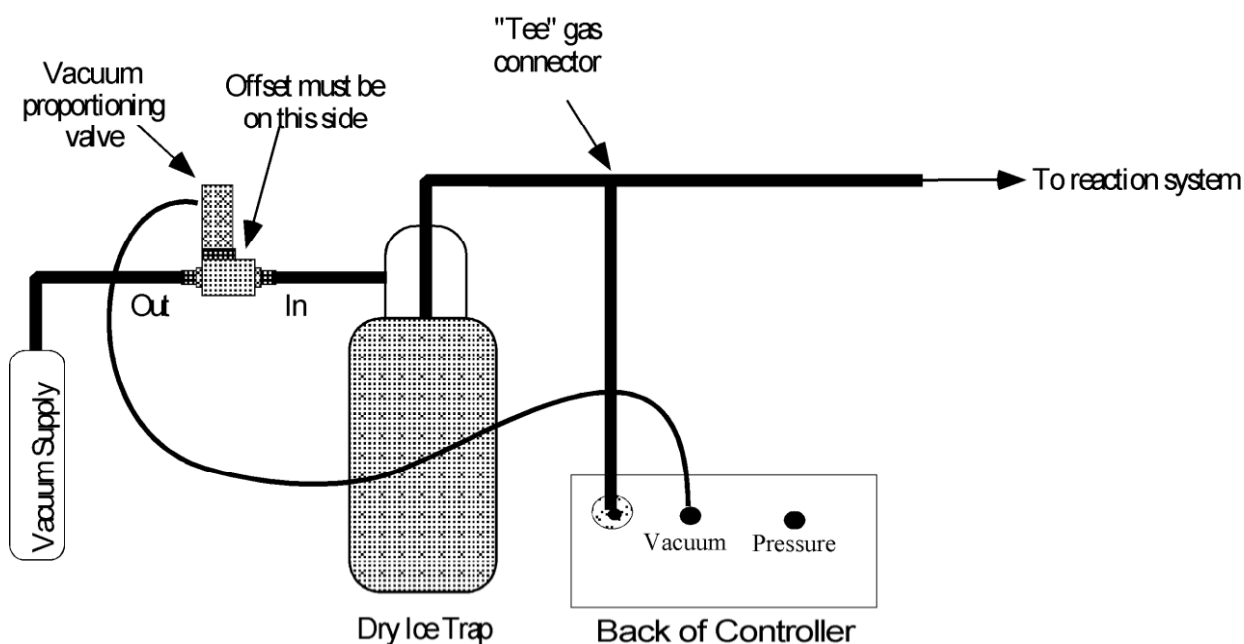
## Software Installation

**Systems With a PC Controller** Pressure regulators ordered with the companion Netbook controller, have KEM-Torr software pre-loaded and no other software setup is required.

**System Without a PC Controller** KEM-Torr software, PC drivers, and this user manual are included on a flash disk shipped with the Infinity.

1. To install the KEM-Torr software - Insert the flash disk into your PC and double click on the installation icon titled Setup.exe. During the installation, accept all of the default selections.
2. Copy the user manual on the flash disk to the desk top of your PC.
3. Connect the Infinity controller to your PC using a USB cable, then turn power on to the controller. The New Hardware Wizard will detect the controller and you'll be prompted to install drivers. Hardware drivers are found on the flash disk in a folder titled J-KEM Drivers. Windows systems 7 and 8 will detect the new hardware, but do not automatically install the required drivers. The drivers must be installed manually using the Device Manager in the Control Panel. Contact your IT group, or call J-KEM for assistance.

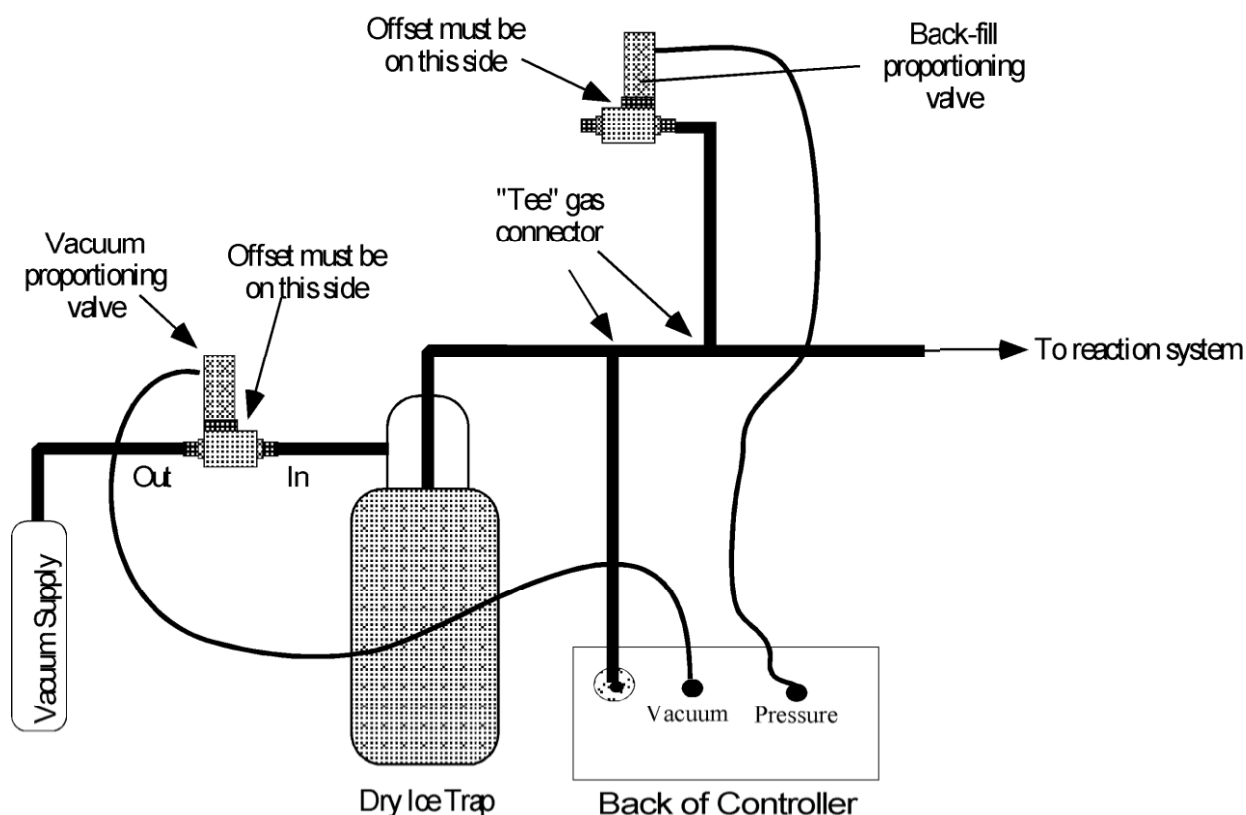
## Hardware Setup for an Evacuation Only (single valve) Controller



**NOTE:** The pressure proportioning valve is very sensitive to contaminants that cause the valve to stick. A high efficiency trap must be placed between the proportioning valve and the reaction system to protect the valve. Proportioning valves are not warranted against failure.

1. Connect the outlet of the vacuum proportioning valve to the vacuum source. The vacuum valve will be one of two types. It will either have a silver coil on top of a silver body (PSV2 - PSV5 valves), or a silver coil on top of a black body (PSV6 – PSV 8 valves). If the valve has a silver body, note that the cylindrical portion of the valve is offset from the square body of the valve, connect the fitting closest to the cylinder to the vacuum source. Connect the other fitting to the outlet of a dry ice trap. If the valve has a black body, connect the port labeled “OUT” to the vacuum source and the port labeled “IN” to the dry ice trap.
2. Plug the proportioning valve’s gray cord into the electrical connector on the back of the Infinity regulator labeled “Vacuum”. Make sure the cable locks into position.
3. Connect the vacuum sensing inlet on the back of the Infinity regulator (a threaded or Swagelok fitting) to a Tee connector between the inlet of the trap and the piece of equipment that pressure is being regulated in. Wide bore tubing should be used to make all pressure connections. The length of tubing between the Infinity regulator’s vacuum sensing inlet and the reactor under vacuum should be kept to a minimum (no longer than 6 feet, but under 3 feet will yield more accurate results). To set up the regulator, simply connect a USB cord between the Infinity-II regulator and the Netbook PC controller.

# Hardware Setup for a Dual Control (dual valve) Controller

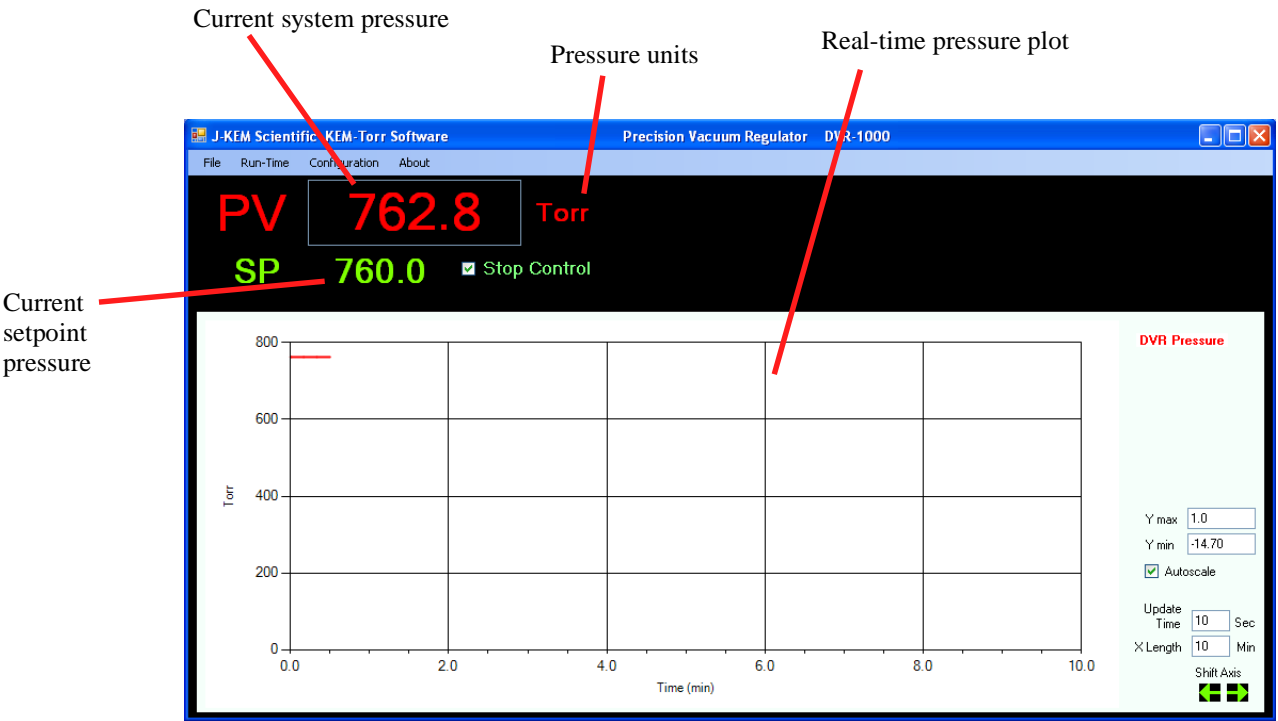


**NOTE:** The vacuum and atmosphere proportioning valves are very sensitive to contaminants which cause the valves to stick. A high efficiency trap must be placed between the vacuum proportioning valve and the reaction system to protect the valve. Proportioning valves are not warranted against failure.



1. Connect the outlet of the vacuum proportioning valve to the vacuum source. The vacuum valve will be one of two types. It will either have a silver coil on top of a silver body (PSV2 - PSV5 valves), or a silver coil on top of a black body (PSV6 – PSV 8 valves). If the valve has a silver body, note that the cylindrical portion of the valve is offset from the square body of the valve, connect the fitting closest to the cylinder to the vacuum source. Connect the other fitting to the outlet of a dry ice trap. If the valve has a black body, connect the port labeled “OUT” to the vacuum source and the port labeled “IN” to the dry ice trap.
2. Plug the vacuum proportioning valves gray cord into the electrical connector on the back of the Infinity regulator labeled “Vacuum”. Make sure the cable locks into position.
3. Plumb the back-fill proportioning valve into the system as shown. If the system uses a silver PSV2 – PSV5 valve, then leave the fitting that is furthest from the top coil open to atmospheric pressure (see drawing above). If the uses a PSV6 –PSV8 valve, then leave the port labeled “IN” open to the air.
4. Plug the back-fill proportioning valves gray cord into the electrical connector on the back of the Infinity regulator labeled “Pressure”. Make sure the cable locks into position.
5. Make the other gas connections shown in the drawing above. Wide bore tubing should be used to make all pressure connections. The length of tubing between the Infinity controller’s pressure sensing inlet and the reactor under control should be kept to a minimum (no longer than 6 feet, but under 3 feet will yield more accurate results).

# Software Setup

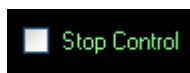
- 1. Connect a USB cable between the Infinity-II regulator and the Netbook PC controller. Turn on power to the Infinity before starting the KEM-Torr software.
- 2. Start the KEM-Torr software by double clicking on the KEM-Torr icon on the controller’s desktop.



The software displays the sensed pressure and immediately begins to plot data. Note that pressures are displayed as ‘Absolute’ pressure.

	The pressure sensed by the regulator is continuously updated and displayed as the PV value in red.
	To enter a setpoint (i.e., the target pressure to regulate the connected system to), place the cursor inside the green setpoint pressure value (i.e., “760.0”) and type the desired value. then hit the Enter (Return) key on the keypad. While the new setpoint is being input, the value turns yellow, when the Return key is hit the new value is entered and the setpoint value turns green again. The regulator begins to operate the vacuum value to evacuate the system until it reaches the setpoint pressure.

**Single and Dual Valve Controllers** – The standard DVR-1000 is programmed to operate a single evacuation proportioning valve. With only an evacuation valve, the DVR-1000 can decrease pressure in the system under test, but it has no ability to increase pressure. For example, the user can evacuate a chamber to 400 torr and subsequently evacuate it to 100 torr, since the evacuation proportioning valve has the ability to decrease the system pressure. But if the chamber is evacuated to 100 torr, the standard DVR-1000 has no ability to increase the system pressure to 300 torr, since this would require bleeding pressure from the atmosphere into the system under test. J-KEM does offer an optional feature for the DVR-1000 controller that allows it to both evacuate a system and to re-pressurize the system. This optional feature requires both an evacuation proportioning valve (the standard valve) and a second back-fill valve (optional). Also the DVR-1000 must be configured for dual valve operation. When the dual valve option is installed, the DVR-1000 can freely increase and decrease pressure in a system under test. Contact J-KEM for information.



Any time during a run, vacuum control can be suspended by placing a check mark in the box titled Stop Control. Removing the check mark restarts vacuum regulation. The system pressure is continuously updated whether the regulator is active or not.

**Menu Options** – The Run-Time menu contains several options pertaining to an active run.

**Ramping** – Contains the controls needed to create and run a vacuum ramp. See the section titled Entering a Vacuum Ramp Program.

**Logging** – Contains controls to configure and initiate logging time and pressure data to a \*.csv file on the PC.

**Charting** – Contains the controls needed to adjust the charting area. See the section titled Charting Controls.

**Fast Update** – When selected, this option provides faster update of the displayed pressure at the cost of slightly more background noise in the pressure signal.

**Menu Options** – The Configuration menu has several items that affect the operation of the DVR-1000.

**Enable Configuration Menu** – The menu items in the Configuration menu are by default, not enabled to prevent accidentally adjusting a parameter that affect the controller in an adverse manner. To enable the items in the Configuration menu, select Enable Configuration Menu.

**Display Units** – From this menu, the user can select the units that pressure is displayed and entered in. The three common units, PSI, Torr, and Atm are presented in this menu, but other units are available in the Customize menu.

**Monitor DAC Output** – This displays a window on the main form that shows the amount of voltage applied to the proportioning valve. This is for diagnostic purposes only and provides no useable information to the researcher.

**Infinity Configuration** – This opens a form that displays the configuration of the various analog inputs on the Infinity controller. From this form the user can recalibrate the controller if needed, see the section titled Vacuum Regulator Configuration and Calibration.

**Customize** – Allows the user to customize various features of the KEM-Torr software including the units pressures are displayed in, logging defaults and other parameters. See the section titled Customizing the KEM-Torr software.

## Entering a Vacuum Ramp Program

The screenshot shows the 'Ramp Builder' window with a table for entering ramp steps. The table has columns for Step, Starting Pressure, Ending Pressure, Duration (Min), Hold Time (Min), and Step Time. The first three steps are filled out: Step 1 (0.0 to -12.0, 50.00, 10.0, 1:00:00), Step 2 (-12.0 to -12.0, 12.00, 0.0, 0:12:30), and Step 3 (-12.0 to -13.0, 60.00, 0.0, 1:00:00). The total program time is displayed as 3:12:30. There are buttons for 'Save Ramp to Meter' and 'Clear Ramp'.

Step	Starting Pressure	Ending Pressure	Duration (Min)	Hold Time (Min)	Step Time
Step 1	0.0	-12.0	50.00	10.0	1:00:00
Step 2	-12.0	-12.0	12.00	0.0	0:12:30
Step 3	-12.0	-13.0	60.00	0.0	1:00:00
Step 4	13.0	0.0	60.00	0.0	1:00:00
Step 5	0.0				
Step 6					
Step 7					
Step 8					
Step 9					
Step 10					
Step 11					
Step 12					

The ramping functions of the software support a 12 step vacuum ramp. To display the ramp construction form, select Run-Time -> Ramping -> Build Ramp from the Run-Time menu.

Each row in the table is a single ramp step, a ramp step includes both a pressure change segment and a hold segment.

**Starting Pressure** – This is the setpoint pressure that the ramp step start at.

**Ending Pressure** – This is the ending setpoint pressure of the ramp step. For controllers with evacuation control only (single valve controllers), the ending pressure must always be lower than the starting pressure. For evacuation and pressure control units (dual valve controllers), the only restriction of starting and ending pressures is the pressure range of the controller.

**Duration (min)** – This is the amount of time the program takes to ramp from the Starting to the Ending Pressure.

**Hold Time** – When a ramp segment completes, the user can optionally enter a hold time for the step. During a hold time, the setpoint is held constant at the ending pressure of the ramp. If you do not want a hold, time, enter a value of 0.

**Step Time** – This column displays the time required to complete the current ramp step.

When a ramp step completes, including the ramp and hold segments, the ramp program immediately continues at the starting setpoint pressure of the next ramp step. The starting setpoint pressure of the subsequent step is always the ending pressure of the previous step.

When a ramp program completes, the controller remains at the ending setpoint pressure of the last step.

The screenshot shows a box with the text 'Total Program Time' and a large digital display showing '0:18:30'. Below the display is a button labeled 'Save Ramp to Meter'.

This box shows the total time required to complete all steps of the ramp program. When the ramp program is completely entered, the program is uploaded to the DVR-1000 by clicking the Save Ramp to Meter button.

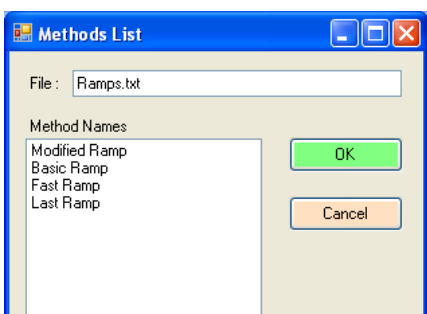
To delete an entered ramp, you can click the Clear Ramp button on the bottom of the screen.

The screenshot shows a box titled 'Ramp Cycling'. It contains a checked checkbox labeled 'Repeat the ramp for' followed by a text box containing the number '12' and the unit 'cycle(s)'.

If the DVR-1000 is equipped with the optional back-fill pressure option, the Ramp Cycling box is enabled. Ramp Cycling allows the ramp program to restart the ramp program as soon as one pass of the program completes. For example, if a

4-step ramp program is entered, ramp cycling resets the ramp to Step 1 as soon as Step 4 completes. The user can enter then number of times the program will repeat (cycle) in the text box provided.

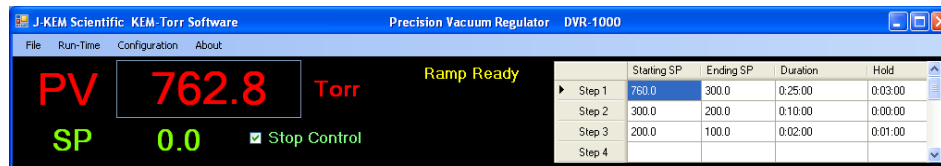
**Storing a Ramp Program** - Ramp programs can be stored for later recall. To save a program, select Store Program from the Programs menu. You will be prompted to enter a name for the ramp method. Enter a name, then click OK.



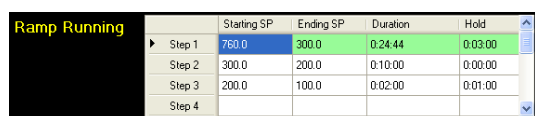
**Recalling a Ramp Program** – To load a saved ramp, select Recall Program from the Programs menu. A window appears that lists the names of the saved programs, click on the desired program, then click the OK button.

**Deleting a Ramp Program** – To delete a save program, select Delete a Saved Program from the Programs menu. From the list of programs that appears, click on the program to delete, then click the OK button.

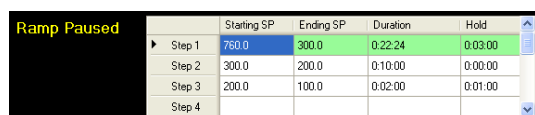
## Running a Ramp Program



Once a ramp program has been saved to the controller, it appears on the main screen.  
**Start a Ramp** - To start the ramp, select Ramping -> Start Ramp from the Run-Time menu.



The current step of a ramp is highlighted in green. During the ramp portion of a program step, the duration time counts down like a digital clock to indicate the time in the ramp remaining. If the program step has a Hold time, then following the completion of the ramp segment, the hold time value begins to count down, indicating the amount of hold time remaining.



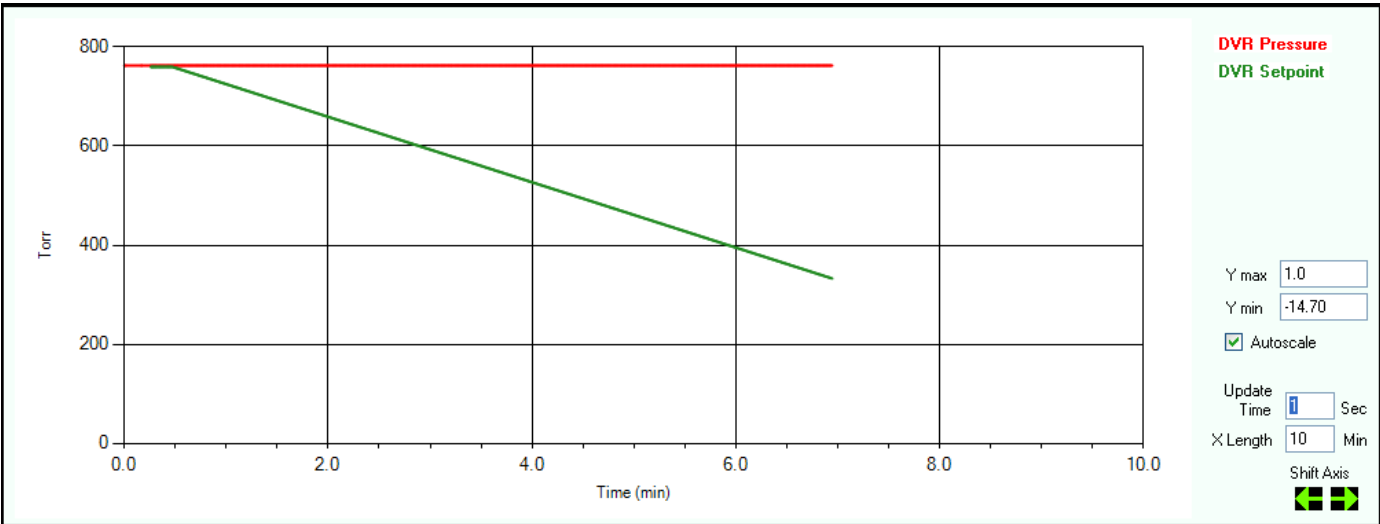
**Pause a Ramp** - A running ramp can be paused by selecting Ramping -> Pause Ramp from the Run-Time menu. When a ramp is paused, the clock in either the Duration or Hold table cells stop decrementing. To resume the ramp step, select Ramping -> Resume Ramp from the Run-Time menu.

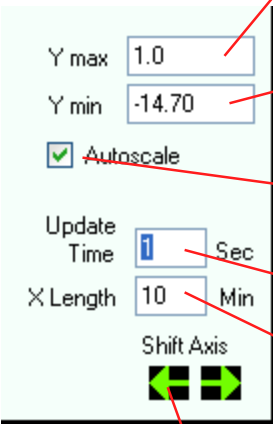
**Advance to Next Step** – A ramp can be forced to complete the current step and advance to the next step in the program by selecting Ramping -> Advance to Next Step from the Run-Time menu.

**Reset Ramp** – When a ramp completes, it can be reset and run again by selecting Ramping -> Reset Ramp from the Run-Time menu. When selected, the ramp is reloaded to the meter. To start the ramp, select Ramping -> Start Ramp.

**Abort Ramp** – A ramp can be terminated by selecting Ramping -> Abort Ramp from the Run-Time menu.

# Charting Controls



 <p>When autoscale is disabled, this sets the minimum value of the Y-axis</p> <p>When autoscale is disabled, this sets the maximum value of the Y-axis</p> <p>Allows KEM-Torr to automatically adjust the scale of the Y-axis as needed</p> <p>Graph update time</p> <p>Length of the X-axis in units of minutes</p> <p>Shifts the displayed X-axis left or right</p>	<p><b>Autoscale -</b> When checked, the graph automatically sets the Y-axis scale to display the plotted data. When unchecked, the user can manually enter the Y-axis minimum and maximum values.</p> <p><b>X-Axis Length</b> Sets the length of the X-axis</p> <p><b>Update Time</b> Sets the update time of the X-axis and the rate at which data points are collected.</p>
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**Shift Axis -** During normal charting, the axis continuously shifts the X axis so that newly collected points are displayed at the end of the plot. The user can manually shift the displayed plot to view points that have scrawled out of the field of view. Every time the shift left button is clicked, the X plot shifts to older times by the amount specified in the Chart X Axis Length box. Every time the shift right button is clicked, the X plot shifts to newer times by the amount specified in the Chart X Axis Length box. While a plot is shifted left, new points are still logged to the plot, but the plot does not update its view. The view remains static and shows only the section of the chart that has been shifted to. While a charts X-axis is shifted, the back color of the chart changes to light blue.

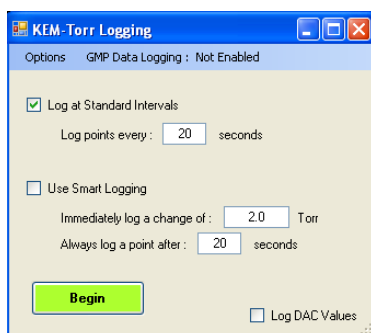


**Menu Options** A bit map image of the chart currently displayed can be captured and saved to the PC hard drive. This might be useful for process documentation purposes. To capture the current chart, from the Run-Time menu, select Charting -> Capture Pressure Plot. When this menu option is selected, you are prompted to enter a file name for the plot.

To clear the charting area, select Charting -> Reset. Clearing the charting area only affects the chart, it has not affect on data being logged to a file using the data logging controls.

The setpoint pressure can be plotted on the chart by selecting the option Chart Setpoint Pressure from the Charting menu in the Run-time menu.

## Logging Pressure Data



There are two logging methods, 1) Standard Logging, and 2) Smart Logging.

**Standard Logging** is enabled by placing a check mark in the box titled “Log at Standard Intervals”. Standard logging records a data point after every time interval specified in the box titled “Log points every “X” seconds.”

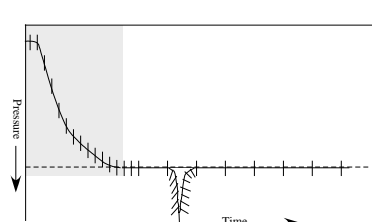
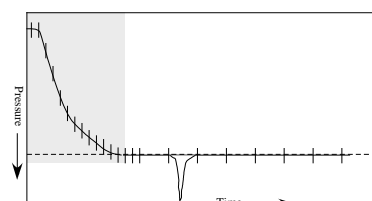
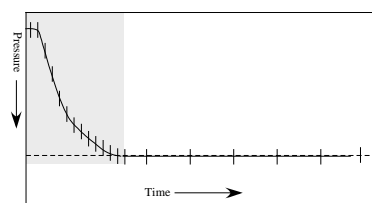
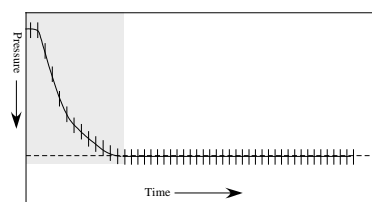
**Smart Logging** is enabled by placing a check mark in the box titled “Use Smart Logging”. Smart logging records a data point when either of two events occurs 1) the time period set in “Always log a point after “X” seconds” passes, or 2) a change in the process pressure exceeds or equals the value set in “Immediately log a change of “Y” Torr”.

### Comparison of Standard and Smart Logging

It’s not always necessary, or desirable, to log data points at specific time intervals. For example, consider this plot.

During the initial stage of evacuation it’s desirable to log data points at short, regular intervals (crosses on the plot) in order to define the shape of the curve. But after the pressure stabilizes at the setpoint, rather than logging points at short intervals, which generates large data tables, it’s probably better to log data at longer intervals such as every 1 or 5 minutes as shown in the second plot, because there’s little value in recording a stable pressure reading.

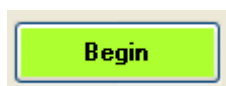
The danger of logging data points at long intervals is that a sharp change in pressure may be missed because it occurred between logged points.



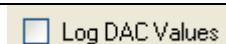
Smart logging address this issue by allowing the user to set two parameters. First the user sets the maximum time period between logged points and, second, sets a *log on pressure change value*. If the sensed pressure changes by the *pressure change value* for any reason, this forces a data point to be immediately logged.

With smart logging on, the shape of the pressure spike is perfectly defined because a data point was logged every time the sensed pressure changed by the *pressure change value*. After the sensed pressure stabilizes, data is logged at the longer timer interval. Smart logging provides the best balance between defining the shape of a pressure profile and keeping log files to a manageable size.

### Starting Data Logging



Click on the Begin button to start data logging. The program prompts the user to enter a file name to save the run data to. The number of logged data points is updated as points are saved.



The option to log DAC values is a diagnostic option and is normally not selected. DAC (Digital to Analog Converter) values represent the voltage applied to the vacuum and pressure proportioning valves.

## Customizing the DVR-1000 software

**Application Customization**

**Data Logging**

☐ **Automatically log data to disk** Log time and pressure data to an output file every time the software starts.

☐ **Automatically create file name** Create file name with the format of: DVR1000 2013\_7\_14 at 9:23.csv

Default directory:

☒ **Prompt for file name**

☒ **Standard Logging** ☐ **Smart Logging**

Log points every :  seconds

Immediately log a change of :  Torr

Always log a point after :  seconds

Log time as: ☐ **Time of day** (e.g., 14:34:25) ☐ **Elapsed time** (e.g., 0:15:30) ☐ **Elapsed minutes** ☒ **Elapsed seconds**

**Control Characteristics**

**Loop Gain**  **Hysteresis**  PSI

Sets how responsive the controller is to a deviation from the Setpoint pressure. Range: 0 to 32.0. Default= 2.5

Hysteresis between switching from Vacuum to Pressure control. Range: 0 to 6.5. Default= 0.05

**Pressure Units**

Display and set pressures in units of:

☐ PSI ☒ **Torr** ☐ ATM ☐ Bar ☐ mBar ☐ InH2O

**Pressure Display**

☒ **Set Atmospheric pressure to 0.0 psi**

Pressure Display Offset:  PSI

Several parameters of the KEM-Torr can be specified as user defaults. To open the customization screen, select Enable Configuration Menu from the Configuration menu, then select Customize.

### Data Logging Controls

<input checked="" type="checkbox"/> <b>Automatically log data to disk</b>	<p>If this option is selected, the controller automatically starts to log time and pressure data to disk as soon as the user starts the control action of the controller by unchecking the “Stop Control” <input type="checkbox"/> <b>Stop Control</b> check box.</p>
<input checked="" type="radio"/> <b>Automatically create file name</b>  <input type="radio"/> <b>Prompt for file name</b>	<p>If the option “Automatically create file name” is selected, when data logging starts, the user is not prompted for a file name to save data to, but the system creates a file name based on the current date and time. If this option is not selected, when data logging starts, the user will be prompted for a file name to save data to.</p>
<b>Default Directory</b>	<p>Optionally, the user can enter a default directory to save all data files to.</p>
<b>Log time as:</b>	<p>In the log file, time data can be recorded in any of 4 formats.</p> <p><b>Time of day</b> – In this format the time the data point is collected is saved at the actual time of day, for example, “4:15 PM”.</p> <p><b>Elapsed time</b> – This option saves the time that the data point is collected in the format of “Hr : Min : Sec” since the start of the data collection.</p> <p><b>Elapsed minutes</b> – This option saves the time data point as a decimal value of minutes since the start of the data collection.</p> <p><b>Elapsed seconds</b> – This option saves the time data point as in integer value of seconds since the start of the data collection.</p>
<b>Type of Data Logging</b>	<p>When logging is set to start automatically, the selection of these variables is used for the logging session.</p> <p><b>Standard Logging</b> <b>Smart Logging</b></p> <p>For a discussion on the nature and differences of these two logging methods, see the section above titled Logging Pressure Data.</p>



## Control Characteristics

<div> <div>Control Characteristics</div> <div> <div>Loop Gain <input type="text" value="2.5"/></div> <div>Sets how responsive the controller is to a deviation from the Setpoint pressure. Range: 0 to 32.0. Default= 2.5</div> </div> <div> <div>Hysteresis <input type="text" value="0.05"/> PSI</div> <div>Hysteresis between switching from Vacuum to Pressure control. Range: 0 to 6.5. Default= 0.05</div> </div> </div>	<p>The Loop Gain sets how responsive the controller is to a deviation of the</p>
<p>system pressure from the setpoint pressure.. Low values product slow, but stable adjustments to bring the system pressure to the setpoint. High values result in a fast response to a deviation from setpoint, but can also result in unstable control. The default value is 2.5.</p> <p>Hysteresis – Dual valve controllers have a vacuum and pressure valve. The algorithm controlling the valves must know how much deviation from the setpoint is required to switch between the two valves. For example, if a flask is being regulated at –10.00 psi, if the flask pressure fell to -10.01 PSI (under pressure), it would not be a good idea to open the pressurization valve with the expectation that the value would inject just the right amount of air to raise the pressure from –10.01 to –10.00 PSI. When the flask is at vacuum pressures, hysteresis is the amount that the flask pressure must be below the setpoint before the pressurization valve is activated to correct for the under-pressure condition. Also, when the flask is at positive pressures, hysteresis is the amount that the flask pressure must be above the setpoint before the vacuum valve is activated to correct for the over-pressure condition. The default value for hysteresis is 0.05 PSI. Hysteresis has no affect on how precisely the pressure is regulated in the flask, the Infinity always attempts to regulate the flask pressure to 0.01 PSI.</p>	

## Pressure Units

<div> <div>Pressure Units</div> <div>Display and set pressures in units of:</div> <div> <input type="radio"/> PSI <input checked="" type="radio"/> Torr <input type="radio"/> ATM <input type="radio"/> Bar <input type="radio"/> mBar <input type="radio"/> InH2O </div> </div>	<p>Specifies the default units for pressure display, data logging, and charting. After selecting the desired unit, the software must be exited and restarted for the change to take effect.</p>
<div> <div>Pressure Display</div> <div> <input checked="" type="checkbox"/> Set Atmospheric pressure to 0.0 psi </div> <div> <div>Pressure Display Offset <input type="text" value="-0.035"/> PSI</div> </div> </div>	<p>The user can select to display atmospheric pressure (ATM) as 0.0 or 14.7 psi. If ATM is displayed as 0.0, then vacuum pressures are entered as negative numbers (i.e., 5 psi below ATM is entered as –5.0 (-259 torr) and full vacuum is –14.7 psi (-760 torr).</p>
<p>A user offset can be added to the displayed pressure to correct a pressure error present in the display. If a display error is larger than 0.2psi, the controller may need to be recalibrated.</p>	

# Vacuum Regulator Configuration and Calibration

Infinity Input/Output Board Configuration. Serial Number : 30849

Configuration	Sensor	Installed	Active	ADC Ch+	ADC Ch-	Buffer Enabled	PGA Gain	Data Rate	View Data	Milivolts	Counts	Calibrate
Fast Input 0	None	<input type="checkbox"/>	<input type="checkbox"/>	0	0	<input type="checkbox"/>	0	0	<input type="checkbox"/>			
Fast Input 1	None	<input type="checkbox"/>	<input type="checkbox"/>	0	0	<input type="checkbox"/>	0	0	<input type="checkbox"/>			
Fast Input 2	None	<input type="checkbox"/>	<input type="checkbox"/>	0	0	<input type="checkbox"/>	0	0	<input type="checkbox"/>			
Fast Input 3	None	<input type="checkbox"/>	<input type="checkbox"/>	0	0	<input type="checkbox"/>	0	0	<input type="checkbox"/>			
Fast Input 4	None	<input type="checkbox"/>	<input type="checkbox"/>	0	0	<input type="checkbox"/>	0	0	<input type="checkbox"/>			
Fast Input 5	None	<input type="checkbox"/>	<input type="checkbox"/>	0	0	<input type="checkbox"/>	0	0	<input type="checkbox"/>			
Fast Input 6	None	<input type="checkbox"/>	<input type="checkbox"/>	0	0	<input type="checkbox"/>	0	0	<input type="checkbox"/>			
Fast Input 7	None	<input type="checkbox"/>	<input type="checkbox"/>	0	0	<input type="checkbox"/>	0	0	<input type="checkbox"/>			
Fast Input 8	None	<input type="checkbox"/>	<input type="checkbox"/>	0	0	<input type="checkbox"/>	0	0	<input type="checkbox"/>			
Fast Input 9	DVR-1000	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	0	1	<input type="checkbox"/>	2	60	<input type="checkbox"/>			Calibrate

Serial Port Configuration

Port	Instrument	Baud Rate
Port 1, RS232	None	9600
Port 2, RS232	None	9600
Port 3, RS232	None	9600
Port 4, RS232	None	9600

PWM Frequency: 0.7/0.5/1.0/2.0

PWM 1, OUT\_8: Enabled, Value (Range: 0/1023): 0

PWM 2, OUT\_9: Enabled, Value (Range: 0/1023): 0

Digital Outputs: Output 1: On/Off

Digital Inputs: 1: Read Input, Low

Analog Outputs: Output 1: Set Voltage, Range: 0 to 4.095 Volts

Buffer - Internal ADC buffer (Default: Off)

ADC Ch-: 0-5 (Default: 8), ADC Ch+: 0 to 7

PGA Gain: 1, 2, 4, 8, 16, 32, 64

Data Rate: 2, 5, 10, 15, 25, 30, 50, 60, 100, 500, 1000, 2000, 3750, 7500, 15000, 30000

Voltage: The input voltage of the sensor, relative to a 2.5 V reference, irrespective of PGA gain

Counts: Actual ADC counts - including PGA gain. Range: -8,388,607 to 8,388,608

Default: CIC Gain = 2, TC Gain = 64, pH Gain = 8, Xducer Gain = 2, Data Rate = 60

The Infinity board inside of the DVR-1000 is a highly versatile board capable of multiple functions. As can be seen, most of the functionality of the Infinity board is not used for the DVR-1000, but if your application has special requirements, please contact J-KEM for more information.

Fast Input 9	DVR-1000	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	0	1	<input type="checkbox"/>	2	60	<input type="checkbox"/>	Calibrate
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Only one analog input is enabled for the DVR, and that input connects to the pressure transducer. The parameters for this input are locked so that they can not be inadvertently changed. The only control that is not locked is the Calibrate button. Prior to calibrating the controller, you must make sure that you have the appropriate pressure calibrator available.

Sensor Calibration

DVR and DPR Calibration

Calibration

Read

Actual Pressure:  PSI

Enter ABSOLUTE pressures only

To calibrate a transducer, select the transducer type, units of measure and enter the pressure range. First you will calibrate on a low pressure, then a high pressure.

Transducer Type

☒ Absolute ☐ Gage

Display Atm as 0.0

☐ Yes ☒ No

Pressure Range

Minimum:  0.0 PSI

Maximum:  15.0 PSI

Enter ABSOLUTE pressures only

1 Atm = 1.01325 Bar = 14.69595 PSI

1 PSI = 51.7149 torr = 27.6799 in H2O

Click the calibration button to open the calibration input screen. Connect the vacuum transducer to a vacuum source and lower the pressure to any value below 0.01 psi. Enter the actual system pressure in the box titled “Actual Pressure” and then click the Read button.

Note: Pressures must be entered as Absolute pressures and in units of PSI. Absolute pressure specified full vacuum as 0.00 and 1 atmosphere as 14.69 psi.

Sensor Calibration: DVR-1000

Instruction 2: Adjust the pressure on the transducer to a value close to the 'Maximum Pressure' value. When the pressure stabilizes, enter the actual pressure in the calibration text box, then click the Read button.

DVR and DPR Calibration

Calibration

Read

Actual Pressure:  750.0 Torr

To calibrate a transducer, select the transducer type, units of measure and enter the pressure range. First you will calibrate on a low pressure, then a high pressure.

Transducer Type

☒ Absolute ☐ Gage

Display Atm as 0.0

☐ Yes ☒ No

Units of Measure

☒ Torr (mmHg) ☐ PSI ☐ Atm ☐ Bar ☐ mBar ☐ in H2O

Pressure Range

Minimum:  0.0 Torr

Maximum:  780.0 Torr

1 Atm = 1.01325 Bar = 14.69595 PSI

1 PSI = 51.7149 torr = 27.6799 in H2O

Now remove the vacuum source and allows the vacuum transducer to set at atmospheric pressure. Enter the current barometric pressure in the box titled “Actual Pressure” and click the Read button. Remember, pressures must be entered as Absolute pressure, so enter the actual barometric pressure, which is probably not 14.69 psi (i.e., exactly 1 atmosphere).

Calibration

Exit

Actual Pressure:  749.879 Torr

The regulator now begins to display the sensed pressure on the vacuum transducer. When you are satisfied that the calibrated pressure is reading properly, click the Exit button.

# Remote Control of the Infinity Controller

The infinity controller does not require KEM-Torr software to run. For users that want to incorporate the Infinity controller into a larger automation system, the controller can be operated by means of ASCII serial commands.

The controller only accepts one set of communication settings:

Baud: 115200

8 data bits

1 stop bit

No parity

No hardware handshaking.

## Understanding the Pressure Unit System Used by the Infinity Controller

Pressure units are entered, and pressure readings are reported in units of “PSI x 10,000”, where atmospheric pressure is reported as 0.00 psi.

So, for example, atmospheric pressure is reported as “0.000”, full vacuum is reported as –146766, and positive 6.5 psi (i.e., 6.5 psi above atmospheric pressure) is reported as 65000.

A pressure of “-53456” is –5.3456 psi, or 483.6 torr  $[760.0 - (-5.3456 \text{ psi} * 51.714924 \text{ torr/psi})]$ .

## Command Set

Note that all commands are case sensitive and are all capital letters. Commands are terminated with carriage return (0x13). The replies to commands, start with the command sent, then any returned data is appended to the returned command string.

Command	Range	Example	Reply	Comments
PCACP	None	PCACP\r	PCACP-1845\r	This command queries the current sensed pressure. The sensed pressure in this example is –1845, or –0.1845 psi. For the DVR-1000 and DDR-1200, pressures are reported as Absolute pressures, while the DPR-1100 reports pressures as gage pressures.
PCASP	-150,000 to 2,500,00	PCASP-100000\r	PCASP-100000\r	This command both sets or queries the current setpoint pressure. Pressure units are ABSOLUTE pressure in PSI x 10,000. When no value follows the PCASP command, the current setpoint pressure is returned in the reply. When a value follows the PCASP command, this sets the current setpoint pressure to the passed value.  A command of PCASP-100000 sets the setpoint of –10.00 psi , or 242.9 torr.
	None	PCASP\r	PCASP-10034\r	Queries the current setpoint pressure.

PCARN	0 to 3	PCARN2\r	PCARN2\r	<p>This command starts or stops pressure control. The argument passed with the command depends on the type of Infinity controller in use.</p> <p>Digital Vacuum Regulator, DVR-1000 – If the regulator is fitted only with a vacuum proportioning valve, the command PCARN2 starts vacuum control. If the DVR-1000 has the optional back-fill valve, then the command PCARN3 starts vacuum control and back-fill control.</p> <p>Digital Pressure Regulator, DPR-1100 – The command PCARN1 starts pressure regulation.</p> <p>Dual Range Pressure Regulator, DDR-1200 – The command PCARN3 starts both vacuum and pressure regulation.</p> <p>The command PCARN0 stops pressure regulation in all model numbers.</p>
PWM4D	None	PWM4D\r	PWM4D692\r	<p>This returns a digital value that is representative of the voltage applied to the vacuum proportioning valve. A value of 0 means no voltage is applied to the valve, a value of 4095 means that 24 Vdc is applied to the valve.</p>
PWM2D	None	PWM2D\r	PWM2D692\r	<p>This returns a digital value that is representative of the voltage applied to the pressure proportioning valve. A value of 0 means no voltage is applied to the valve, a value of 4095 means that 24 Vdc is applied to the valve.</p>
PINFO	None	PINFO\r	MFC V3.1,12-Apr-13,4.116\r	<p>Queries product information and program date. This is a good command to verify that you have serial communication with the controller</p>
PCAHP	-150,000 to 2,500,000	PCAHP-140987\r	PCAHP-140987\r	<p>Set the low pressure calibration point. To calibrate the controller, 1) introduce a known low pressure point, (close to full vacuum) and then send the pressure in PSI x 10,000 as an absolute pressure.</p> <p>So, for example, if the low pressure standard point is 1.2 torr, then send the command: PCAHP-146727\r</p>
PCALP	-150,000 to 2,500,000	PCALP-213\r	PCALP-213\r	<p>Set the high pressure calibration point. To calibrate the controller, 1) introduce a known pressure point close to atmospheric pressure and then send the pressure in PSI x 10,000 as an absolute pressure.</p> <p>So, for example, if the high pressure standard point is 758.9 torr, then send the command: PCAHP-213\r</p>



Here is a reasonable startup sequence:

PINFO - Tests to make sure you have serial communications

PCASP##### - Send in a new setpoint

PCARN3 (or PCARN1, or PCARN2. Use the appropriate command) - Start pressure control

PCACP - The command queries the current sensed pressure.

New pressure setpoints can be sent at any time

To create a ramp, send in a timed sequence of setpoints to create the desired pressure ramp.

To stop pressure control and close both the vacuum and pressure control valves, send the command PCARN0.