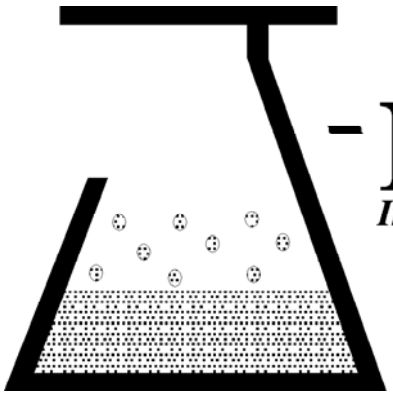
Pressure to Perform

Precision Vacuum Regulator DVR-1000



KEM Scientific, Inc.

Instruments for Science from Scientists

Warranty

J-KEM Scientific, Inc. warrants this unit to be free of defects in materials and workmanship and to give satisfactory service for a period of 12 months from date of purchase. If the unit should malfunction, it must be returned to the factory for evaluation. If the unit is found to be defective upon examination by J-KEM, it will be repaired or replaced at no charge. However, this WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive current, heat, moisture, vibration, corrosive materials, or misuse. Components which wear or are damaged by misuse are not warranted. This includes syringes and valves

THERE ARE NO WARRANTIES EXCEPT AS STATED HEREIN. THERE ARE NO OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND OF FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL J-KEM SCIENTIFIC, INC. BE LIABLE FOR CONSEQUENTIAL, INCIDENTAL OR SPECIAL DAMAGES. THE BUYER'S SOLE REMEDY FOR ANY BREACH OF THIS AGREEMENT BY J-KEM SCIENTIFIC, INC. OR ANY BREACH OF ANY WARRANTY BY J-KEM SCIENTIFIC, INC. SHALL NOT EXCEED THE PURCHASE PRICE PAID BY THE PURCHASER TO J-KEM SCIENTIFIC, INC. FOR THE UNIT OR UNITS OF EQUIPMENT DIRECTLY AFFECTED BY SUCH BREACH.

Service

J-KEM Scientific maintains its own service facility and technical staff to service all parts of the controller, usually in 24 hours. For service, contact:

J-KEM Scientific, Inc.
6970 Olive Boulevard
St. Louis, MO 63130
(314) 863-5536
FAX (314) 863-6070
Web site: http://www.jkem.com
E-Mail: jkem911@jkem.com

J-KEM Scientific, Inc.
Instruments for Science from Scientists

J-KEM® Scientific, Inc.
6970 Olive Blvd.
St. Louis, MO 63130
(314) 863-5536
Fax (314) 863-6070
E-Mail: jkem911@jkem.com

Infinity Vacuum Regulator

Here's an offer you can't refuse

Your Infinity Controller <u>is not</u> a static instrument.

J-KEM's strives is to make the finest instruments available to the research community. We understand that research continuously changes, as a result this instrument is designed to allow customized upgrades to its software simply and in your own lab. Your controller is designed to take advantage of a new memory technology that allows software (containing new or modified program features) to be uploaded directly to the controller's memory via e-mail. Upgradeable programming allows the controller to change as the requirements of your research change.

If you want the program to work a different way, or if you need a new feature added to the program, call us!! We're ready to work with you.

Robert Elliott

President

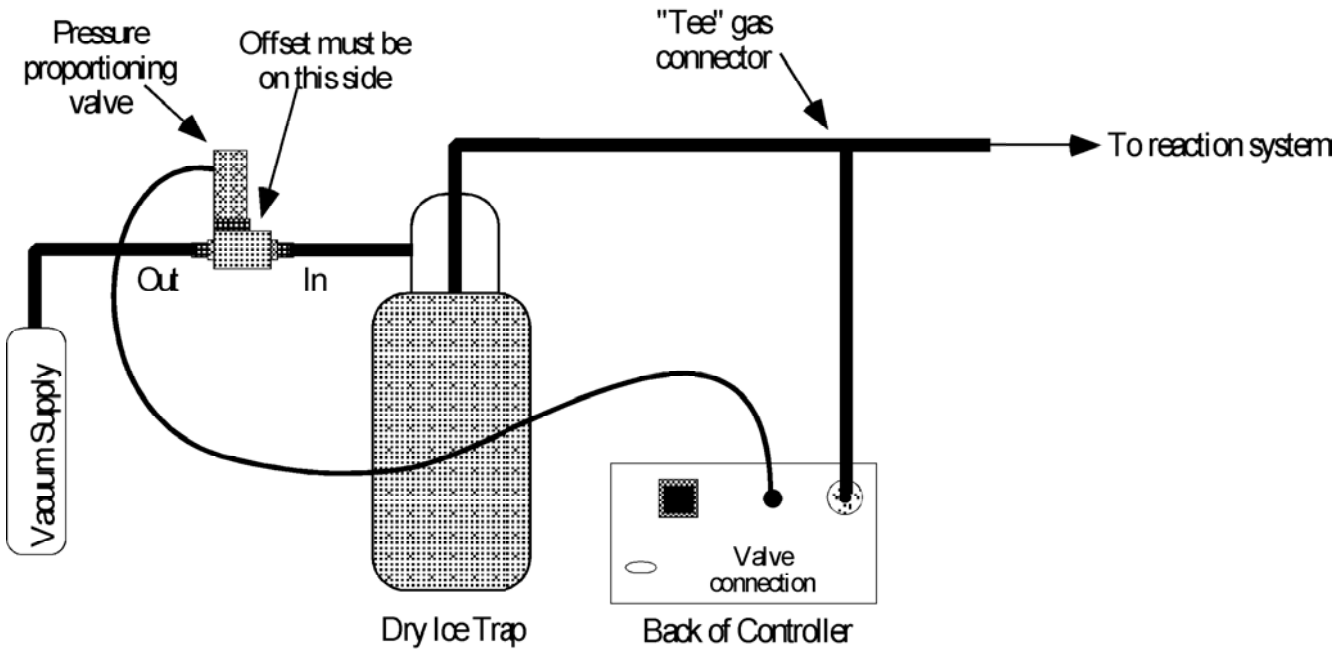
Index

Controller Overview

The Infinity Digital Vacuum Regulator controls the vacuum in an attached instrument at a user entered setpoint pressure or according to a user entered pressure ramp.
Options available for the Infinity vacuum regulator include:

Analog inputs to read temperature, pH or other input signals.
Two valve configuration, vacuum and back-fill valves.
User configurable analog or digital outputs.
User configurable alarms.
Custom Requests.

Hardware Setup



NOTE: The pressure proportioning valve is extraordinarily sensitive to contaminates 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 valve). 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 valves gray cord into the electrical connector on the back of the Infinity computer regulator. Make sure the cable locks into position.

3. Connect the vacuum sensing inlet on the back of the Infinity controller (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 controller'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).

Program Setup

This program allows the regulation of vacuum in an attached reactor at either a single user entered pressure or according to a user entered pressure ramp.

Turn power to the regulator on, following an introductory message this screen appears. (To select Yes, press the '2' key, to select No, press the '5' key).

Log Data to PC?
Yes No

If you want to log time and pressure data to a remote PC select "Yes" and read the section titled , Data Logging Using HyperTerminal, otherwise select "No". The next screen to appear is the controller's default run-time screen, shown here:

Ready
SP= 760.0 PV= 748.2

This screen indicates that the controller is "Ready" to take a command, that the current setpoint [SP] (i.e., the desired pressure) is at 760.0 mmHg and, that the current process value [PV] (i.e., the pressure inside the piece of attached equipment) is at 748.2 mmHg. NOTE: Process pressure are always read as absolute pressures.

Single Setpoint Program

A single setpoint program allows the user to enter a specific pressure to evacuate the reactor to. When a single setpoint is entered the controller adjusts the system pressure to equal the setpoint pressure. Single setpoint pressures are entered by pressing the "SP" (1) key. The following keys are active during a single setpoint program and have the following meanings.

Key	Controller Display	Comment
SP 1	Enter SETPOINT in mmHg: Manual SP SP= 200.3 PV= ***.*	Enter the desired setpoint in units of mmHg. For example, enter a pressure of 200.3mmHg. Setpoints are entered as floating point numbers. The section below describes how to use the controller's keypad to enter a floating point number. When entered, the display of the controller changes to that at the left to indicate the newly entered setpoint.
	Floating Point Numbers Several of the controller's screens require entering a floating point number, for example 200.3	A pressure of 200.3 is entered with the following key presses. Press Ramp 2, Data 0, Data 0, Enter ·, SP↑ 3, Enter · on the J-KEM controller [Note: the Enter · key is both the decimal point and the Enter key. The first time Enter · is pressed a decimal point is entered, the second time Enter · is pressed the newly keyed value is "entered" into the controller's memory. If a mistake is made during data entry, the incorrect value can be deleted one digit at a time by pressing the Reset - Del key. A mistake must be corrected BEFORE pressing the Enter · key the second time to enter the number.
Ramp 2	Pressing this key starts a pressure ramp program which is detailed in the next section.	
SP↑ 3	Manual SP SP= 201.3 PV= ***.*	Pressing this key causes the setpoint to increase by 1 mmHg each time the key is pressed.
SP↓ 4	Manual SP SP= 199.3 PV= ***.*	Pressing this key causes the setpoint to decrease by 1 mmHg each time the key is pressed.
Pause 5	Pauses the evacuation of the attached piece of equipment.	The Pause key reads the current system pressure and enters that pressure as a *temporary* setpoint pressure which has the effect of stopping the systems evacuation. Pressing the pause key a second time restores the original setpoint and continues the evacuation. The pause key is useful to control foaming or bumping of liquids that can occur when being placed under reduced pressures.
Close 6	Ready SP= 760.0 PV= ***.*	Closes the vacuum valve and sets the setpoint pressure to 760.0. The controller is set to its beginning "Ready" state.
Open 7	Ready SP= 0.0 PV= ***.*	Opens the vacuum valve to its full open state and sets the setpoint to 0.0
Reset	Ready SP= 760.0 PV= ***.*	Pressing the "Reset" key resets the controller to its beginning "Ready state".

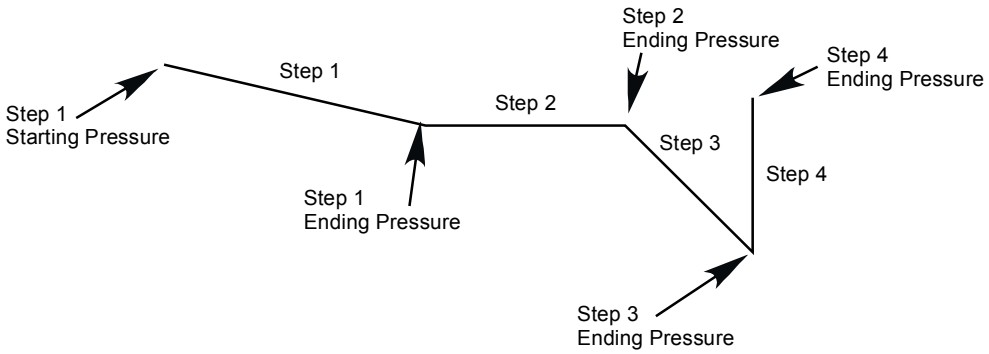
Entering a Vacuum Ramp Program

The Infinity controller provides the option of entering a new vacuum ramp program, repeating the last program run, or recalling any of three programs previously stored in memory.

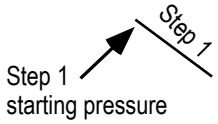
Key	Controller Display	Comment
Ramp 2	Options: Load NEW(1) Do Last(2) Recall(3)	Pressing the Ramp key on the controller's keypad causes the controller to prompt the user to press the '1' key to enter a new ramp program, press the '2' key to re-run the last used ramp program, or press the '3' key to load a previously stored ramp program.
If you elect to enter a NEW ramp program, see the example of how to enter this program below. Pressing the '2' key repeats the last ramp program run. The controller always retains in memory the last ramp program it ran. This program is retained in memory even if power to the controller is turned off and whether it's saved or not. Pressing the '2' key reloads this program for use. This is useful when the same program is repeatedly run. If you elect to recall a previously stored ramp program, the controller prompts for the program number (1-3) to recall. After any choice, the controller presents the option of reviewing the program (see later).		

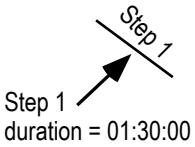
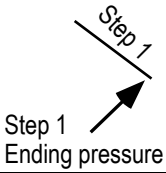
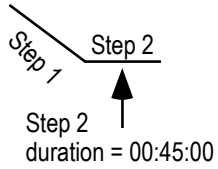
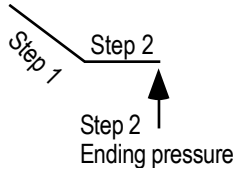
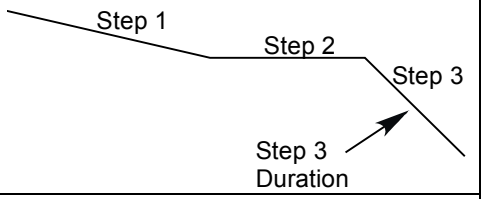
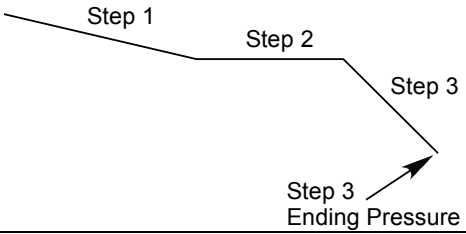
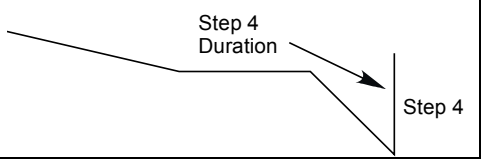
Entering a New Vacuum Ramp Program

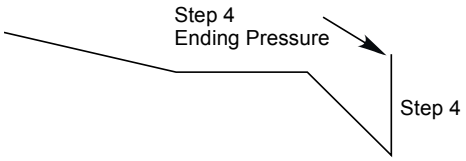
A vacuum program consists of discrete steps and has the general profile of the programs below.



To demonstrate how the controller works, the program above is entered as an example.

Controller Screen	Explanation	Constructed Program
Step 1 Starting Setpoint[mmHg] =	Enter the starting pressure for Step 1. For example, enter a starting pressure of 700mmHg by pressing: Open 7 Data 0 Data 0 Enter · Data 0 Enter · on the J-KEM controller [Note: the Enter · key is also the decimal point key].	
Editor's Note:	If you make a mistake during data entry, the incorrect value can be deleted one digit at a time by pressing the Reset – Del key. You must correct your mistake BEFORE pressing the Enter · key.	

Step 1 Duration: 00:00:00	Enter the length of time for step 1 to go from the starting pressure of 700mm to the ending pressure of 600mm. For example, enter a time of 1hr 30 min by pressing: Data 0 · SP 1 · SP↑ 3 · Enter ▪ Note: there is no need to enter the extra "zero's" in the time display, as soon as the time you want is displayed, you can hit ENTER.	
Step 1 Ending Pressure[psi]:	Enter an ending pressure of 600mmHg by pressing: Close 6 · Data 0 · Data 0 · Enter ▪ · Data 0 · Enter ▪	
Step 2 Duration: 00:00:00	Enter the length of step 2 as 45 minutes by pressing: Data 0 · Data 0 · SP↓ 4 · Pause 5 · Enter ▪	
Step 2 Ending Pressure[psi]:	There's no reason to enter a "starting pressure" for step 2 because the starting pressure for step 2 is automatically set to the "ending pressure" of step 1. Since step 2 is a "hold" step, enter an ending pressure of 600mHg by pressing: Close 6 · Data 0 · Data 0 · Enter ▪ · Data 0 · Enter ▪	
Step 3 Duration: 00:00:00	Enter a duration of 55 minutes by pressing: Data 0 · Data 0 · Pause 5 · Pause 5 · Enter ▪	
Step 3 Ending Pressure[psi]:	Enter an ending pressure of 100.0 mmHg by pressing: SP 1 · Data 0 · Data 0 · Enter ▪ · Data 0 · Enter ▪	
Step 4 Duration: 00:00:01	Enter a step length for step 4 of 1 second by pressing: 0 · 0 · 0 · 0 · 0 · 1 · Enter ▪.	

Step 4 Ending Pressure[psi]:	Enter an ending pressure of 700 mmHg for step 4 by pressing: Open 7 · ~~Data~~ 0 · ~~Data~~ 0 · Enter · ~~Data~~ 0 · Enter	
Step 5 Duration: 00:00:00	Entering a step time of '0' terminates data entry. At the end of a ramp program, the controllers setpoint pressure is set to the last entered pressure and stays there indefinitely	

Reviewing & Editing a Program

In edit mode you review the active program and change, or add, any steps in the program. For example, here's the program just entered

	Starting Setpoint	700mmHg	
Step 1	Duration	01:30:00	
Step 1	Ending Pressure	600mmHg	
Step 2	Duration	00:45:00	
Step 2	Ending Pressure	600mmHg	
Step 3	Duration	00:55:00	
Step 3	Ending Pressure	100mmHg	
Step 4	Duration	00:00:01	
Step 4	Ending Pressure	700mmHg	Termination pressure

Suppose you wanted to change the duration of step 3 from 55 minutes to 30 minutes and the ending setpoint in step 4 from 700mmHg to 550mmHg. The key sequences below would make these changes.

Screen Display	Response
Starting Setpoint = 700mmHg	Correct value. Press the Enter · key to accept.
Step 1 Duration: 01:30:00	Correct value. Press the Enter · key to accept.
Step 1 Ending Pressure: 600mmHg	Correct value. Press the Enter · key to accept.
Step 2 Duration: 00:45:00	Correct value. Press the Enter · key to accept.
Step 2 Ending Pressure: 600mmHg	Correct value. Press the Enter · key to accept.
Step 3 Duration: 00:55:00	To change this value from 55 to 30 minutes, press the Reset - Del key. This deletes the old value and places the controller in edit mode. Enter the new time of 30 minutes by pressing: Enter ·
Step 3 Ending Pressure: 100mmHg	Correct value. Press the Enter · key to accept.
Step 4 Duration: 00:00:01	Correct value. Press the Enter · key to accept.
Step 4 Ending Pressure: 700mmHg	To change this value from 700 to 550mmHg, press the Reset - Del key. This deletes the old value and places the controller in edit mode. Enter the new pressure by pressing: Pause 5 Pause 5 ~~Data~~ 0 Enter · ~~Data~~ 0 Enter ·.
End of Program [Reset= 'Add steps']	To accept this as the end of the program, press the Enter key. To add an additional step (Step 5) press the Reset key.

The following keys are active during a pressure ramp program and have the following meanings.

Key	Controller Display	Comment
Pause 5	PAUSED 00:45:00 SP= ---.- PV= ***.*	Causes an active ramp program to Pause. The paused state of the program is released by pressing the Pause button a second time.
Close 6	Ready SP= 760.0 PV= ***.*	Closes the vacuum valve and set the setpoint pressure to 760.0. The ramp program is aborted and the controller is set to its beginning "Ready" state.
Open 7	Ready SP= 0.0 PV= ***.*	Opens the vacuum valve to its full open state and sets the setpoint to 0.0. An active ramp program is aborted.
Reset	Ready SP= 760.0 PV= ***.*	Pressing the "Reset" key resets the controller to its beginning "Ready state".

Serial Communications

Overview:
The DVR-1000 communicates via a standard 9-pin connector using an RS232 protocol. This allows communication with the controller using a standard PC comm port.
The regulator sends and receives ASCII string commands. There are 3 regulator commands of the general form:

COMMAND{optional value}TERMINATING CHARACTER

Commands are case sensitive. The terminating character is '\r' or 0x0D (i.e., carriage return).
The regulator responds to a valid serial command by echoing the command and appending the characters 'OK' to the command string (see later). The response occurs AFTER the command is executed, so monitoring for the regulator's response is an excellent way of knowing when the regulator is ready to receive another command. The reply to an improperly formatted or invalid command is "ERROROK\r".

Example of Serial Communication Interchange

	Host Command	SPS Regulator Response	Comments
1	S125.0\r	S125.0OK\r	Set the controllers setpoint to 125.0 mmHg
2	P\r	P324.8OK\r	Query actual reactor pressure. Pressure is at 324.8 mmHg.
3	C\r	COK\r	Instruct the regulator to Close the vacuum valve.
4	R,500.0,5.0,125\r	R,500.0,5.0,125OK\r	This string loads the values needed for 1 step pressure ramp. The format of the string is: "R" – Signifies that Ramp data follows. "500.0" – The starting pressure for the ramp in units of mmHg. "5.0" - The ending pressure for the ramp in units of mmHg. "125" - Length of time for the ramp in units of minutes. Each field is separated by a comma and the string is terminated with a "\r". NOTE: There is no error checking when loading a ramp. Make sure the transmitted command complies with the above format exactly. When the ramp completes, the pressure remains at the ending pressure of the ramp (in this case at 5mmHg). A ramp is aborted by issuing the "S", or "C" command. A new ramp can be started while a ramp is running by issuing a new ramp command. The "P" command can be sent at any time without disturbing a ramp in progress.
5	B41\r	ERROROK\r	Non-existent command.

Communications parameters can be changed in the SPS regulators programming mode. Default communication parameters are:
Baud - 9600, Parity - none, Data bits - 8, Stop bits - 1.

The controller's key pad and communication port are simultaneously operative. Commands are simultaneously accepted from both the key pad and the serial port.

Logging Time & Pressure to a PC

A free Windows program is available from J-KEM, KEM-Logger, that provides an intuitive graphical interface to log time and pressure data to a PC. KEM-Logger logs data directly to Excel or to a standard text file and can be downloaded from J-KEM's web site at:
http://www.jkem.com/downloads/kemlogger

Another option is to use HyperTerminal which is part of the Windows operating system. Contact J-KEM for an application not on how to configure HyperTerminal for data capture.

Programming Mode

Certain parameters are stored in non-volatile memory in the controller and are read each time the controller is turned on. It's possible to change the default values of these parameter by placing the controller in programming mode. Programming mode is entered by turning the controller off, waiting 5 seconds, then turning power back on. When the message "Recall Data..." appears, press and release the ENTER key and a message will appear indicating that you've entered programming mode.

It should be noted that programming mode has virtually no error checking of the entered number. Make sure data is entered accurately or very unpredictable results will occur.

	Controller Display	Comment
1	Edit Communications? Yes No	Allows setting of the controller's serial communications parameters. Note: 'Yes' is selected by pressing the key that Yes appears above (i.e., the '2' key). 'No' is selected by pressing the key that No appears above (i.e., the '5' key).
	If serial communications is entered, the following questions appear (otherwise proceed to point 2): Baud = 9600 1= OK 2= Change	Allows the user to change the current baud rate. Press 1 to accept this value, or 2 to change it.
	Data Bits= 8 1= OK 2= Change	Use this screen to change the number of data bits. Press 1 to accept this value, or 2 to change it.
	Parity is NONE 1= OK 2= Change	If parity is changed, parity can be set to either None (N), Even (E) or Odd (O)
	Stop Bits= 1 1= OK 2= Change	Press 1 to accept this value, or 2 to change it.
2	Calibrate Unit? Yes No	Entering this section allows calibration of the controllers pressure curve.
	If the calibration section is entered, the following questions appear (otherwise proceed to point 3): Are you sure? Yes No	Since the calibration section shouldn't be entered unless you are properly equipped to calibrate the unit, you must verity that you really do want to enter the calibration mode.
	Place under vacuum [Ent] = Continue	Directly attach a high vacuum source to the stainless steel pressure connection on the back of the controller and place the controller under full vacuum, then press the ENTER key.
	Enter vacuum pressure [mmHg]=	Enter the pressure the controller is at (in mmHg) as a floating point number. See the section at the end of this table titled "Entering Numeric Data into the Controller" for instructions on how to enter a floating point number.

	Set to Atmospheric Pressure [Enter]	Remove any connection to the controller's pressure connection and allow the controller to sit at atmospheric pressure, then press the ENTER key.
	Current Pressure [mmHg]=	Enter the current atmospheric pressure as a floating point number in units of mmHg.
3	Enter Diagnostics? Yes No	Allows testing system components and setting process variables
	If diagnostics is entered the following questions are asked: Test Max132? Yes No	 Tests the analog to digital converter.
	Find Crack Point? Yes No	Allows the user to test the circuit that drives the proportioning valve. Minimum value is 1, maximum value is 4095. To exit, enter a value of 0.
	Store Crack Value? Yes No	The crack value is the digital value (from 1 to 4095) that causes the proportioning valve to initially crack its seal allowing gas to flow. This value is typically in the range of 1200 – 1400.
	Gain: 1.0 [Def 1.0] Change? 1=Yes 2=No If the question is answered Yes, the following screen appears: Gain: 1.0 [Def 1.0] New:	To enter a new default pressure gain factor, answer this question Yes (1) or No (2) to continue. This screen shows that the recommended default is 1.0. Enter a new default pressure gain factor as a floating point number.
	Adjust Zero offset? 1= Yes 2= No If the question is answered Yes, the following screen appears: Enter Zero Offset [[mmHg]	A zero offset is a user entered offset added to the display. [To enter negative offsets, when queried for a value, press the Reset Del – key first to enter a "-" sign. Enter an offset in mmHg.
4	Enter Testing Mode? Yes No	This is a diagnostic routine. Answer this question No (2).

Entering Numeric Data into the Controller

	Controller Display	Solution
1	**Answering Yes/No questions**	Many questions are answered with Yes/No answers. The standard format of these questions is for the controller to ask its question on the first line of the display and then list Yes and No on the second line of the display. To answer the question 'Yes', press the key that's directly below 'Yes' (that would be the #2 key). To answer the question 'No', press the key that is directly below 'No' (that would be the #5 key).
2	**Floating Point Numbers** Many questions require that you enter a floating point number, for example 20.13	An answer of 20.13 is entered with the following key presses. Press Reset — on the J-KEM controller [Note: the Enter • key is both the decimal point and Enter key. The first time you press Enter • you get a decimal point, the second time the number is entered]. If you make a mistake during data entry, the incorrect value can be deleted one digit at a time by pressing the Reset — key. You must correct your mistake BEFORE pressing the Enter • key the second time to enter the number Negative numbers are entered by pressing the Reset — first to create the "-" sign.
3	**Integer Numbers**	Whole numbers are entered by pressing the correct number keys then the 'Enter' key to store the number. For example, to enter the number 18, press '1' '8' 'Enter'. To delete an incorrectly entered number, press the Reset — key. Negative numbers are entered by pressing the Reset — first to create the "-" sign.
4	**Entering a Time** Questions requiring a time to be entered will look something like this: Enter Time 00:00:00	When entering a time, only the flashing digit can be changed. To enter 45 minutes, press: '0' '0' '4' '5' 'Enter'. It is not necessary to fill in trailing zeros. To delete or backup 1 space in the timer display, press the 'Delete' button. Negative numbers are entered by pressing the Reset — first to create the "-" sign.