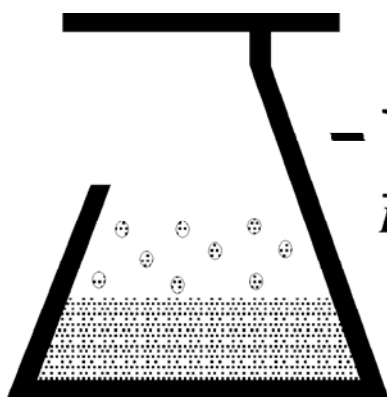


Custom Products for Research

J-KEM Scientific Reaction Controller



-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

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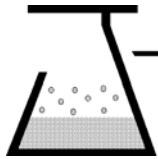
Index

Controller Overview	3
Temperature Dependent Addition Description	4
pH Dependent Addition Description	8
Timed Addition Description	13
Remote PC Control Description	16
Program Recorder Description	20
Program Examples	21
Configuring HyperTerminal for use with Program Loader	23
Preparing a File for Upload Using Notepad	24
Uploading Data Using HyperTerminal	24
Program Printer Using HyperTerminal	24
Data Logging Using HyperTerminal	25
Entering Numeric Data into the Controller	26
Using the Controller's Manual Prime Function	27
Programming Mode	28
Changing Syringes and Distribution Valves	31
Calibrating a Thermocouple Input	32
Calibrating a pH Probe	33

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:

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J-KEM Reaction Controller

Your controller has five programs resident in memory.

- Program 1. **Temperature Regulated Addition.** [*Available only on controllers with thermocouple inputs*] Adds reagents at a user specified rate while maintaining the reaction below a specified limit temperature. This program adds up to 8 reagents according to a user defined sequence. Three user defined programs can be stored in non-volatile memory. Data can be logged to a remote PC.
- Program 2. **pH Regulated Addition.** [*Available only on controllers with pH probe inputs*] Adds reagents at a user specified rate while maintaining the reaction below, or above, a specified pH. This program adds up to 8 reagents according to a user defined sequence. Three user defined programs can be stored in non-volatile memory. Data can be logged to a remote PC.
- Program 3. **Timed Addition.** This program adds a reagent to a reaction over a user specified period of time. Program 3 employs a more sophisticated addition sequence than Programs 1 or 2 which results in smoother addition profiles but offers no temperature or pH control. Three user defined programs can be stored in non-volatile memory.
- Program 4. **Remote PC Control.** This program allows the user to control the actions of the pump via serial communications from a remote PC. It is also used to download data logged to the Infinity controller's internal memory.
- Program 5. **Program Recorder.** This program allows the user to load a program script, written on the PC, to the controllers memory and run it automatically. Five scripts can be stored and recalled for use at any time.
-

Controller Overview

When the controller is turned on, the program prompts the user to select between the available programs. Press the numbered key corresponding to the program you want to run.

Depending on the features ordered on the Reaction Controller, the back panel of the controller may contain a connection for a type 'T' thermocouple (only thermocouples with a blue plug should be used), a pH probe, and other optional input sensors.

The Keypad serves multiple functions. It allows entry of numeric data such as reaction temperatures and also invokes special functions such as manually directed pump motions. The action needed from the keypad are explained by messages shown in the controllers LCD display.

Temperature Dependent Additions Program One

For controllers fitted for thermocouple input, program one adds reagents at a user defined rate but adjusts the rate of addition, as needed, to maintain the reaction temperature below a user set limit. A program can have up to 8 steps. In each step the user can specify the port to fill the syringe from (the reagent port), the port to deliver the contents of the syringe to (the reaction port), the volume of reagent to deliver, the addition rate, and an upper temperature limit for the reaction step. To use this program a type T thermocouple must be plugged into the thermocouple receptacle on the back of the controller and placed in the reaction pot to sense the reaction temperature.

This program limits the reaction temperature by controlling the rate of addition of an exothermic reagent. The program does not control reaction heating due to any other source (i.e., a heating mantle, loss of cooling, or other thermal input). If excessive reaction temperatures can result from loss of cooling or an attached heater, the chemist must take appropriate precautions.

Controller Display	Comments
Select: 1=Temp 2=pH 3=Rate 4=PC 5=Loader	Default display of the controller allows you to select any of the five available programs. 1= Controlled addition as a function of temperature. 2= Controlled addition as a function of pH. 3= Controlled addition. 4= Remote PC control. 5= Program loader Select program 1 by pressing the '1' key.
Temp controlled Add Yes No	Introductory screen that allows you to verify the program selected. Select YES by pressing the '2' key or NO by pressing the '5' key.
1= Build NEW Prog. 2= Recall OLD Prog.	The option is presented to enter a new program, or recall a previously stored program. For the procedure to load a new program, see the section in this table titled "Procedure to enter a new program".
Procedure to recall a stored program	
Recall which Program [Last=0; 1-2]:	The option is presented to reuse the last program run or recall stored programs 1 or 2. The last program run by the controller is always resident in memory (it's automatically stored as program 0) and can be re-run by selecting '0'.

Procedure to enter a new program			
1= Single Step Prog 2= Multi-Step Prog	Select between the addition of a single reagent (i.e., the single step program) and the addition of multiple reagents (i.e., the Multi-step program).		
The following questions are asked if a single step program is selected		The following questions are asked if a multi-step program is selected	
Controller Display	Comments	Controller Display	Comments
Duration of Addition: 00:00:00	Enter the duration for the addition step. For an example of how to enter a time into the controller, see the section titled "Entering Numeric Data into the Controller" at the end of this section.	Duration of Step 1 00:00:00	Enter the duration for the first addition step. For an example of how to enter a time into the controller, see the section titled "Entering Numeric Data into the Controller" at the end of this section. Up to an 8 step sequence can be entered into the program. To terminate entry short of the full 8 steps, entering a time of "0" terminates entry. For example, to enter a 3 step program, enter the run time for step 1, step 2 and step 3. When queried for the run time for step 4, enter "0" which causes program entry to stop.
Enter Reagent Port:	Enter the port on the pump's distribution valve that the reagent is attached to, followed by the ENTER key.	Enter Reagent Port:	Enter the port on the pump's distribution valve that the reagent is attached to, followed by the ENTER key.
Enter Reaction Port:	Enter the port on the pump's distribution valve that the reaction is attached to, followed by the ENTER key.	Enter Reaction Port:	Enter the port on the pump's distribution valve that the reaction is attached to, followed by the ENTER key. Note that each step can have a different reaction port which allows the control of multiple reactions.
Enter upper limit Temperature [C]:	Enter an upper limit temperature that the reaction should not exceed. As the reaction temperature approaches the limit temperature, addition of the reagent slows and is stopped completely when at the limit temperature. When the reaction temperature falls below the limit temperature, addition of the reagent resumes. Enter this number as a floating point number (see the section titled 'Entering numeric data into the controller' at the end of this section).	Enter upper limit Temperature [C]:	Enter an upper limit temperature that the reaction should not exceed. As the reaction temperature approaches the limit temperature, addition of the reagent slows and is stopped completely when at the limit temperature. When the reaction temperature falls below the limit temperature, addition of the reagent resumes. Enter this number as a floating point number (see the section titled 'Entering numeric data into the controller' at the end of this section).

<p>Volume of reagent to add [ml]: [Rst=All]</p>	<p>The single step program has two options. You can either enter a specific volume, such as 20.0 ml or you can manually load the syringe (via the controller's keypad) with any amount of reagent and instruct the controller to simply 'add everything that was loaded'.</p> <p>To add a specific volume: Simple enter the volume as a floating point number.</p> <p>To manually load the syringe and add the syringes entire content: Press the "Reset" key to place the controller in manual mode. This option is useful when you have a reagent and you want to add 'all of it' but don't know the exact volume. Manual mode allows you to control the pumps valve position and plunger to manually fill the syringe. For instructions on how to manually load the syringe, see the section titled "Using the Controller's Manual Prime Function".</p>	<p>Volume of reagent to add[ml]:</p>	<p>Enter the volume of reagent to add in this step as a floating point number.</p>
	<p>For multi-step programs, the sequence of questions starts over again to allow data entry for the next step. Up to 8 program steps can be entered. To terminate programs prior to 8 steps, enter a time of '0' when prompted for the reaction time of the next step.</p>		
	<p>Review Program? 1= Yes 2= No</p>	<p>The option of reviewing and editing the entered program is presented. The questions in this section are the same as when entering the program, except at each step you are given the option of changing any entered value.</p>	
	<p>Store Program? 1= Yes 2= No</p>	<p>Two memory locations are reserved to store entered programs. Select memory location 1 to 2.</p>	
	<p>Store as Program [1-2]:</p>	<p>Select the memory location by entering 1 or 2 followed by the ENTER key.</p>	

Prime Reagent before use? 1= Yes 2= No	Before adding a reagent, it may be desirable to flush air from the tubing leading from the pump to the flask containing the reagent to add and to prime the syringe. The program does this by withdrawing a user specified volume of reagent into the syringe and then dispensing it back to the reagent flask. This action fills the intake line with reagent prior to filling the syringe with the volume of reagent requested in the program. If you elect to prime reagents, the program asks the volume of reagent to prime with. The volume can not exceed the size of the syringe.
Flush delivery line when done 1= Yes 2= No	When the addition of a reagent is done, the tubing between the pump and the reaction flask contains undelivered reagent (which can be several milliliters). This reagent can be flushed from the delivery tube by displacing it with either air or solvent (attached to one of the valves ports). If this option is selected, you will be queried for the port the flush solvent is attached to and the volume of solvent to use. If a port is specified that has nothing attached, then air is used to flush the line.
For Multi-Step Programs Only Wash syringe between reagents? 1= Yes 2= No	After the addition of one reagent is complete, you have the option of washing the syringe with a wash solvent before filling the syringe with the next reagent. If you select this option you are queried for the port the wash solvent is attached to. You are also queried for a waste port to expel the dirty wash solvent out of.
Log Data to PC? 1= Yes 2= No	Selecting this option allows you to log time, temperature, and other reaction parameters to a remote PC. If you elect to log data, the following screen is displayed. Whether you choose to log data to a PC or not, reaction data is always stored in the controllers internal memory. This memory can be downloaded to a PC after the reaction is complete. See the description of Program 4.
Start HyperTerminal Enter -> Continue	If you choose to log data, the program prompts for a log interval time and then instructs to start HyperTerminal. HyperTerminal, or any other terminal program can be used to collect data from the Infinity controller. See the section titled "Data Logging Using HyperTerminal" for instructions on initially configuring and then using HyperTerminal for data logging.
Program READY Press any key [Rst]	The program is now ready to begin. Press any key to start, or press the RESET key to abort the program and begin again.
Step: 1 Temp 55.0 C Added: 125.25ml	This is the normal run-time screen. The screen shows the step number, reaction temperature, and volume added.

Keys Active During Execution

Reset Pressing the Reset key will cause an immediate abort of the program.

Pause This will temporarily pause delivery of the reagent. The current reaction temperature is displayed.

Setpoint The limit temperature for the current reaction step can be changed by pressing this key.

pH Dependent Additions Program Two Description.

For controllers fitted with a pH probe input, this program adds reagents at a user defined rate but adjusts the rate of addition, as needed, to maintain the reaction pH above or below a user set limit. A program can have up to 8 steps. In each step the user can specify the port to fill the syringe from (the reagent port), the port to deliver the contents of the syringe to (the reaction port), the volume of reagent to deliver, the addition rate, and a pH limit for the reaction step. To use this program a pH probe must be connected to the BNC connector on the back of the controller and placed in the reaction pot to sense the reaction pH.

This program limits the reaction pH by controlling the rate of addition of an acidic or basic reagent. The program does not control reaction pH due to inputs from any other source. If excessive reaction pH's can result from sources other than addition of reagents, the chemist must take appropriate precautions.

Controller Display	Comments
Select: 1=Temp 2=pH 3=Rate 4=PC 5=Loader	Default display of the controller allows you to select any of the five available programs. 1= Controlled addition as a function of temperature. 2= Controlled addition as a function of pH. 3= Controlled addition. 4= Remote PC control. 5= Program loader Select program 2 by pressing the '2' key.
pH controlled Add Yes No	Introductory screen that allows you to verify the program selected. Select YES by pressing the '2' key or NO by pressing the '5' key.
1= Build NEW Prog. 2= Recall OLD Prog.	The option is presented to enter a new program, or recall a previously stored program. For an example of how to load a new program, see the section in this table titled "Procedure to enter a new program".
Procedure to recall a stored program	
Recall which Program [Last=0; 1-2]:	The option is presented to reuse the last program run or recall stored programs 1 or 2. The last program run by the controller is always resident in memory (it's automatically stored as program 0) and can be re-run by selecting '0'.

Procedure to enter a new program			
1= Single Step Prog 2= Multi-Step Prog	Select between the addition of a single reagent (i.e., the single step program) and the addition of multiple reagents (i.e., the Multi-step program) in a user defined sequential sequence.		
The following questions are asked if a single step program is selected		The following questions are asked if a multi-step program is selected	
Controller Display	Comments	Controller Display	Comments
Duration of Addition: 00:00:00	Enter the duration for the addition step. For an example of how to enter a time into the controller, see the section titled "Entering Numeric Data into the Controller" at the end of this section.	Duration of Step 1 00:00:00	Enter the duration for the first addition step. For an example of how to enter a time into the controller, see the section titled "Entering Numeric Data into the Controller" at the end of this section. Up to an 8 step sequence can be entered into the program. To terminate entry short of the full 8 steps, entering a time of "0" terminates entry. For example, to enter a 3 step program, enter the run time for step 1, step 2 and step 3. When queried for the run time for step 4, enter "0" which causes program entry to stop.
Enter Reagent Port:	Enter the port on the pump's distribution valve that the reagent is attached to, followed by the ENTER key.	Enter Reagent Port:	Enter the port on the pump's distribution valve that the reagent is attached to, followed by the ENTER key.
Enter Reaction Port:	Enter the port on the pump's distribution valve that the reaction is attached to, followed by the ENTER key.	Enter Reaction Port:	Enter the port on the pump's distribution valve that the reaction is attached to, followed by the ENTER key. Note that each step can have a different reaction port which allows the control of multiple reactions.
Enter limit pH:	Enter the reaction pH at which you want addition of reagent to stop. As the reaction pH approaches this value, addition of the reagent slows and is stopped completely when at the limit pH. When the reaction pH moves away from this value, addition of the reagent resumes. Enter this number as a floating point number (see the section titled "Entering Numeric Data into the Controller").	Enter limit pH:	Enter the reaction pH at which you want addition of reagent to stop. As the reaction pH approaches this value, addition of the reagent slows and is stopped completely when at the limit pH. When the reaction pH moves away from this value, addition of the reagent resumes. Enter this number as a floating point number (see the section titled "Entering Numeric Data into the Controller").

Is Reagent ACIDIC or BASIC? 1=Acid 2=Base	If when the reagent is added, it causes the reaction to become more acidic, press 1. If the added reagent causes the reaction to become more basic, press 2.	Is Reagent ACIDIC or BASIC? 1=Acid 2=Base	If when the reagent is added, it causes the reaction to become more acidic, press 1. If the added reagent causes the reaction to become more basic, press 2.
<p>How the Specification of the Reagent as Acidic or Basic Affects the Addition of Reagent</p> <p>The affect that specifying a reagent as acidic or basic has on how a reagent is added can be confusing. If a reagent is specified as being acidic, that means that its addition to the reaction mixture causes the reaction pH to become more acidic. If the reagent is specified as being basic, its addition to the reaction mixture means the reaction pH becomes more basic. To clarify how the entered pH limit and specification of the reagent affect its addition, a couple examples are presented.</p> <p>Example 1. A pH limit of 7.0 is entered and the reagent is specified to be acidic. If the current reaction pH is 10.0, the reagent will be added since addition of the reagent will drive the reaction pH in the direction of the entered pH limit. If the current reaction pH is 5.0, the reagent will not be added since addition of the reagent will drive the reaction pH further from the entered limit pH.</p> <p>Example 2. A pH limit of 7.0 is entered and the reagent is specified to be basic. If the current reaction pH is 10.0, the reagent will not be added since addition of the reagent will drive the reaction pH further from the entered pH limit. If the current reaction pH is 5.0, the reagent will be added since addition of the reagent will drive the reaction pH towards the entered limit pH.</p>			
Volume of reagent to add [ml]: [Rst=All]	<p>The single step program has two options. You can either enter a specific volume, such as 20.0 ml or you can manually load the syringe (via the controller's keypad) with any amount of reagent and instruct the controller to simple 'add everything that was loaded'.</p> <p>To add a specific volume: Simple enter the volume as a floating point number.</p> <p>To manually load the syringe and add the syringes entire content: Press the "Reset" key to place the controller in manual mode. This option is useful when you have a reagent and you want to add 'all of it' but don't know the exact volume. Manual mode allows you to control the pumps valve position and plunger manually fill the syringe. For instructions on how to manually load the syringe, see the section titled "Using the Controller's Manual Prime Function".</p>	Volume of reagent to add[ml]:	Enter the volume of reagent to add in this step as a floating point number.

	For multi-step programs, the sequence of questions starts over again to allow data entry for the next step. Up to 8 program steps can be entered. To terminate programs prior to 8 steps, enter a time of '0' when prompted for the reaction time of the next step.	
	Review Program? 1= Yes 2= No	The option of reviewing and editing the entered program is presented. The questions in this section are the same as when entering the program, except at each step you are given the option of changing any entered value.
	Store Program? 1= Yes 2= No	Two memory locations are reserved to store entered programs. Select memory location 1 to 2.
	Store as Program [1-2]:	Select the memory location by entering 1 or 2 followed by the ENTER key.

<p>Prime Reagent before use? 1= Yes 2= No</p>	<p>Before adding a reagent, it may be desirable to flush air from the tubing leading from the pump to the flask containing the reagent to add and to prime the syringe. The program does this by withdrawing a user specified volume of reagent into the syringe and then dispensing it back to the reagent flask. This action fills the intake line with reagent prior to filling the syringe with the volume of reagent requested in the program. If you elect to prime reagents, the program asks the volume of reagent to prime with. The volume can not exceed the size of the syringe.</p>
<p>Flush delivery line when done 1= Yes 2= No</p>	<p>When the addition of a reagent is done, the tubing between the pump and the reaction flask contains undelivered reagent (which can be several milliliters). This reagent can be flushed from the delivery tube by displacing it with either air or solvent (attached to one of the valves ports). If this option is selected, you will be queried for the port the flush solvent is attached to and the volume of solvent to use. If a port is specified that has nothing attached, then air is used to flush the line.</p>
<p>For Multi-Step Programs Only Wash syringe between reagents? 1= Yes 2= No</p>	<p>After the addition of one reagent is complete, you have the option of washing the syringe with a wash solvent before filling the syringe with the next reagent. If you select this option you are queried for the port the wash solvent is attached to. You are also queried for a waste port to expel the dirty wash solvent out of.</p>
<p>Is a thermocouple in solution? 1=Yes 2=No</p>	<p>The pH level of a solution is a function of solution temperature. For the most accurate pH measurements, a thermocouple should be attached to the controller and placed in the solution being measured. If a thermocouple is not in solution, the program assumes that the solution temperature is 23C.</p>
<p>Enter Temp Limit? Yes No</p>	<p>If a thermocouple is in solution, the program presents the option of entering a limit temperature for the reaction, above which addition of reagent will be halted. In this case, for the addition of reagent to continue, the solution must be below (or above depending on settings) the setpoint pH value and limit temperature.</p>
<p>Log Data to PC? 1= Yes 2= No</p>	<p>Selecting this option allows you to log time, temperature, and other reaction parameters to a remote PC. If you elect to log data, the following screen is displayed. Whether you choose to log data to a PC or not, reaction data is always stored in the controllers internal memory. This memory can be downloaded to a PC after the reaction is complete. See the description of Program 4.</p>
<p>Start HyperTerminal Enter -> Continue</p>	<p>If you choose to log data, the program prompts for a log interval time and then instructs to start HyperTerminal. HyperTerminal, or any other terminal program can be used to collect data from the Infinity controller. See the section titled "Data Logging Using HyperTerminal" for instructions on initially configuring and then using HyperTerminal for data logging.</p>

Program READY Press any key [Rst]	The program is now ready to begin. Press any key to start, or press the RESET key to abort the program and begin again.
Step: 1 pH: 6.31 V: 127.09ml 34.1C Step: 1 pH: 6.31 Added: 127.09ml	If a thermocouple is present in solution, the normal run-time display is shown on top, otherwise the display on the bottom appears.

Keys Active During Execution

Reset Pressing the Reset key will cause an immediate abort of the program.

Pause This will temporarily pause delivery of the reagent. The current reaction temperature is displayed.

Setpoint The limit temperature for the current reaction step can be changed by pressing this key.

Timed Addition. Program Three Description.

This program adds any amount of reagent over any specified period of time. The reagent is loaded through one port on the valve and dispensed through a second port. Up to an 8 step program can be entered. This program has the most sophisticated timed addition algorithm and should be used when temperature (program 1) or pH (program 2) are not needed.

Controller Display	Comments
Select: 1=Temp 2=pH 3=Rate 4=PC 5=Loader	Default display of the controller allows you to select any of the five available programs. 1= Controlled addition as a function of temperature. 2= Controlled addition as a function of pH. 3= Controlled addition. 4= Remote PC control. 5= Program loader Select program 3 by pressing the '3' key followed by the Enter key.
Timed Addition Yes No	Introductory screen that allows you to verify the program selected. Select YES by pressing the '2' key or NO by pressing the '5' key.
1= Recall Program 2= Load New Program	You are presented with the option of recalling a previously stored program (1) or entering a new program via the controllers keypad (2). For instructions on recalling a stored program, see below.
Procedure to recall a stored program	
Recall which Program [Last=0; 1-2]:	The option is presented to reuse the last program run or recall stored programs 1 or 2. The last program run by the controller is always resident in memory (it's automatically stored as program 0) and can be re-run by selecting '0'.
Procedure to enter a new program	
For Step **, Enter Duration: 00:00:00	Enter the total duration of this addition step (i.e., the amount of time required to add the reagent). See the section titled "Entering Numeric Data into the Controller" for an example of how to enter a time.
For Step **, Enter Reagent Port:	For the current step, enter the port on the distribution valve that the reagent is attached to.
For Step **, Enter Dispense Port:	For the current step, enter the port on the distribution valve that the reaction flask is attached to.
Add ABSOLUTE [1] or RELATIVE [2] volume?	For Step 1, and only Step 1 , of any program, the controller presents the option of adding an Absolute or Relative volume of reagent. The program presents the option of adding an absolute volume of reagent, for example, add 3.500 ml of a stock solution, or adding a relative volume of reagent. Adding a relative volume means adding the entire content of the syringe, whatever that volume is, after being manually loaded by the user.
For Step **, Enter Volume[ml]: Fill manually Press ENTER to start	For ABSOLUTE Addition , the following question is asked: Enter the total amount of reagent to add to the reaction. A RELATIVE Addition is an addition where the pump adds the entire quantity of reagent manually loaded by the user into the syringe, whatever that volume is. This is useful when adding an unknown amount of reagent, for example, the product mixture from a previous reaction. For a relative addition, the following questions are asked: The controller instructs you to fill the syringe with the reagent. Pressing the ENTER key places the controller into a manually operated mode where the user has complete control over port selection and pump movement via the controller's keypad. See the section titled "Using the Controller's Manual Prime Function". When finished filling the syringe, the program advances to the next program step.

	For multi-step programs, the sequence of questions starts over again to allow data entry for the next step. Up to 8 program steps can be entered. To terminate programs prior to 8 steps, enter a time of '0' when prompted for the reaction time of the next step.
Store Program? Yes No	After a new program is entered, you are given the option of storing the program for future recall.
Store at Program Number[1-2]:	If you elect to store the program, you are prompted for the storage location. The controller stores 2 independent programs.
Prime Pump Manually? Yes No	The program gives the option of priming the pump manually. See the section titled "Using the Controller's Manual Prime Function". If the pump is manually primed, the program compensates for any reagent left in the syringe from the prime. For example, if you instructed the pump to deliver 10.0 ml of reagent in total and 234 μ l remains in the syringe from priming, when the delivery is started the pump will withdraw 9,766 μ l of reagent to add to the residual 234 μ l for a total of 10.0 ml.
Flush when done? Yes No	At the end of each program step, you have the option of washing the syringe and the delivery line with a wash solvent. If you elect to wash the syringe between program steps, the controller prompts for the port the wash solvent is on and what volume to wash with. The controller draws the wash solvent into the syringe and delivers it to the reaction mixture. This acts to flush the reagent left in the delivery line into the reactor before beginning the addition of the next reagent. The controller washes with this solvent after every program step.
Press any key to Start [Exit=RESET]	The program is ready at this point. The program automatically refills the syringe as many times as needed to complete the delivery request. For example, if the pump is equipped with a 5 ml syringe and you request that 20 ml of reagent be delivered over the course of 1 hour, the syringe will automatically fill itself a total of 4 times during the course of the program.
Dispensed: 12.323 ml Time Left: 12:43:18	The programs run-time screen shows the amount of reagent delivered and the time remaining in the program.

Keys active during program execution.

Pause. Pressing the Pause key, stops the addition until being manually restarted by the user. The program resumes as the point that the pause key was pressed.

Reset. Pressing the 'Reset' key aborts the program.

Remote PC Control Program Four Description.

This program allows the actions of the syringe pump to be controlled by a remote PC, and for controllers fit with optional extended memory for data logging, program four downloads the logged data to a PC.

- Program Setup:**
1. Set up the reaction with all necessary liquid connections.
 2. Connect the syringe pump to a PC's comm port via a 9-pin cable.

Select Program four by answering '4' to the question	Select: 1=Temp 2=pH 3=Rate 4=PC 5=Loader
The controller displays the name of the program and allows you to select it or start again. Press the key under the word "Yes" [2] to run this program or the key under the word "No" [5] to select again.	PC Remote Control Yes No
If the controller has optional extended memory installed this screen is displayed: To run the pump by sending commands from an attached PC, press the '1' key. To download data stored in the controllers internal memory, press the '2' key.	1= Run from PC 2= Dump stored data
If the controller does not have extended memory installed, this screen is displayed: This screen indicated that the controller is ready to receive commands via it's RS232 port.	Ready for Remote Control

For Infinity controllers fitted with optional extended memory

Downloading Data From the Previous Reaction

The controller automatically logs reaction data from the most recent execution of Program 1 and 2 to internal memory. This data is protected even when the controller is physically turned off. The data can be downloaded to a PC at anytime, but must be downloaded before conducting a new run of either Program 1 or Program 2. Every time program 1 or 2 is executed, data from the previous run is erased and the new data is stored. If you selected to "Dump stored data" to the PC, follow the directions in the section titled "Data Logging Using HyperTerminal".

When the downloader is ready to transmit data, the controller displays the message "Start HyperTerminal". Prepare HyperTerminal to capture data, then press ENTER on the infinity controller. During the data transfer, the Infinity controller displays how many data points have been transferred. When the transfer is complete, the Infinity controller displays a message the transfer is done. Close HyperTerminal, then press the ENTER key.

Remote PC Control of the Reaction Controller

The command structure of this program is very exacting in the syntax of an issued command, a command with the wrong syntax will most likely hang the program. All commands are upper case and case sensitive.

Sending Commands

The Infinity controller communicates via a straight through 9-pin connector using an RS232 protocol. This allows communication with the controller using a standard PC comm port.

Commands are case sensitive. The terminating character is ‘\r’ or 0x0D (i.e., carriage return).

The controller responds to a valid serial command by returning the appropriate value listed in the table below. 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 “ERROR\r”.

Communications parameters can be changed in the Infinity controller’s programming mode. Default communication parameters are:

Baud - 9600, Parity - none, Data bits - 8, Stop bits - 1.

Implemented Serial Commands

PC Command	Example	Infinity Response	Comments
TEMPERATURE() Only on controllers fitted with a thermocouple input.	TEMPERATURE()\r	TEMPERATURE()28.50 K\r	Returns the current reaction temperature. The controllers reply consists of the command sent, the current reaction temperature, followed by ‘OK’ and terminated with a carriage return.
PH() Only on controllers fitted with a pH probe input	PH()\r	PH()4.23OK\r	Returns the current reaction pH. The controllers reply consists of the command sent, the current reaction pH, followed by ‘OK’ and terminated with a carriage return.
WITHDRAW(volume) Volume is the volume to withdraw into the syringe. Volume is a floating point number and is in microliters.	WITHDRAW(25000.0)\r	WITHDRAW(25000.0)O K\r	This command instructs the pump to withdraw the specified volume. Volume is in microliters and is a floating point number. The controllers reply is the sent command with OK appended to the end. If the volume requested exceeds the remaining capacity of the syringe to withdraw, the syringe fills to its maximum position.
FILL()	FILL()\r	FILL()OK\r	Causes the syringe to fill to its maximum capacity.
DISPENSE(volume) Volume is the volume to dispense and is in microliters.	DISPENSE(125.6)\r	DISPENSE(125.6)OK\r	This command instructs the pump to dispense the specified volume. Volume is in microliters and is a floating point number. The controllers reply is the sent command with OK appended to the end. If the volume is specified is larger than the volume in the syringe, the entire syringe content is dispensed.
HOME()	HOME()\r	HOME()OK\r	Causes the pump to dispense the entire content of the syringe. Periodically using the HOME() command is a good programming technique since it sets certain program counters to 0.
PORT(port)	PORT(4)\r	PORT(4)OK\r	This command sends the pump to the specified port. The controllers

Port is the port number you want the distribution valve to advance to.	PORT(1)r	PORT(1)OK\r	reply is the command sent with OK appended to the end.
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RATE(rate) Rate is the rate of fluid delivery. Units are in ml/minute	RATE(1.75)\r RATE(DEFAULT)\r	RATE(1.75)OK\r RATE(DEFAULT)OK\r	Sets the syringe speed to the specified rate in units of ml/min. Rate commands apply to both dispenses and withdrawals. If a rate outside of the allowable rates (see below) is sent, the reply will be the actual rate set by the controller rather than the user specified rate. Specifying the rate as “DEFAULT” sets the syringe rate to its default valve. The table below shows the default, minimum and maximum syringe speeds for the various syringe sizes.
DELAY_MS(value) Value is the number of milliseconds to pause.	DELAY_MS(120)\r	DELAY_MS(120)OK\r	Causes the program to delay for the number of milliseconds specified. The number of milliseconds must be a whole number in the range of 1 to 65000.
DELAY_SEC(value) Delay for the number of seconds specified.	DELAY_SEC(5)\r	DELAY_SEC(5)OK\r	Causes the program to pause for the number of seconds specified. Seconds must be a whole number in the range of 1 to 1x10 ⁸ .
BEEP(value) Causes the controller to ‘beep’ for the number of milliseconds specified.	BEEP(350)\r	BEEP(350)OK\r	Causes the controller to emit a ‘beep’ sound for the number of milliseconds specified.
WARNING()	WARNING()\r	WARNING()OK\r	Causes the controller to emit a 3-beep tone useful as a attention getting warning signal.
PAUSE()	PAUSE()\r	PAUSE()OK\r	Causes the program to pause until the RESET key is pressed on the controllers keypad.
Non-existing command	HELLO()\r	ERROR\r	The reply to any non-existing command is ERROR
	dispense(500.0)\r	ERROR\r	All commands must be upper case.
	PORT(12)\r	ERROR\r	The value for port setting (12) is larger than the number of ports available.

Table of Default, Minimum, and Maximum Syringe Speeds.

Syringe Size	25µl	50µl	100µl	250µl	500µl	1ml	1.25ml	2.5ml	5ml	10ml	25ml	50ml
Default Speed (vol/min)	156µl	312µl	624µl	1.56ml	3.12ml	6.24ml	7.8ml	15.6ml	31.25ml	62.5ml	118.8ml	125ml
Minimum Speed (vol/min)	1.25µl	2.5µl	5µl	12.5µl	25µl	50µl	62.5µl	125µl	250µl	500µl	1.25ml	2.5ml
Maximum Speed** (vol/min)	312.5µl	625µl	1.25ml	3.125ml	6.25ml	12.5ml	15.625ml	31.25ml	62.5ml	125ml	312.5ml	625ml

** The maximum speed that a syringe will obtain is dependent on the viscosity of the material delivered.

Program Recorder. Program Five Description.

Program recorder allows a group of syringe pump commands to be uploaded from a PC into the controllers memory and then run at any future point. A total of three programs can be stored and each stored program can have of up to 300-400 program steps.

Program Setup:

1. Set up the reaction with all necessary liquid connections.
2. Connect the female 9-pin connector on the syringe pump to the PC's comm port via a 9-pin cable.

Program recorder allows you to write syringe pump scripts using a text editor on your PC, and then upload the commands into the syringe pumps memory. Once stored in memory, the syringe pump runs the script without being attached to the PC. Any of the syringe pump commands listed in program 4 can be used.

In addition to the commands available for program 4, this program includes two unique commands LOOP_START and LOOP_END that allow iterative program loops to be run. The LOOP_START and LOOP_STOP commands mark the starting and stopping point of a program loop, respectively. All the commands contained between the LOOP_START and LOOP_END commands are run for the number of times specified in the LOOP_START(passes) command. Loops can be nested 1 deep, that is, a loop can appear inside a loop one time. Examples of programs are presented later in this section.

Keys Active During Execution

Reset Pressing the Reset key will cause an immediate abort of the program.

Pause This temporarily pauses the program. The program resumes when the pause key is pressed again.

Select Program five by answering '5' to the question	Select: 1=Temp 2=pH 3=Rate 4=PC 5=Loader
The controller displays the name of the program and allows you to select it or start again. Select YES by pressing the '2' key, or NO by pressing the '5'	Run Program Recorder Yes No
The controller presents the option of recalling a previously stored program or loading a new program to memory. Select '1' or '2'.	1= Run Program 2= Upload Program
If you selected to Run an existing program, the following questions are asked. If you selected to Load a new program, see the section below.	
The syringe pump stores 3 user defined programs of 300 steps each. Enter the program you want to recall.	Load program[1-3]:
You are given the option of sending the recalled program to an application like HyperTerminal, where it can be printed.	Print Program? Yes No
If you elect to print the program, the controller prompts you to start your PC file capture program. For instructions, see the paragraph titled "Program Printer Using HyperTerminal".	Start File Capture Continue -> Enter
The controller provides the option of priming the pump. Priming the pump flushes and fills the liquid lines with the desired solvent. Usually, priming the pump is necessary. See the section titled "Using the Controller's Manual Prime Function" for additional information.	Prime Pump? Yes No
The program is ready to start. Press the Enter key to begin.	Program Ready... Continue -> Enter
A running program can be paused by pressing the PAUSE key. The step currently executing must finish running and then the program will pause. The program is resumed by pressing the Enter key.	Program PAUSED.. Continue -> Enter

The controller asks the following questions if you selected to Load a new program. See examples of loading a new program below.	
Enter an address to store the new program at	Store as Program Number[1-3]:
The controller is ready for the PC to begin uploading the program. See the paragraph titled “To Upload Data Using HyperTerminal”.	Ready for upload
When the program begins to upload, the screen changes to show the number of commands received. When a program finishes uploading, the controller checks each command for correct syntax. If an error is found, the following screens are displayed. The offending command is displayed. If the offending command is listed as “VOID”, that means that the uploaded program exceeded the 300 command limit. The program upload is aborted. You must correct the offending command and re-upload the program.	Commands Received ### Error at Line ### Continue -> ENTER WITHDRA(500.0)r Continue -> ENTER Program Aborted Continue -> ENTER
When the program is done uploading, the total number of commands read is displayed.	### Commands Read Continue -> ENTER
You are given the option of sending the recalled program to an application like HyperTerminal, where it can be printed.	Print Program? Yes No
If you elect to print the program, the controller prompts you to start your PC file capture program. For instructions, see the paragraph titled “Program Printer Using HyperTerminal”.	Start File Capture Continue -> Enter

Any program that sends text out the PC’s serial port can be used to upload programs to the controller. A convenient program is HyperTerminal since it’s included with all installations of MS Windows. To use HyperTerminal to upload siring pump programs, see the paragraph titled “Uploading a Program Using HyperTerminal”.

Program Recorder Example Program Simple command script

Command	Effect
PORT(1)	Go to port 1
FILL()	Fill the syringe from port 1. Filling, then homing the syringe has the effect of flushing air from the syringe and feed lines.
HOME()	
WITHDRAW(3000.0)	Withdraw 3ml of reagent from port 1.
PORT(4)	Go to port 4, the reaction port.
RATE(2.50)	Set the delivery rate of the syringe to 2.5ml/min
HOME()	Deliver the entire content of the syringe
DELAY SEC(3600)	Delay for 1 hour before proceeding to the next step
PORT(2)	Go to port 2
RATE(DEFAULT)	Set the rate of the syringe to its normal speed
WITHDRAW(4000.0)	Withdraw 4ml of reagent from port 2
PORT(4)	Go back to the reaction port
RATE(1.00)	Set the syringe rate to 1ml/min
HOME()	Deliver the entire content of the syringe
RATE(DEFAULT)	Set the syringe rate to its normal speed
END	End of program. NOTE: The “END” command is
END	End of program required to appear twice

Program Recorder Example Program Example of a single program loop.

Command	Effect
PORT(1)	Go to port 1
FILL()	Fill the syringe from port 1. Filling, then homing the syringe has the effect of flushing air from the syringe and feed lines.
HOME()	
FILL()	Fill the syringe from port 1
PORT(2)	Go to port 2
RATE(2.50)	Set the syringe delivery rate to 2.5ml/min
LOOP_START(50)	Mark the beginning of a loop. The statements in italic will be repeated 50 times before the loop exits.
<i>DISPENSE(1000.0)</i>	Dispense 1.0 ml
<i>DELAY_MS(500)</i>	Delay 500 milliseconds
LOOP_END()	Make the end of the loop
HOME()	Home the syringe
END	End of program. NOTE: The “END” command is
END	End of program required to appear twice

Program Recorder Example Program Example of a nested program loop. This program instructs a pump with a 10ml syringe to repeatedly make ninety six 100 µl dispense to 10 different titer plates (It would add 100 µl to each cell of 10 microtiter plates). By using the loop command you can construct very sophisticated programs will very few commands.

Command	Effect
PORT(1)	Go to the reagent port, port 1
FILL()	Fill the syringe from port 1. Filling, then homing the syringe has the effect of flushing air from the syringe and feed lines.
HOME()	
LOOP_START(10)	Mark the starting point of the outer loop and run it 10 times
PORT(1)	Go to the reagent port.
FILL()	Fill the syringe with reagent
PORT(2)	Go to the delivery port
<i>LOOP_START(96)</i>	Mark the start of the inner loop and run it 96 times
<i>DISPENSE(100.0)</i>	Dispense 100 µl
<i>DELAY_MS(250)</i>	Delay 250ms to move the dispensing tip to the next cell
<i>LOOP_END()</i>	Mark the end of the inner loop
WARNING()	Audio cue that plate is done
PAUSE()	Pause the program until a new plate is in place. Resume the program by pressing the Enter key.
LOOP_END()	Mark the end of the outer loop.
PORT(1)	Program over. Go to reagent port.
HOME()	Empty syringe.
END	End of program. NOTE: The “END” command is
END	End of program required to appear twice

Configuring HyperTerminal for use With Program Loader

HyperTerminal must be configured to communicate with the Infinity Controller.

1. Connect a serial cable (9-pin) between the PC's COMM port and the female 9-pin connector on the back of the Infinity controller.
2. Start HyperTerminal (under 'Programs', 'Accessories', 'Communications'). Enter a name for the uploader like 'Infinity Uploader', then click OK twice.
3. Select 'Properties' from the File menu.. On the Connect To tab, choose the current PC comm port on the 'Connect Using' drop down menu. Typically, this is 'Direct on Com1', sometimes 'Direct on Com2'.
4. Click the 'Configure' button.
 - Set port settings to: Bits per second: 9600
 - Data bits: 8
 - Parity: None
 - Stop Bits: 1
 - Flow control: None.Click the OK button
5. Click the Settings tab, then click the ASCII setup button.
 - Uncheck 'Send line ends with line feeds'
 - Check, 'Append line feeds on incoming line ends'
 - Click OK (twice).
6. From the File menu, select 'Save'.
7. Exit HyperTerminal (this is required to properly store parameters).

Preparing a File for Upload Using Notepad

Syringe pump programs must be simple ASCII text files. The best way to assure you're writing a text file is to use Notepad and save files with the default extension of '.txt'. You can use text editors like Microsoft Word, but you MUST save the file as a "Text only (.txt)" file. Excel is a poor choice of a text editor since it adds special characters to the end of each command even when the file is saved as a '.txt' file. A properly prepared file will appear as a list of commands with no formatting, extra spaces, tabs, or comments following the commands. The last two lines of the program should be END followed by a carriage return. Remember, all commands are case sensitive. Below is a short sample:

```
PORT(1)
FILL()
LOOP_START(3)
DISPENSE(200.0)
DELAY_MS(800)
LOOP_END()
END
END
```

Uploading Data Using HyperTerminal

Configure HyperTerminal for communication with the Infinity controller as described in the paragraph "Configuring HyperTerminal".

1. Start Program 5 in the Infinity controller. Answer all the questions until the controller displays the message "Ready for upload".
2. Start HyperTerminal by double clicking on the HyperTerminal program "Infinity Uploader".
3. From the Transfer menu, select 'Send Text File'.
4. Locate the text data file created in Notepad, then click Open.

Program Printer Using HyperTerminal

Program printer downloads the current script program to your PC where it can be printed or archived.. The easiest way to capture and then print a stored program is by using HyperTerminal since HyperTerminal is included with all versions of Windows. Before HyperTerminal can capture the file, it must be configured with the correct communications parameters. Set up the HyperTerminal application as described earlier in the section titled "Configuring HyperTerminal for use With Program Loader".

1. Start HyperTerminal by double clicking on the application icon "Infinity Uploaded" created when HyperTerminal was configured.
2. When the message 'Start File Capture' appears on the screen of the Infinity Controller, select the option "Capture Text..." from HyperTerminal's Transfer menu.
3. Enter a file name, then click OK.
4. Press the ENTER key of the Infinity controller to begin file transfer. During the file transfer, the commands appear on HyperTerminal's screen and are saved to disk under the file name entered.
5. When transfer is complete, exit HyperTerminal. The file created can be printed from any text editor like MS Word or Notepad.

Data Logging Using HyperTerminal

The easiest way to log data to a remote PC is to use HyperTerminal since it's included with all versions of Windows.

To Initially Configure HyperTerminal

1. Connect a serial cable (9-pin) between the PC's COMM port and the female 9-pin connector on the back of the Infinity controller.
2. Start HyperTerminal (under 'Programs', 'Accessories', 'Communications'). Enter a name for the uploader like 'Infinity Uploader', then click OK twice.
3. Select 'Properties' from the File menu.. On the Connect To tab, choose the current PC port on the 'Connect Using' drop down menu. Typically, this is 'Direct on Com1', sometimes 'Direct on Com2'.
4. Click the 'Configure' button.
Set port settings to: Bits per second: 9600
Data bits: 8
Parity: None
Stop Bits: 1
Flow control: None.
Click the OK button
5. Click the Settings tab, then click the ASCII setup button.
Uncheck 'Send line ends with line feeds'
Check, 'Append line feeds on incoming line ends'
Click OK (twice).
6. From the File menu, select 'Save'.
7. Exit HyperTerminal (this is required to properly store parameters).

To Log Data Using HyperTerminal










1. Double click the file saved in Step 6 above.
2. From the Transfer menu, select 'Capture Text'.
3. Enter a filename appropriate for the current experiment, then click 'Start'.
4. As data is received, it is logged to the data file as ASCII text and is displayed on the HyperTerminal screen.
5. When done, from the Transfer menu, select 'Capture Text', then click on 'Stop'.
6. Exit HyperTerminal. The logged text data is in the file entered in Step 3. This file can be read into, manipulated, and plotted from Excel.

To Load the Logged File into Excel

The file above is an ASCII text file that can be read and printed from applications like MS Work or Notepad. Most often it's desirable to load the data into Excel for processing or plotting.

1. Start Excel. From the File menu, select Open.
2. From the drop down menu "Types of Files", select "All Files (*.*)"
3. Locate the data file to import into excel, then click the Open button.
4. From the screen that appears, click on the Finish button to import into a standard Excel data table.
5. Manipulate and plot the data as desired.
6. When exiting, it may be desirable to save the data as an Excel table. To do this, select Save As, then from the drop down menu select 'Microsoft Excel Workbook (*.xls)', then click the Save button.

Entering Numeric Data into the Controller

	Controller Display	Solution
1	<p align="center">Floating Point Numbers</p> <p>Many questions require that you enter a floating point number, for example 20.13</p>	<p>An answer of 20.13 is entered with the following key presses.</p> <p>Press  on the J-KEM controller [Note: the  key is both the decimal point and Enter key. The first time you press  you get a decimal point, the second time the number is entered].</p> <p>If you make a mistake during data entry, the incorrect value can be deleted one digit at a time by pressing the  key. You must correct your mistake BEFORE pressing the  key the second time to enter the number</p> <p>Negative numbers are entered by pressing the  first to create the “-” sign.</p>
2	<p align="center">Integer Numbers</p>	<p>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  key.</p> <p>Negative numbers are entered by pressing the  first to create the “-” sign.</p>
3	<p align="center">Entering a Time</p> <p>Questions requiring a time to be entered will look something like this: Enter Time 00:00:00</p>	<p>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.</p> <p>Negative numbers are entered by pressing the  first to create the “-” sign.</p>

Using the Controller's Manual Prime Function

Example of Manual Prime Screens.

<p>The purpose of priming the pump is to flush air from the lines and fill all the various pieces of tubing connecting solvents, reagents, and the reaction vessel with the proper fluid prior to starting a procedure. This is done by operating the pump, via the front panel keypad. In manual mode you are able to select the pumps port position and cause the pump to dispense and withdraw solvent on command.</p>	
<p>When the prime routine is running, the entire keypad is active.</p> <ul style="list-style-type: none"> • Change ports by pressing the 'A - H' keys. <p>The top line of this display shows the active keys, which are: The PORT keys (A-H), the Withdraw key, the Dispense key, and RESET</p> <p>For example, select port C by pressing the C key.</p> <p>For example, pull reagent into the syringe by pressing the 'Withdr' key.</p>	<p>Sel PORT, W, D [Rst] Port: A Vol: 0.0µl</p> <p>Sel PORT, W, D [Rst] Port: C Vol: 0.0µl</p> <p>WITHDRAW Slo Fas Ent Port: C Vol: 0.0 µl</p>
<p>When the withdraw key is pressed you're given the option of filling the syringe slowly (by pressing the 'Slow' key) or more rapidly (by pressing the 'Fast' key). To stop the pump after a manual withdraw is started, press any key on the controller.</p>	<p>WITHDRAW Slo Fas Ent Port: C Vol: 125.8 µl</p>
<p>To exit withdrawal mode, press the 'Enter' key.</p>	<p>Sel PORT, W, D [Rst] Port: C Vol: 125.8 µl</p>
<p>When the dispense key is pressed you're given the option of dispensing the contents of the syringe slowly (by pressing the 'Slow' key) or more rapidly (by pressing the 'Fast' key). To stop the pump after a manual dispense is started, press any key on the controller.</p>	<p>DISPENSE Slo Fas Ent Port: C Vol: 125.8 µl</p>
<p>To exit dispense mode, press the 'Enter' key.</p>	<p>Sel PORT, W, D [Rst] Port: C Vol: 45.1 µl</p>
<p>The process of selecting a port, withdrawing and dispensing reagents can continue until all solvent and reagent lines are primed. Press the 'Reset' key to exit the prime routine.</p>	

Programming Mode

Certain parameters of the various programs are loaded 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 parameters 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 you hear 3 beeps, press and release the ENTER key and a message will appear indicating that you've entered programming mode.

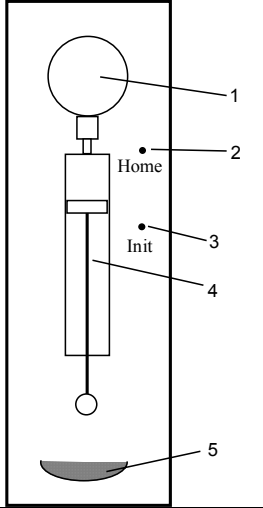
It should be noted that programming mode has virtually no error checking of the entered number. Make sure data is entered accurately or very unpredictable results will occur.

	Controller Display	Comment
1	Edit Pump Data? Yes No	These are constants defining the characteristics of the pump.
	Syringe=50000 ul 1=OK 2=Change	Make choice. Note that syringe size is entered in microliters. This must be set correctly.
	Valve Positions= 8 1=OK 2=Change	Make choice. Enter the number of ports on the pumps valve.
	PAW Flag = ON 1=OK 2=Change	Make choice. PAW Flag stands for 'Pause After Withdrawal Flag'. For 25 and 50ml syringes it's often necessary to pause the program after the syringe makes a withdrawal to allow solvent to settle in the syringe. If the pump is using a 25 or 50ml syringe, this flag should equal '1', for all other syringe sizes the flag is set to '0' in most cases. If the PAW Flag is correct, press '1', otherwise press '2' to change it.
	PAW Delay = 4000 1=OK 2=Change	Make choice. PAW Delay stands for 'Pause After Withdrawal Delay'. If the 'PAW Flag' is '0', this question can be ignored by pressing the '1' key. Otherwise, enter the number of milliseconds the program should pause after making a withdrawal followed by the 'Enter' key. This is an empirically determined number and will vary depending on the viscosity of the solvent being drawn into the syringe. The correct value allows enough time for vacuum bubbles to disappear after making a large withdrawal. As a rule of thumb, 2000 milliseconds is adequate for a 25 ml syringe and 4000 ms is adequate for a 50ml syringe.

	Max Pump speed:0 1=OK 2=Change	<p>Make choice.</p> <p>Max Pump Speed:*****. This shows the maximum allowable speed for the pump to withdraw and dispense with the syringe. A value of '0' instructs the pump to use pre-defined default pump speeds. If the displayed value is the desired value, press 1=[OK] to accept it or press 2=[Change] to change it.</p> <p>If you pressed 2 to change pump speed, the programs asks you to enter a speed between 0 - 10,000. Enter the desired number followed by the 'Enter' key. As a guide to selecting a pump speed, consider the table below.</p> <table border="0"> <tr> <td>Syringe Size</td> <td>Default Speed</td> </tr> <tr> <td>10ul - 10 ml</td> <td>5000</td> </tr> <tr> <td>25 ml</td> <td>2000</td> </tr> <tr> <td>50 ml</td> <td>1000</td> </tr> </table>	Syringe Size	Default Speed	10ul - 10 ml	5000	25 ml	2000	50 ml	1000
Syringe Size	Default Speed									
10ul - 10 ml	5000									
25 ml	2000									
50 ml	1000									
2	Edit Pump COMMS? Yes No	<p>Do not change any values in this section.</p> <p>Select 2 [No]. This section controls communications between the pump and the Infinity Controller.</p>								
3	Edit PC COMMS? Yes No	<p>This section allows setting communication parameters between the PC and the syringe pump controller.</p>								
		<p>Baud = 9600 1= OK 2= Change</p> <p>If this is the desired baud rate, press OK to accept this value, otherwise press CHANGE and you'll be queried to enter a new value.</p>								
		<p>Data Bits= 8 1= OK 2= Change</p> <p>If this is the desired number of data bits, press OK to accept this value, otherwise press CHANGE and you'll be queried to enter a new value.</p>								
		<p>Parity is NONE 1= OK 2= Change</p> <p>If this is the desired value, press OK to accept this value, otherwise press CHANGE and you'll be queried to enter a new value.</p>								
		<p>Stop Bits= 1 1= OK 2= Change</p> <p>If this is the desired number of stop bits, press OK to accept this value, otherwise press CHANGE and you'll be queried to enter a new value.</p>								
4	Test MAX132? Yes No	<p>This is used for system debugging. Answer this question No.</p>								
5	Enter Calibration Yes No	<p>This section should only be entered when it is necessary to calibrate either the temperature or pH calibration.</p>								

	<p>Calibrate CJC Yes No</p>	<p>Before calibrating the thermocouple input (or temperature sensor), you must calibrate the Cold Junction Compensation circuit. Only enter this section if you intend to calibrate the thermocouple. To calibrate the CJC, see the section titled “Calibrating a Thermocouple Input”.</p>
	<p>Calibrate Thermocouple Yes No</p>	<p>This section is entered to calibrate the thermocouple input. Before calibrating the thermocouple input, the CJC must be calibrated first. See the section titled “Calibrating a Thermocouple Input”.</p>
	<p>Calibrate pH? Yes No</p>	<p>The pH input can be calibrated. You will need two different pH standards to calibrate successfully. A pH=3 and pH=10 standard work well. See the section titled ‘Calibrating a pH Probe’.</p>
6	<p>Enter Temp Offset? Yes No</p>	<p>A temperature offset can be added to the temperature sensed by the thermocouple to remove any error of the thermocouple. Temperature offsets can be both positive and negative.</p>

Changing Syringes and Distribution Valves

	1	Turn power to the syringe pump off.							
	2	Use the syringe adjustment knob (#5) to move the syringe plunger down about 1/2"							
	3	Completely remove the screw at the base of the syringe (i.e., the screw that moves the plunger up and down							
	4	Unscrew the syringe from the distribution valve							
	5	If you're replacing the valve, remove the two screws holding the valve to the pump, then pull the valve straight off. Install the new valve by sliding the valve on to the pump and replacing the two screws. Tighten the screws finger tight.							
	6	Screw the new syringe into the distribution valve. Make sure a white Teflon washer is in the distribution valve screw port when the new syringe valve is installed. If not put a washer in before proceeding. Tighten the syringe securely with your fingers, never use pliers. Install the screw holding the plunger of the syringe to the drive bar.							
	7	Turn power to the pump on, then press the 'INITIALIZE' button (# 3) on the front panel of the pump. The syringe will go to a 'soft stop' position.							
8	Using the 'Manual Syringe Adjustment' (# 5) wheel at the bottom of the front panel, move the syringe up until it stops moving freely, then pull it back until most of the tension is relieved.								
9	Press the 'SET HOME' button (#2). The syringe initializes to its new 'home' position.								
10	The computer controller must be programmed for the new syringe size. Turn power to the controller on, when the message 'recalling data...' appears, immediately press and release the ENTER key to place the controller in programming mode. The controller displays a short message indicating that programming mode has been entered. Depending on the program in the controller different questions will appear in the screen. Answer all questions NO until the question "Edit Pump Data" appears, answer this question 'Yes'. This section of the program is very <u>unforgiving</u> , make sure you answer each question accurately or the syringe pump will not perform correctly.								
11	"Syringe= #####µl 1=[OK] 2=[Change]". The display is showing the last stored syringe size. If this size is correct, press the '1' key for OK and then continue at step 13. If it's not correct, press '2' to enter the correct size (in microliters).								
12	Enter the correct syringe size using the numbers on the keypad. 'Del' will delete the last entered number. When the display shows the correct size, press the 'Enter' key.								
13	"Valve positions = # 1=[OK] 2=[Change]". If the display shows the correct number of ports on the valve, press '1', otherwise press '2' and enter the correct number followed by the 'Enter' key.								
14	"PAW flag = ON (or) OFF 1=[OK] 2=[Change]". PAW Flag stands for 'Pause After Withdrawal Flag'. For 25 and 50ml syringes it's often necessary to pause the program after the syringe makes a withdrawal to allow solvent to settle in the syringe. If the pump is using a 25 or 50ml syringe, this flag should be set to ON, for all other syringe sizes (in most cases) the flag is set to OFF. If the PAW Flag is correct, press '1', otherwise press '2' to change it.								
15	"PAW Delay = ##### 1=[OK] 2=[Change]". PAW Delay stands for 'Pause After Withdrawal Delay'. If the 'PAW Flag' is 'OFF', this question can be ignored by pressing the '1' key. Otherwise, enter the number of milliseconds the program should pause after making a withdrawal. Store this value by pressing the ENTER key. This is an empirically determined number and will vary depending on the viscosity of the solvent being drawn into the syringe. The correct value allows enough time for vacuum bubbles to disappear after making a large withdrawal. As a rule of thumb, 2000 ms is adequate for a 25 ml syringe and 4000 ms is adequate for a 50ml syringe.								
16	"Max Pump Speed:***** 1=[OK] 2=[Change]". This shows the maximum allowable speed for the pump to withdraw and dispense with the syringe. A value of '0' instructs the pump to use default pump speeds which is generally the correct choice. If the displayed value is the desired value, press 1=[OK] to accept it or press 2=[Change] to change it. If you pressed 2 to change pump speed, the program prompts you to enter a new speed in the range of 40 to 10000 [or 0 for default]. Enter the desired number followed by the 'Enter' key. As a guide to selecting a pump speed, consider the table below.								
	<table border="1"> <thead> <tr> <th>Syringe Size</th> <th>Default Speed</th> </tr> </thead> <tbody> <tr> <td>10ul - 10 ml</td> <td>5000</td> </tr> <tr> <td>25 ml</td> <td>3500</td> </tr> <tr> <td>50 ml</td> <td>2000</td> </tr> </tbody> </table>	Syringe Size	Default Speed	10ul - 10 ml	5000	25 ml	3500	50 ml	2000
Syringe Size	Default Speed								
10ul - 10 ml	5000								
25 ml	3500								
50 ml	2000								
17	To store these values, turn power to the controller off.								

Calibrating a Thermocouple Input

Before calibrating the controllers thermocouple input, the controller should be off for at least one hour to allow it to cool to room temperature. To calibrate the controller you will need three temperature references. It's best to generate these reference temperatures using a thermocouple calibrator, but if one is not available, the three reference temperatures can be:

- 1) The current room temperature. Place a thermometer next to the controller and allow it to come to room temperature.
- 2) An ice water bath (0° C)
- 3) A boiling water bath (100° C)

If you are using water baths for the calibration, these should be ready before turning the controller on to begin the calibration. Plug a type T thermocouple into the back of the Infinity controller and place it next to the thermometer at room temperature.

Controller Display	Comment
	Turn power to the controller on and enter programming mode as described in the section titled Programming Mode. Answer all questions NO until you get to the question:
Enter Calibration Yes No	To calibrate a thermocouple input, you must enter the calibration section from the controllers programming mode by answering this question YES.
Calibrate CJC Yes No	Answer yes.
Current board temperature= =	Enter the board temperature as room temperature (as read on the thermometer) plus 2° C.
Calibrate TC? Yes No	Answer this question Yes.
1= Calibrate 2= Check Linearity	Select 1 [Enter]
Type T thermocouple Channel * [Ent]	This is just an informational message, press Enter.
Enter *** C on the calibrator [Ent]	If you are using a thermocouple calibrator, enter the temperature shown, then press Enter. If a thermocouple is connected to the controller, press the Enter key.
Enter 0.0 C on the calibrator [Ent]	If you are using a thermocouple calibrator, enter the temperature shown, then press Enter. If a thermocouple is connected to the controller, place the thermocouple in the ice bath and allow it to come to temperature. When the thermocouple is a 0° C, press the Enter key.
Calibrate at: 100C or 250C	If you are using a thermocouple calibrator, select 250° C by pressing the '5' key, otherwise select 100° C by pressing the '2' key.
Enter ### C on the calibrator [Ent]	If you are using a thermocouple calibrator, enter the temperature shown, then press Enter. If a thermocouple is connected to the controller, place the thermocouple in the boiling water bath and allow it to come to temperature. When the thermocouple is at 100 0° C, press the Enter key.
Temp ### (1)Gain (2)Offset (3)Exit	This screen shows the current temperature of the thermocouple calibrator or the thermocouple. When done reading the temperature, press the '3' key to Exit. This completes the temperature calibration.

Calibrating a pH probe

The controller presents the following questions in response to a user request to calibrate a pH probe.

Controller Display	Comment
	If your controller has multiple pH probes, each probe is cycled through in the order of its channel number. For each probe, the following questions are asked.
1= Calibrate 2= Check Linearity	You are presented with two options, the pH probe can either be calibrated by pressing 1, or the linearity of the probe can be checked by reading its present value by pressing 2.
pH of 1st standard pH= [54.2/pH]	Place the pH probe in a pH standard solution and allow the probe time to equilibrate. Once the reading has settled, enter the pH value of the solution as a floating point number. pH standards of approximately pH 4 and 10 are good choices.
Temp. of the buffer? [deg C]:	pH readings are a function of solution temperature. Enter the solution temperature as a floating point number.
pH of 2ed standard pH= [54.2/pH]	Place the pH probe in a second pH standard and allow the probe time to settle. Enter the solution pH as a floating point number.
Temp. of the buffer? [deg C]:	Enter the solution temperature as a floating point number.
Testing Linearity. Buffer Temp:	The calibration is complete. After the calibration is complete, the controller enters a routine that allows the linearity of the probe to be tested. Enter the temperature of the current solution.
pH= 10.2742 [54.2mv] 1=Ext 2=Offst 3=Gain	The pH value of the probe is displayed. The probe can be placed in other standard solutions to test its linearity while the displayed pH is updated continuously. The options presented on the bottom of the screen are: 1= Exit 2= Adjust Offset 3= Adjust Gain The offset and gain of the probe should not be changed. When ready, this section is exited by pressing the 1 key.